



Courses

Academic Year 2019-2020



Clarkson™

Clarkson University Non-Discrimination Policy

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Clarkson University does not discriminate on the basis of sex or disability in its educational programs and activities, pursuant to the requirements of Title IX of the Educational Amendments of 1972, and Section 504 of the Rehabilitation Act of 1973, and the American Disabilities Act of 1990 respectively. This policy extends to both employment by and admission to the University.

Inquiries concerning Section 504, and the Americans with Disabilities Act of 1990 should be directed to ADA504@clarkson.edu.

Inquiries concerning Title IX, the Age Discrimination Act, or other discrimination concerns should be directed to the Chief Inclusion & Human Resources Officer/Affirmative Action Officer at (315) 268-3788, Room 102 Graham Hall, Clarkson University, Box 5542, Potsdam NY 13699-5542 and/or the Title IX Coordinator, Room 168 Bertrand H. Snell Hall, Clarkson University, Box 5750, Potsdam, NY 13699-5750; or telephone (315) 268-4208.

Information on the processing of grievances and charges relating to the above policies can be obtained from the Human Resources/ Affirmative Action Office

Clarkson University is making a special effort to identify for employment opportunities and participation in its educational programs a broad spectrum of candidates including women, minorities, and people with disabilities.

This document was prepared by: Alysson Darrah, Assistant Registrar
Student Administrative Services (SAS)
Clarkson University
Box 5575
Potsdam, NY 13699-5575

If you have any comments or questions, please direct them to the above office.

Clarkson University reserves the right to amend this entire document from time to time as deemed necessary.

Throughout this document, courses are listed alpha-numerically by their subject and catalog number designation. The numerical designation assigned to each course is unique, and can be used to identify if the course is lower division (100-299), upper division (300-499), or graduate level (500 and above).

How to read a course description:

HIST 101

America: 1877 - Present

A social, political, cultural and economic survey of the United States from Reconstruction through the present. Prerequisites: HIST 100

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CSO/IG

Comm Points: 1

← Course subject, catalog number, and title

← Course description & prerequisites (if any)

← Number of credits, grading basis, academic calendar

← Class components, term when the course is typically taught

← Knowledge Area, or Technology designators (if any)

← Number of Communication Points (if any)

The following designators are used to indicate the course may be used to satisfy a **Knowledge Area (KA)**:

CGI – Contemporary & Global Issues

CSO – Cultures & Societies

EC – Economics & Organizations

STS – Science, Technology & Society

IA – Imaginative Arts

IG – Individual & Group Behavior

UNIV – Common Experience University Courses

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Accounting

AC 1 (3,5...) **Accounting Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

AC 2 (4,6...) **Accounting Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

AC 202 **Financial Accounting**

In this course students will gain the fundamental knowledge of analyzing, recording, classifying, and summarizing accounting information into financial statements. These financial statements are important both inside and outside of the reporting entity, as they aid business managers, creditors, and investors in making many types of business decisions. This course will allow students to become proficient in preparing financial statements in accordance with Generally Accepted Accounting Principles by developing their ability to identify and interpret financial transactions, classify and record business transactions in a financial accounting system, and complete the accounting cycle.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

AC 203 **Managerial Accounting**

The purpose of this course is to provide future managers with an introduction to and an appreciation of the vast array of tools and techniques that comprise managerial accounting. Managerial accounting information is used widely in an organization, from pricing products to allocating company resources. This course develops your understanding of procedures, methods, and information gathering techniques that managers and other business professionals use to analyze financial data in order to make managerial decisions and budget/forecast results of operations. Prerequisite: AC202

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

AC 205 **Introduction to Financial and Managerial Accounting**

[Cross-listed with EM 205] An introductory survey of accounting information to guide and improve decision making. Many course topics involve cost planning and control techniques used to evaluate and improve the financial performance of organizations and/or products.

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

AC 305 **Cost Accounting**

Cost accounting information is used for both internal and external reporting purposes and plays a vital role within an organization as a basis for making sound business decisions. This course is an extension of Managerial Accounting with its primary objective to develop an in-depth understanding of cost accounting tools and techniques at an advanced cost accounting level. More specifically, students will learn fundamental cost analysis principles, generalizations and theories and gain in-depth factual knowledge of various product costing management systems (terminology, classifications, methods &

trends), and learn various cost allocation methods. Overall, students are introduced to various methods to assist in decision-making, both operational and strategic within the organization developing their skills, competencies, and points of view needed by accounting professions. Prerequisites: AC203 or EM205 or AC205

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

AC 311 **Intermediate Financial Accounting I**

First course in a two-course sequence in financial reporting at the professional level. Seeks to develop student's understanding of the environment in which financial reporting choices are made and how they impact financial statement information. The course integrates the perspectives of accounting, corporate finance, and economics to help understand how business transactions get reported and their decision implications. Examines the principles and practices of external financial reporting, with particular emphasis on balance sheet valuation and income determination. Reviews basic accounting concepts and the essentials of the accounting process. Covers the measurement and disclosure problems associated with such topics as cash, receivables, inventories, long-lived assets, and intangibles. Prerequisites: AC203

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

AC 312 **Intermediate Financial Accounting II**

Continues the two-course sequence begun in AC 311 by exploring additional coverage of generally accepted accounting principles such as current liabilities, long-term debt, stockholders' equity, earnings per share, accounting for income taxes, accounting changes, and the Statement of Cash Flows. Pro forma 'as if' disclosures, earnings, and financial statements are introduced as well as present value techniques to accounting valuations. Prerequisites: AC 311

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

AC 407 **Taxation of Business Entities**

Emphasis is placed on federal income tax responsibilities of individual taxpayers and small businesses. Topics covered include tax planning, compliance, sales taxes, and payroll taxes. Restriction: Must have junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

AC 421 **Accounting Information Systems**

The course covers the design and installation of accounting systems that provide relevant and reliable information. Special emphasis is given to potential risks of errors or irregularities and the need for systems control. Projects may include analysis, design and implementation of an accounting system. Prerequisites: AC305 or AC203.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

AC 431 Advanced Accounting: Investment and Ownership Interests

This course examines the theory and practice of accounting for business combinations, consolidated financial statements, partnerships, foreign currency transactions, and foreign inter-company investments. Additional topics may also be covered. Current issues in these areas will also be discussed. Prerequisites: AC311

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

AC 436 **Auditing**

A study of the independent auditor's examination of his or her clients' recording of events, periodic adjustments and formal statements. Topics will include the auditor's opinion, sampling as used in auditing, auditing and the computer. Prerequisites: AC311, senior standing and at least a C average in all previous accounting courses taken at Clarkson.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

AC 487 **Special Project in Accounting**

An investigation of a problem or in-depth topic undertaken by the student under the guidance of a faculty member. Prerequisites: junior standing, grade of at least C in all Clarkson accounting courses, and consent of the instructor.

Credits: (1-3), Graded, Semester Calendar
Research, Given When Needed

AC 490 **Internship in Accounting**

An unpaid internship that is related to the student's professional goals.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

Aeronautical Engineering

AE 1,3,5... **Mechanical and Aeronautical Engineering Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

AE 2,4,6... **Mechanical and Aeronautical Engineering Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used as a Professional Elective.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

AE 201 **Intro to Exp Methods in Mechanical & Aeronautical Eng**

[Cross-listed with ME 201] This course provides an introduction to experimental methods including the structure of experiments, measurement error types, statics, frequency distributions, error propagation, plot types, introductory design of experiments and use of computer for data processing. Experiments are used to demonstrate principles of material science, statics, strength of materials, rigid body dynamics and electrical science. Experiments are documented using written memoranda and worksheets. Corequisites: ES220, ES222, ES223

Credits: (1), Graded, Semester Calendar
Lecture, Spring Terms
Comm Points: 2

AE 212 **Introduction to Engineering Design**

This course lays the foundation for the design curriculum of the MAE Department. Students are introduced to how to solve complex, open-ended engineering problems. Core topics covered are: the design process; engineering ethics and professional responsibilities; design

for safety; mathematical and computer modeling; and written, oral and graphical communication. These topics are presented within the framework of at least one design project which students must complete, including documentation, construction, and demonstration. Prerequisite: ES100. Co-Requisite: ES220.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

AE 301 **Exp Methods in Mechanical and Aeronautical Engineering**

[Cross-listed with ME 301] This course covers experimental methods including sampling statistics, uncertainty analysis, error propagation, variable transformations, multi-variable regression, design of experiments and use of computers for data acquisition and processing. Experiments demonstrate principles from fluid mechanics, thermodynamics and introductory vibrations. Experiments are documented using written memoranda. Corequisites: ES330 and ES340 (or CH271)

Credits: (1), Graded, Semester Calendar
Lecture, Fall Semesters
Comm Points: 2

AE 342 **Introduction to Numerical Methods with Application**

The goal of this course is to introduce the techniques needed for the numerical solution of ordinary and partial differential equations. These techniques will include the formulation of physical problems for numerical simulations, discretization and solution methods, and use of commercial software for solving engineering problems governed by differential equations. Specific topics covered are numerical differentiation, integration, interpolation, and associated errors, the solution of systems of non-linear algebraic equations, and the solution of initial and boundary value problems using finite difference and finite element methods.

Prerequisites: ES 100, MA 232 Corequisites: ES 222, MA 231
Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Every Term

AE 350 **Aircraft Structural Analysis**

[Cross-listed with ME 350] Properties of wing sections. Beam-column moments; torsion of thin-walled and skin-stringer multiple-cell sections; non-symmetrical bending of skin-stringer wing sections; flexural shear in open and closed thin-walled and skin-stringer sections; loads and stresses in rib system; cut-outs and shear lag; modified beam theory for wing design; deflection by energy method; fundamentals of static aeroelasticity. Prerequisites: ES 222 and ES223

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

AE 365 **Independent Projects I**

[Cross-listed with ME 365] An opportunity for the student to become involved singly, or with a group, working on a special project under the guidance of a faculty member. Topics are often suggested by the faculty but suggestions from the students are encouraged. By permission of adviser only.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Term

AE 366 **Independent Projects II**

[Cross-listed with ME 366] Continuation of AE 365.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Term

AE 401 Advanced Exp Methods in Mechanical and Aeronautical Eng

[Cross-listed with ME 401] This course covers advanced experimental methods including Fourier analysis filtering, computer data acquisition. Experiments demonstrate principles of heat transfer, fluid mechanics, gas dynamics and aerodynamics. Experiments are documented using written memoranda and worksheets.

Prerequisites: AE/ME201 or AE/ME301 Corequisites: AE425 or AE455
Credits: (1), Graded, Semester Calendar
Lecture, Spring Semesters

AE 425**Aerodynamics**

[Cross-listed with ME 425] Topics covered include: Wing aerodynamics, thin airfoil theory, source panel methods, and supersonic and subsonic finite wing theories. Boundary layer theory and flow separation will also be discussed.

Prerequisites: ES330, ES340 and MA231
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

AE 427**Design of Propulsion Systems**

[Cross-listed with ME 427] The course covers the preliminary design of various propulsion devices of historical and modern significance including propellers, ramjets, turbojets and its variations and rockets and its variations and supersonic nozzles. These systems will be designed in the context of aircraft, watercraft and land vehicle applications. Detailed design on components such as turbine blades, diffusers, compressor stages, combustors, fans and two-dimensional supersonic nozzle shapes will be addressed. Many lessons will include examination of actual component hardware. Instruction on design methodology is combined with fluid and thermodynamic analysis techniques to form computational schemes for testing design variations. Design decisions will be based on matching application performances, optimizing, meeting application constraints and iterative selection. A series of engineering homework assignments and design projects will be used to learn about each system. Most work will be individual with one or two projects requiring teamwork. Methods and results will be documented with engineering memoranda. Prerequisites: ME326 or ME431 or AE431, and ES340.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms
Comm Points: 2

AE 429**Aircraft Performance and Flight Mechanics**

Fundamentals of propeller and jet aircraft performance. Steady and accelerated flight. Equations of motion. Level flight. Gliding, climbing, driftdown. Takeoff and landing. FAR requirements. Range and endurance. Payload-range diagrams. Maneuvering. V-n diagram. Turning and pull-ups. Stall and spin behavior. Energy methods. Corequisites: AE425/ME425.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

AE 430**Stability and Control of Aerospace Vehicles**

[Cross-listed with ME 430] An introduction to atmosphere flight vehicle dynamics. Static stability and control. Equations of motion. Dynamic stability and control. Classical control theory. Transfer functions and block diagrams. Routh's criterion, Root locus techniques, Bode plots. Modern control theory. State space techniques. Observability, and controllability. Flying qualities, ratings and regulations. Application to aircraft autopilot design.

Prerequisites: AE455/ME455, MA231, and MA232.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

AE 431**Gas Dynamics**

[Cross-listed with ME 431] The fundamental theories of modern compressible flow and their applications to aerodynamics are introduced. Topics include steady and unsteady supersonic flows, transonic flows, high-temperature gas dynamics, numerical methods and nozzle design. Prerequisites: ES330, ES340 and MA 232 or equivalent.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

AE 443**Optimal Engineering**

[Cross-listed with ME 443] An introduction to the optimal design of mechanical systems. This course involves the application of mathematical optimization techniques, including linear and nonlinear methods, to the design of devices and systems of interest to mechanical engineers. Emphasis is placed on the formulation of problems which can be solved by these techniques. Use is made of currently available optimal design computer programs. Prerequisites: AE/ME350 or ME341.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

AE 450**Aircraft Design I**

An introduction to basic methodology and decisions surrounding aircraft design leading to the conceptual and preliminary design of an aircraft. Topics include preliminary sizing, requirements and constraints, mission definition, layout, stability and performance estimation, structural issues, economics, trade studies, and ethical implications of the design and decision process. Prerequisites: AE212, AE425, AE429, AE458

Corequisites: AE430, AE431

Credits: (3), Graded, Semester Calendar
Research, Fall Terms
(TECH)
Comm Points: 1

AE 451**Aircraft Design II**

Continuation of concepts introduced in Aircraft Design I on the basic methodology and decisions surrounding aircraft design with a focus on the specific design of an aircraft in the context of a company type of environment. The course is supplemented by lectures on various topics including conceptual design issues, detailed system considerations, trade studies, propulsion integration, structural issues, CFD methods, testing considerations, cost, and manufacturing.

Prerequisites: AE450 Corequisites: AE427

Credits: (3), Graded, Semester Calendar
Research, Spring Terms
(TECH)

AE 455**Mechanical Vibrations and Control**

[Cross-listed with ME 455] Fundamentals, free vibration, harmonically excited vibration, transient vibration, multi-degree freedom systems, vibration measurements, introduction to control theory, linear feedback control, vibration control, adaptive and optimal control, numerical methods. Prerequisites: ES223

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

AE 457 Composite Mechanics and Design

[Cross-listed with ME 457, CE 421] Nature of composite materials. Classification and characteristics of composite materials, mechanical behavior of composite materials. Macromechanical and micromechanical elastic behavior of unidirectional lamina. Constitutive and transformation relations. Strength of unidirectional lamina. Composite failure theory. Mechanics of multidirectional structural laminates. Lamination theory. Strength and failure analysis of multidirectional laminates. Effect of temperature and moisture. Prerequisites: ES222 and ES260
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

AE 458 Design of Aircraft Structures

Properties of fuselage sections; modified beam theory for fuselage design; linear elastic plate theory and analyses; linear elastic shell theory and analyses; numerical techniques for complex structures; failure modes of plates and shells; introduction to composite materials; design techniques for plates and shells. Prerequisites: AE350.
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

AE 460 Introduction to Spacecraft Engineering

One-semester elective course offered to Juniors and Seniors in the ME or AE programs. Introduces the major engineering subsystems and disciplines required to design and operate a space satellite e.g. configuration and structure, electrical power subsystem, attitude control subsystem etc. Also basic orbital mechanics, launch vehicles, space environment including ionizing radiation and Sun-Earth-spacecraft geometries, ground operations; overall mission and spacecraft system engineering. Prerequisites: ME212 or AE212
Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

AE 465 Advanced Independent Projects I

[Cross-listed with ME 465] An opportunity for the advanced student to undertake an independent investigation in a mechanical engineering field of his or her own choice. Assistance will be given only when the student requests it. The project may be a comprehensive literature investigation, involve laboratory experiments, or involve analytical work by permission of adviser only.
Credits: (3), Graded, Semester Calendar
Independent Study, Spring Terms

American Studies**AMST 1,3,5... American Studies Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.
Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

Anthropology**ANTH 1,3,5... Anthropology Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.
Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

ANTH 2,4,6... Anthropology Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.
Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

ANTH 201 Introduction to Cultural Anthropology

Using case studies examining a number of different cultures, the course gives students the opportunity to explore the similarities and differences of cultures around the world by showing them the varieties of ways in which humans organize their lives and understand their worlds. The course also introduces students to the concepts and methods that anthropologists use to describe and understand those similarities and differences, providing them with the tools to better understand the complexity and the diversity of the human condition. The course gives students an introduction to the basic theoretical concepts and methods used in social analysis and it provides them the opportunity to see the use of those tools in a variety of specific, ethnographic cases drawn from a range of societies and cultures.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CGI/CSO

ANTH 225 Global Perspectives on Sexuality

Sexuality is often thought of as one of the most private aspects of life. Yet, it is also the subject of politics, commerce and public imagination at the state and global level. Exploring such topics as Human Trafficking, HIV/AIDS, Cybersex, and the emergence of new sexual identities, this course examines sexuality in a global context.
Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Semesters
UNIV/CGI/STS

ANTH 230 Introduction to Race and Ethnicity

[Formerly LC315/Cross-Listed with SOC230] Variations in phenotype--skin color--have always existed, but has 'race'? What are the bases of racial identity in the contemporary United States? How have they changed? How are 'race' and 'ethnicity' related? In this course we will address broader questions about race by focusing on contemporary racial and ethnic divisions and by examining the history of these concepts in the Western Hemisphere.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CGI/IG
Comm Points: 1

ANTH 235 Europe Through Film and Fiction

This introductory Anthropology course introduces students to the diversity of European cultures through film and fiction, and through various themes, including love across cultures, post Cold War transitions, the expansion of the European Union, the growing integration between European states, cultural conflicts, and the rise of anti-immigrant movements and politics in wide swaths of Europe.
Credits: (3), Graded, Semester Calendar
Lecture
CSO
Comm Points: 1

ANTH 238 Men and Masculinities

[Formerly LC393] Over the last few decades, manhood has come under attack. Instead of warrior heroes like John Wayne and James Bond, TV shows today feature a good number of losers like Homer Simpson and Frazier and numerous men's movements have emerged centered on such issues as 'male bonding' and atonement. At the same time, other aspects of popular culture bombard us with an image of men as muscle-packed, mean, lean fighting machines or as exploitative pimps. While the average size of men's muscles seemed to have increased dramatically, what has happened to men's sense of self, how they see each other, and how they see women? Is this all the result of feminists attacking men as being domineering, oppressive chauvinists? Or is this a period of sorely needed male self-reflection? In this discussion-based course we take a critical look at the role of manhood in our society and elsewhere, by looking at how it is represented in popular culture, and lived in such institutions as sports, schools and college, military, prisons, marriage, politics or work, and within the social dimensions of race and class. This will help us to develop a better understanding of what it means to be considered 'a man.'

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CSO

ANTH 240 The Diversity of the U.S. in Ethnographic Perspective

The United States is often referred to as a 'melting pot' of cultures. This metaphor is said to represent the ways in which people of diverse racial and ethnic backgrounds make up the American nation. As components of diversity in the U.S., race and ethnicity are understood in varied ways. Racial and ethnic conflict, clashes, disparities, and inequalities sometimes manifest themselves across professions, housing, access to opportunities, and livelihoods in general. But a closer look can unveil the remarkably creative ways in which different groups of people establish meaningful connections to bridge differences, allowing productive syntheses to emerge in social, cultural, political, religious, and economic realms. This course offers a window into some of these clashes and collaborations through engaging readings and audiovisual materials putting U.S. diversity into context. Anthropologists and other social scientists usually call such a window an ethnographic one. In other words, the course will help you put diversity into perspective by bringing you in touch with miscellaneous on-the-ground experiences of new immigrant groups in the U.S. hailing from Bosnia, Albania, Liberia, Congo, and Iraq; as well as with those of more established groups such as African Americans, Arab Americans, and Hispanic Americans.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CGI/CSO

ANTH 255 Culture and the Environment

As our world faces ever-more urgent challenges related to climate change and environmental instability, the very categories of "nature," "environment," and "climate" deserve critical and innovative thought. Central to this rethinking is a consideration of the cultural, political, and economic aspects of these terms, thereby creating space for careful critiques and alternative engagements. Anthropologists have long been active in examining cultural beliefs and practices related to environments. Today, these perspectives are changing to reflect a better understanding of human relationships with non-human actors and processes. This class provides an

introduction to Environmental Anthropology, with particular attention to the power and politics of knowledge production about environments and climates. It begins with a historical look at the sub-discipline, followed by a discussion of more recent theoretical and methodological approaches to rethinking how we study and engage with the environment.

Credits: (3), Graded, Semester Calendar

Lecture, Fall and Spring Terms

UNIV/CGI/CSO

ANTH 285 Food and Society or What to Think About What You Eat

[Cross-listed with SOC 285] [Formerly LC 397, ANTH 385] Patterns of food production and consumption have dramatic impact on individuals, societies, and the environment. In this class we will examine aspects of food consumption and production in the United States. We will examine the nature and history of contemporary patterns of consumption and production and the impacts of these patterns and changes on our health and our environment. Topics to be discussed include the role of food in American society, the transformation of eating habits over the 20th century--including the rise of processed and fast food and also ethnic and organic food and vegetarian alternatives--the nature and impact of industrial agriculture and of genetically modified organisms, and the political economy of food.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

UNIV/CGI/STS

ANTH 311 Ethnography

Ethnographic methods, the key research methodology of cultural anthropologists, are now used in a wide variety of disciplines, such as education, to health, environment, business, to name just a few. An exploration of anthropological research and writing through the analytical and practical study of "fieldwork" and "ethnography", this course examines a variety of anthropological research methods and genres of representation, and teaches students how to conduct an ethnographic fieldwork project of their own. This course is in large part a workshop in which students will learn and mobilize various ethnographic methods and techniques, identify a research project and conduct ethnographic fieldwork. The culminating experience of the course is the writing of a 10-15 pages mini ethnography, based on the fieldnotes that students are writing.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

IG

Comm Points: 1

ANTH 325 Sex and Commerce

This course, designed for upper division students who have been taking courses on sexuality and/or gender, examines in depth the commercial aspects of sex. From looking at the concept of marriage as an economic transaction, to the ways in which sex is sold or is used as a vehicle to sell, this course provides an in depth discussion of the question of pornography, sex-trafficking, and prostitution. It raises fundamental questions about sexuality, love, and gender.

Credits: (3), Graded, Semester Calendar

Lecture

UNIV/CGI/IG

Comm Points: 1

ANTH 340 **Medical Anthropology**

This course is an introduction to the anthropological consideration of illness, health, healing, and the body. We will explore the cultural and historical specificity of what appear to be biological givens, drawing from a variety of anthropological questions, theoretical approaches, and research techniques. Topics covered include the experience of illness and the way understandings of disease, health, and dying are affected by- and in turn influence- social, cultural, and political phenomena. We will approach bio-medicine as one of many culturally produced medical systems, comparing ways of seeing and knowing across traditions, and exploring the power of medicine to act as a form of social control.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

STS

Comm Points: 1

ANTH 370 **Environment, Technology and Society**

This course examines the relationship between environment, technology and society. The first portion of the semester covers the ways in which traditional peoples using traditional technologies have exploited the range of environments occupied by human populations, focusing on understanding the forces which lead to parallel and divergent development of social organization and culture. We then turn to a discussion of aspects of the relationship of environment, technology and society in America, with a focus on understanding the relationship between sources of power, environmental transformation and people's lives. In the final portion of the semester, we will examine the interconnection of social, environmental, and technological forces pertaining to a key environmental issue in the modern world.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CSO/STS

ANTH 380 **Drugs, Guns, Spices**

[Formerly LC340] The history of the modern world is more than a sequence of kings and queens, empires, wars, and revolutions. While these grand events were taking place, trade in drink, drugs, food, and weapons created massive changes in the world economy and in people's lives. This course examines the growth of the interconnections that came to link the flow of people, goods, and wealth from the fifteenth through the twentieth century, particularly focusing on the ways in which the 'discovery' and spread of drugs, drug foods, foods, and spices shaped the development of the modern world.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CGI/CSO

ANTH 381 **Consumption and Culture**

[Formerly LC399] In the contemporary United States, consumer spending drives the economy. People shop for recreation and use their possessions to mark and create their social status. This was not always the case, and though our patterns of consumption seem natural to us, the way we think about goods, our relationship to them, and their meaning to us are all historically and culturally determined. In this class we will place our current 'culture of consumption' in context. We will examine the rise of consumer culture and its link to other social and economic changes; we will explore the systems of

meaning which we use; and we will consider the implications – political, social and ecological - that our culture and our consumption entails.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CGI/EC

ANTH 397 **The Anthropology of Inequality**

Thomas Piketty's *Capital in the Twenty-First Century* has brought renewed attention to the causes and outcomes of economic inequality. In this class we will read and discuss Piketty's work, examining the nature of his argument and placing it in the context of anthropological examination of inequality. The course will centrally argue that equality or its absence are preeminently social outcomes caused by the presence or absence of mechanisms for social redistribution or the accumulation of wealth. Students will write shore, directed essays comparing the societies in question and a single, longer paper in which they will demonstrate their ability to integrate the material.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CGI/EC

ANTH 499 **Minor Portfolio**

In this course, students complete their Liberal Arts Minor Portfolios under the direction of their minor advisor. The course is graded on a Pass-No Credit Basis.

Credits: (0), P/NC, Semester Calendar

Independent Study,

Visual and Performing Arts**ARTS 1,3,5...** **Art Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Lecture, Transfer Credit Only

ARTS 2,4,6... **Art Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Knowledge Area requirement.

Credits: (2-4), Graded, Semester Calendar

Lecture, Transfer Credit Only

ARTS 100 **Introduction to Art**

Credit for this course is awarded only in the following cases: 1) receipt of a 4 or 5 on the AP Art History Exam, 2) receipt of a score of 5 through 7 on the International Baccalaureate Visual Arts Higher-Level Examination, or 3) satisfactory completion of a college-level introductory art appreciation or art history course.

Credits: (3), Graded, Semester Calendar

Independent Study, Transfer Credit Only

IA

ARTS 101 **Introduction to Music Theory**

Credit for this course is awarded only in the following cases: 1) receipt of a 4 or 5 on the AP Music Theory Exam or 2) satisfactory completion of a college-level introductory music theory course.

Credits: (3), Graded, Semester Calendar
Independent Study, Transfer Credit Only
IA

ARTS 200**Music Through the Ages**

This course offers an understanding and appreciation of music through a study of the principal forms and major composers. The course concerns itself with the chronological development of music from its beginnings through the present. One of the objectives of the course is to have the student learn what to listen for, and how to listen for it.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
IA

Aerospace Studies**AS 101****Air Force Heritage and Values I**

This is a survey course focusing on the organizational structure and missions of Air Force organizations, military customs and courtesies, officership and core values, and an introduction to written and oral communication skills. AFROTC cadets must take AS 103 Leadership Laboratory in conjunction with this course.

Credits: (1), Graded, Semester Calendar
Lecture, Fall Semesters

AS 102**Air Force Heritage and Values II**

This is a continuation of the overview of the organizational structure and missions of Air Force organizations, military customs and courtesies, officership, and core values to include further emphasis on basic communications principles. AFROTC cadets must take AS 104 Leadership Laboratory in conjunction with this course.

Credits: (1), Graded, Semester Calendar
Lecture, Spring Semesters

AS 103**Leadership Laboratory**

Leadership Laboratory is the application of personal leadership skills, demonstration of command, effective communication, individual leadership instruction, physical fitness training, and knowledge of US Air Force customs and courtesies. Corequisites: AS101.

Credits: (0), P/NC, Semester Calendar
Laboratory, Fall Semesters

AS 104**Leadership Laboratory**

Leadership Laboratory is the application of personal leadership skills, demonstration of command, effective communication, individual leadership instruction, physical fitness training, and knowledge of US Air Force customs and courtesies. Corequisites: AS102.

Credits: (0), P/NC, Semester Calendar
Laboratory, Spring Semesters

AS 201**Team and Leadership Fundamentals I**

This is a historical survey of trends, events, and policies that led to the emergence of air power through the Persian Gulf War. The course also provides an introduction to basic leadership and management skills and looks at ethical decision making. Basic communication skills are emphasized throughout the course. AFROTC cadets must take AS 203 Leadership Laboratory in conjunction with this course.

Credits: (1), Graded, Semester Calendar
Lecture, Fall Terms

AS 202**Team and Leadership Fundamentals II**

This is a continuation of the survey of the emergence of air powers, basic leadership and management skills, and ethical decision making. Basic communication skills will also be stressed. AFROTC cadets must take AS 204 Leadership Laboratory in conjunction with this course.

Prerequisites: AS201 or consent of the instructor.

Credits: (1), Graded, Semester Calendar
Lecture, Spring Semesters

AS 203**Leadership Laboratory**

Leadership Laboratory is the application of personal leadership skills, demonstration of command, effective communication, individual leadership instruction, physical fitness training, and knowledge of US Air Force customs and courtesies. Corequisites: AS201.

Credits: (0), P/NC, Semester Calendar
Laboratory, Fall Semesters

AS 204**Leadership Laboratory**

Leadership Laboratory is the application of personal leadership skills, demonstration of command, effective communication, individual leadership instruction, physical fitness training, and knowledge of US Air Force customs and courtesies. Corequisites: AS202.

Credits: (0), P/NC, Semester Calendar
Laboratory, Spring Semesters

AS 301**Leading People and Effective Communication I**

This course is a study of leadership and quality management fundamentals, professional knowledge, leadership ethics, and communication skills required of an Air Force junior officer. Case studies are used to examine Air Force leadership and management situations as a means of demonstrating and exercising practical application of the concepts. AFROTC cadets must take AS 301 Leadership Laboratory in conjunction with this course. Prerequisites: AS202 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

AS 302**Leading People and Effective Communication II**

This is a continuation of the study of leadership and quality management fundamentals, professional knowledge, leadership ethics, and communication skills. AFROTC cadets must take AS 304 Leadership Laboratory in conjunction with this course. Prerequisites: AS301 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

AS 303**Leadership Laboratory**

Leadership Laboratory is the application of personal leadership skills, demonstration of command, effective communication, individual leadership instruction, physical fitness training, and knowledge of US

Air Force customs and courtesies. This course provides advanced leadership experiences in officership activities, giving students the opportunity to apply leadership and management principles learned in AS 301. Corequisites: AS301.

Credits: (0), P/NC, Semester Calendar
Laboratory, Fall Semesters

AS 304**Leadership Laboratory**

Leadership Laboratory is the application of personal leadership skills, demonstration of command, effective communication, individual

leadership instruction, physical fitness training, and knowledge of US Air Force customs and courtesies. This course provides advanced leadership experiences in officership activities, giving students the opportunity to apply leadership and management principles learned in AS 301 and AS 302. Corequisites: AS302.

Credits: (0), P/NC, Semester Calendar
Laboratory, Spring Semesters

AS 401 Natl Security, Leadership Resp, and Commission Prep I

This course covers the Armed Forces as an integral element of contemporary society with specific emphasis on the military profession, civil-military interaction, and the formulation, organization, and implementation of US national security policy. In addition, students study leadership and management, ethical decision making, and communication skills. AFROTC cadets must take AS 403 Leadership Laboratory in conjunction with this course. Prerequisites: AS302 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

AS 402 Natl Security, Leadership Resp, and Commission Prep II

This is a continuation of the study of the military profession, civil-military interaction, and US national security policy. Midway through the course, the focus shifts to orient junior officers toward their first duty assignment in the Air Force. AFROTC cadets must take AS 404 Leadership Laboratory in conjunction with this course. Prerequisites: AS401 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

AS 403 Leadership Laboratory

Leadership Laboratory is the application of personal leadership skills, demonstration of command, effective communication, individual leadership instruction, physical fitness training, and knowledge of US Air Force customs and courtesies. This course provides advanced leadership experiences in officership activities, giving students the opportunity to apply leadership and management principles learned throughout their AFROTC experience. Corequisites: AS401.

Credits: (0), P/NC, Semester Calendar
Laboratory, Fall Semesters

AS 404 Leadership Laboratory

Leadership Laboratory is the application of personal leadership skills, demonstration of command, effective communication, individual leadership instruction, physical fitness training, and knowledge of US Air Force customs and courtesies. This course provides advanced leadership experiences in officership activities, giving students the opportunity to apply leadership and management principles learned throughout their AFROTC experience. Corequisites: AS402.

Credits: (0), P/NC, Semester Calendar
Laboratory, Spring Semesters

Bioethics

BIE 400 Responsible Conduct of Research

This course is designed to provide students with an introduction to the ethics of scientific research, including research involving human participants and animal subjects. The course will start with a discussion of responsible conduct of research (also known as research integrity and commonly referred to by the acronym RCR). As close to

ninety percent of the work that research ethicists do focuses on the education, promotion and adjudication of RCR issues, these issues are applicable to all aspects of the research endeavor and all fields of scientific study. Understanding these issues and being able to apply the basic principles to critically analyze cases is thus an essential starting point for anyone interested in research and research ethics. The course will also delve briefly into some of the basic ethical, legal, and social issues surrounding research using animal subjects or human volunteers.

Credits: (3), Graded, Semester Calendar, Lecture, Spring Terms

Biomedical/Rehabilitation Engineering

BR 200 Intro to Biomedical & Rehabilitation Eng, Science and Tech

Introductory course focused on biomedical and rehabilitation engineering, science and technology (BEST). With remarkable progress in medical technology for saving lives and improving quality of life, this course will focus on advances in biomedical engineering and its application to rehabilitation technology. Using ten most significant technological innovations, a quantitative focus will consider fundamental scientific bases and engineering concepts for devices and technologies as well as the societal context of which these innovations arose. We will explore various factors that impact the technological solution including culture, medical ethics, regulatory issues, economics and marketing. Students will focus on one specific problem, apply design principles and develop a solution while considering the factors which impact the design.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

STS

Comm Points: 2

BR 400 Biomedical Engineering Fundamentals

[Cross-listed with BY 440, ES 402] This interdisciplinary course will introduce students to basic principles of biomedical rehabilitation engineering. The course will present principles of disability and the diverse roles of engineering in medicine and rehabilitation. Students will use engineering methods to study anatomical and physiological systems including applications in rehabilitation engineering, bioinstrumentation, biosignal and image processing, biomechanics, and biomaterials. Prerequisites: MA131/132, PH131/132, junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

BR 450 BEST Capstone Design I

Biomedical Engineering, Science, and Technology (BEST) senior capstone design course. Students will be divided into multi-disciplinary teams charged with investigating a BEST-related open ended project. Students focus on one aspect of design/production/marketing appropriate for their background and be conversant on other area of the project, including design, human interface, regulatory, ethics, marketing and economics. Includes written reports and oral presentations

Credits: (3), Graded, Semester Calendar
Project Team, Fall Semesters

Biology

BY 1,3,5... **Biology Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

BY 2,4,6... **Biology Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Science Foundation Curriculum Requirement.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

BY 100 **Biology Elective with Laboratory Experience**

Credit for this course is awarded only on the basis of an incoming student's performance on the Biology Advanced Placement (AP) exam or in the International Baccalaureate (IB) Biology course. See the AP/IB policy for specifics. Biology, Biomolecular Science, and Environmental Science (EHS and ES&P) majors may not use credit for BY100 as one of their required Biology Electives.

Credits: (4), Graded, Semester Calendar

Lecture, Transfer Credit Only

BY 110 **Biology and Society**

Definition of science, the scientific method, overview and scope of modern biology, introduction to biomolecules and cell structure, Mendelian inheritance and genetics, human physiology, evolution, and ecology. Course topics are presented from the perspective of current issues in biotechnology, medicine, and human impact on the biosphere. This course is intended for students who are not majoring in the biological sciences and may not be taken by students with credit for BY100 or BY140. Restriction: Students may not enroll in this course if they have credit for BY140 or BY160.

Credits: (3), Graded, Semester Calendar

Lecture, Every Term

BY 112 **Laboratory for Biology and Society**

Companion laboratory course to BY110 introducing students to the scientific method of laboratory and field experimentation used by contemporary biologists. Corequisite: BY110.

Credits: (1), Graded, Semester Calendar

Laboratory, Every Semester

BY 115 **Introduction to Environmental Sustainability**

This course will provide students with a basic understanding of environmental science and sustainability concepts. Students will gain an understanding of the impacts that humans have on atmosphere, lithosphere, and hydrosphere. The course will also focus on sustainability concepts that are particularly relevant to business practices and engineering. Specific case studies will also be used to increase understanding of how businesses are tailoring their practices to meet sustainability goals. The course will be lecture based, and active learning exercises will be implemented to enhance understanding of sustainability concepts. Students will be evaluated through homeworks, examinations, and a group project. Restriction: Students may not enroll in this course if they have credit for BY140 or BY160.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

BY 120 **Intro to Biotechnology Sciences and their Applications**

Students in today's competitive market often need to possess multifaceted knowledge and skills. The interdisciplinary structure of BY120 encourages collaborations across schools and fields. The syllabus is designed to meet the needs and spark the interest of non-biology majors in biotechnology. By creating a stimulating, lecture-based, solid foundation in basic molecular biology and providing insight into the innovative discipline of biotechnology, students will be inspired and encouraged to apply their own academic backgrounds in a creative manner to drive innovations and applications in this field forward and to investigate possible employment niches for themselves. Aside from covering the fundamentals, the lectures will venture into bioinformatics, DNA amplification and sequencing technologies, genetic engineering and gene expression systems, large scale production, molecular diagnostics, personalized medicine, commercial products, gene therapy, stem cells, transgenic animals and plants, synthetic biology, patenting, as well as societal and ethical impacts. Extra credit opportunities will be offered for students who would like to deepen their knowledge on specific topics.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

BY 130 **Contemporary Issues in Environmental Science**

This course examines how human activity impacts the environment. Topics include air and water pollution, environmental systems management, industrial ecology and environmental policy with emphasis on the multidimensional aspects of currently environmental issues. Case studies of chemical exposures, life cycle assessments, and integrated resources management will be used to discuss the process of environmental decision making.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

BY 140 **Biology I - Inheritance, Evolution, and Diversity**

Introduction to the scientific method, mitotic and meiotic cell division, genetic inheritance, evolution of species, phylogenetics, systematics, paleobiology, survey of the tree of life, population biology, ecology and behavior.

Credits: (3), Graded, Semester Calendar

Lecture, Discussion, Fall Semesters

BY 142 **Biology I Laboratory**

Companion laboratory course to BY140 providing practical exposure to the scientific method of hypothesis testing, presentation and statistical analysis of biological data, writing scientific reports and papers in the context of field and laboratory experimentation related to BY140. Corequisite: BY140.

Credits: (2), Graded, Semester Calendar

Laboratory, Fall Semesters

Comm Points: 1

BY 160 **Biology II - Cellular and Molecular Biology**

Introduction to biomolecules, organelles, and cytoarchitecture of cells, energy metabolism and photosynthesis, DNA replication, transcription of RNA, protein synthesis, gene regulation, development and differentiation with a view towards biotechnology.

Credits: (3), Graded, Semester Calendar

Lecture, Discussion, Spring Semesters

BY 162 **Biology II Laboratory**

Companion laboratory course to BY160 providing a hands-on experience to put your knowledge to the test. Here you will be introduced to the scientific method and you will be describing, analyzing, and reporting your results the way a scientist would in a real laboratory setting. Experiments include chemical properties of the molecules of life, enzymatic analyses, microscopy and microdissections, photosynthesis and respiration, mitosis and meiosis, Drosophila genetics, molecular biology of nucleic acids and bacteriology. You will be presenting your results both orally and in writing.

Credits: (2), Graded, Semester Calendar
Laboratory, Spring Semesters
Comm Points: 1

BY 214 **Genetics**

The overall goal of this course is to provide a comprehensive introduction to the science of genetics. Classical principles of Mendelian genetics will be covered, however, the emphasis will be placed on fundamentals of molecular genetics and recent advances. Major topics include gene structure and function, genetic recombination, genetic engineering, genomics, gene and chromosome mutations, regulation of gene transcription, cell cycle and cancer genetics, developmental genetics, and an introduction to population genetics. Prerequisites: BY160 or consent of the instructor

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
STS

BY 216 **Classical Genetics Laboratory-Theory and Practice**

Hands-on experimental testing of genetic concepts using *D. melanogaster* as a model organism. Objectives: to learn how to develop testable hypotheses and use the scientific method to interpret and analyze data and write a scientific manuscript of experimental findings. Outcomes: students will become proficient in using their knowledge from previous biology courses, especially BY214 (required) as well as newly acquired knowledge from lectures and literature searches to design experiments, include proper controls, objectively analyze data, use statistical methods to evaluate their results, and gain experience in presenting their findings both orally and in written form.

Credits: (4), Graded, Semester Calendar
Laboratory, Spring Semesters

BY 222 **Ecology**

Ecology is the study of factors that control the distribution and abundance of species in nature. Ecological interactions will be explored at the individual through ecosystem level in terrestrial, freshwater, and marine habitats. Emphasis will be on fundamental ecology, but applications to human-related problems will be explored. Prerequisite: BY140 or Corequisite: BY140.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters
Comm Points: 1

BY 224 **Ecology Laboratory**

Field and laboratory exploration of physical, chemical, and biological factors influencing animal and plant species, populations, and communities in upstate New York. Students will learn field and

laboratory techniques in ecology and general identification of some organismal groups. Course will include required field trips to surrounding habitats and laboratory experiments. Corequisites: BY222

Credits: (2), Graded, Semester Calendar
Laboratory, Fall Semesters
Comm Points: 1

BY 280 **Environmental Science**

This course will investigate the key concepts and principles of environmental science, emphasizing human impacts to the earth. The themes will include, energy flows through nature, and biogeochemical systems and how they have been perturbed by human activities. Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. Quantitative analysis of air, soil, and water quality on local, regional, and global scales will be a significant component of the course. Emerging principles in environmental science, including sustainability, industrial ecology, risk assessment, and the precautionary principle will be introduced. The course will prepare students to qualitatively and quantitatively analyze fluid and contaminant flow in varied biological and geologic systems. Prerequisites: sophomore standing, CM131/CM132 or CM103/CM104, or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture

BY 300 **Recent Advances in Biological Research**

The objective of this course is to present recent advances in biological and biomolecular research, and to describe opportunities for graduate study and undergraduate summer research. Students will receive one credit for attending biology seminars (6 per semester), reading a journal article prior to each presentation, writing short review of each seminar, and participating in discussions. This course can be taken for credit more than once. Prerequisites: BY140 and BY160

Credits: (1), Graded, Semester Calendar
Lecture, Every Semester
Comm Points: 1

BY 302 **Plant Science of Northern New York**

Upon completion of the course, the student will be aware of the classification of plants, recognize and appreciate the life cycles of the main plant phyla, plant physiology, plant metabolism, understand the relationships among plant tissue and organ structures and function, and the plant community structure along environmental gradients in a temperate zone such as the region in northern New York. Prerequisites: BY 140 and BY 142

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

BY 304 **Introductory Zoology**

In this course, we will conduct a diversity survey of animal life with emphasis on invertebrates. Course content will primarily consist of comparing the major animal phyla emphasizing integration of form, function, ecology, and phylogeny. Prerequisites: BY140/142 and BY160/162, or consent of the instructor

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

BY 312 Adirondack Ecology and Environmental Science

[Cross-listed with EV 312] This course introduces ecological and environmental science concepts relevant for understanding the structure and function of terrestrial, aquatic, and human systems in the Adirondack Park. Students will learn to identify important plant and animal species representative of the Adirondack Mountains, and learn major features of ecological systems in the Park. The course will also provide the students an assessment of human impacts on the ecology of the Adirondack Park.

Enrollment is limited to those students participating in the Adirondack Semester Program.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Given When Needed
(TECH)

BY 313 Biogeochemical Earth Systems Science

[Cross-listed with CE 313, EV 313] This course will investigate the key concepts and principles of environmental science emphasizing the earth's biogeochemical cycles and how they have been perturbed by human activities. Quantitative analysis of air, soil and water quality on local, regional and global scales will be a significant component of the course. Emerging principles in environmental science, including sustainability, industrial ecology, risk assessment and the precautionary principle will be introduced. In addition to the quantitative aspects, the course will consider the historical, social, and political contexts in which the practice of environmental science takes place. Prerequisites: CM132 (or CM104), or consent of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters
(TECH)

BY 314 Bioinformatics

[Cross-listed with CM 314] This course and companion lab provides students with an introduction to the theory and methods of DNA and protein sequence analysis. Students receive experience retrieving information from sequence and genome databases. Methods of sequence alignments include dynamic programming and statistical methods of molecular evolutionary change are outlined. Emphasis is also placed on calculating the statistical significance of results. Protein structural alignments and displays, and structural prediction are covered. Gene prediction algorithms, methods of phylogenetic analysis and database similarity searching are explained. The course introduces students to the analysis of genomes for protein families and domains and to the analysis of gene expression patterns. Prerequisites: BY160 and BY214.

Credits: (4), Graded, Semester Calendar

Lecture, Laboratory, Even Fall Semesters
(TECH)

BY 315 Bioinformatics for Disease Research

This course will provide students with an introduction to the theory and methods of DNA, RNA, and protein sequence analysis in the context of disease biology. Integrated computer laboratory exercises will give students significant experience retrieving, manipulating, and analyzing information from sequence and genome databases. Enrollment is limited to students participating in the Trudeau Semester. Enrollment is limited to students participating in the Trudeau Semester.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

STS
(TECH)

BY 319 Current Readings in Animal Behavior

[Cross-listed with PY 319] The field of animal behavior is a rapidly advancing one, especially at the interface of neurobiology and cognition, and the interface of cognition and functional analysis of behavior (behavioral ecology and sociobiology). This one credit hour course is designed as a 'journal club' with a focus on the latest developments in theory and empirical research on animal behavior. The course is intended for any student who has a sincere interest in integrative animal behavior. Prerequisites: BY222 or PY151

Credits: (1), Graded, Semester Calendar

Lecture, Fall Semesters

BY 320 Microbiology

This course will provide a fundamental introduction to the study of microbial life forms. The diverse biology of these organisms will be reviewed and application to human health and society, the natural environment, and biotechnology will be emphasized. Upon completion of the course, students will be capable of assessing microbial growth and metabolism and understand its applications in natural and engineered environments. Prerequisites: BY160, BY214 and CM132 or CM104 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

BY 322 Microbiology Laboratory

Laboratory exercises will stress the classical techniques for handling bacteria and demonstrate concepts presented in the lecture series: both clinical and environmental aspects of applied microbiology will be explored. Upon completion of the course, students will be capable of safely manipulating microbes in a laboratory setting, as well as become competent in techniques used to observe and culture microbes. Prerequisites: BY162, CM132 or CM104 or consent of the instructor.

Credits: (2), Graded, Semester Calendar

Laboratory, Spring Semesters

Comm Points: 2

BY 324 Parasitology

The natural history, ecology and molecular biology of parasites are explored with an emphasis on life cycles, host/parasite interactions and evolution of parasitism. Basic principles of epidemiology, transmission, diagnosis, treatment and prevention are examined in parasites of medical, veterinary, and economic importance. Lectures will be supplemented by demonstrations of fixed materials and by exercises in identification and diagnoses. Prerequisite: BY 140 and BY 160

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Semesters

BY 328 Conservation Biology

BY428 provides an overview of the core theory of conservation biology, and how conservation biology is applied for environmental conservation and management. Major topics of this course will include conservation prioritization, the problems of small population size on the long-term persistence of a species, conservation genetics, habitat fragmentation and nature reserve design, invasive species,

consequences of extinctions on an ecosystem processes and community structure, and the possible effects on biodiversity of global climate change. A course emphasis will be on the challenge of translating the core lessons of conservation biology to effective policy and environmental management.

Prerequisites: BY222 or consent of the instructor. Prerequisites: BY222 or consent of instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

STS

BY 330 **Great Lakes Water Protection**

[Cross-listed with EV 330] The Laurentian Great Lakes contain 20% of the world's surface fresh water and serve both water supply and waste disposal services for over 30 million residents in the United States and Canada. Technological advances have controlled the outflow of the Great Lakes at the St. Lawrence River and this has brought with it social benefits and environmental costs. The United States and Canada share the management of this resource and have shared notable success controlling environmental consequences of development yet are faced with emerging issues. The LGL/SLR system will be examined from a multidisciplinary, multinational perspective to illustrate that a shared resource can be maintained. Students will be able to understand the forces (geomorphic, biological, chemical, social, economic, and political) that have shaped and impacted a globally significant resource. Restriction: At least Sophomore standing.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

UNIV/CGI/STS

Comm Points: 1

BY 340 **Behavioral Ecology and Sociobiology**

[Cross-listed with PY 340] This course is concerned with the adaptive functions of animal behavior, emphasizing ecological and evolutionary perspectives. Topics covered include foraging behavior, sexual selection, social systems, parental care, and cooperation and conflict. One major focus will be on evaluating the arguments of proponents and critics of sociobiology on whether the field is useful at explaining human behavior. Prerequisites: BY140 or PY151 or consent of instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

IG

BY 345 **The Human Genome**

This course explores our current understanding of genomics as applied to the human genome. We will begin with an introduction to genome structure and function, and then apply that knowledge to understanding patterns of human history and evolutionary adaptation, exploring the genetic causes of disease with genome-wide association studies, and discuss the multifaceted impacts of the personal genomics revolution. Prerequisites: BY140 or permission of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

STS

BY 350 **Comparative Vertebrate Anatomy**

This course compares anatomical structures throughout different classes of vertebrates. We begin by defining anatomical terms and

identifying what constitutes a vertebrate. We will also learn how vertebrate organ systems develop and the physical constraints placed on development of these systems. The anatomical study will be broken down into major organ systems that will be discussed one at a time. For each of the organ systems, there will be a discussion of relevant structure and function followed a description of the major changes in form and function throughout vertebrate evolution. Since there are numerous classes of vertebrates, we will concentrate on representatives from some of the better studies examples. Prerequisites: BY160 or consent of the instructor.

Corequisite: BY352.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 352 **Comparative Vertebrate Anatomy Lab**

Through the use of dissection and histological observation, we will observe and make direct comparisons of anatomical structures from representative vertebrates. The organ systems that are dissected in this course will follow the topics presented in BY350. After the first two introductory labs, you will dissect specific organ systems one at a time in each of your specimens. This will allow you to make direct comparisons between comparable structures in different vertebrates. The animals that will be dissected (Necturus – Mud Puppy, Dogfish shark, pigeon, and cat) are representative vertebrates chosen to illustrate changes to the organ systems as vertebrates became more complex. Prerequisites: BY160 or consent of the instructor.

Corequisite: BY350.

Credits: (2), Graded, Semester Calendar

Laboratory, Fall Semesters

BY 357 **Human Cognitive Evolution**

[Cross-listed with PY 357] Evolutionary psychology is concerned with the adaptive problems and selective pressures our ancestors encountered in their environments, the psychological mechanisms that evolved to help them solve those problems, and the way those evolved mechanisms function in current environments. This way of thinking about the brain, mind, and behavior is changing how scientists approach old topics, and is opening up new ones. This course will focus on current developments and selected topics in evolutionary psychology (e.g., foraging, mate choice, parental investment, cooperation and culture) and explore the evolution of cognition from a broad comparative perspective. Prerequisites: PY151 or junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 358 **Animal Learning and Cognition**

[Cross-listed with PY 358] This course focuses upon how animals acquire, process, store and recall information about their environment and social partners. Topics that will be examined include how animals perceive and classify stimuli; how they learn and remember; how they orient and navigate; how they measure time, number, and amount; how they acquire abstract concepts; how they perceive social relationships; and how they communicate. A diversity of invertebrate and vertebrate organisms will be included (sea slugs to primates!), and there will be an emphasis on understanding taxon-specific specializations as well as general patterns across animals. Prerequisites: BY140 or PY151 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

BY 359 **Perception**

Perception deals with our conscious experience of the world, ourselves and each other. This course will examine how perceptions are measured (psychophysics); how visual, auditory, touch and pain sensory stimulation is actively organized into conscious perceptions; developmental aspects of perception; the role of cognitive factors, such as attention; and how altered conscious states (e.g., achieved through meditation, hallucinogenic drugs) affect perception. Fundamental principles of perception discussed in this course will be used to explain how we experience the world, ourselves, and each other. Prerequisites: PY151 or junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 360 **Comparative Physiology**

In this course, students will be instructed in all the main branches of modern animal physiology with a strong emphasis on the integration of physiological knowledge, ecology, and evolutionary biology. In addition to an in-depth treatment of mammalian physiology, students will be exposed to the various physiological systems that have evolved in other vertebrate, as well as invertebrate, animals. The primary goal is to understand how these physiological systems allow animals to survive in the environments that they inhabit.

Prerequisite: BY160 or consent of the instructor. Prerequisites: BY160 or consent of instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

BY 362 **Comparative Physiology Laboratory**

In this laboratory-based course, students will gain practical exposure to basic research techniques used in the study of animal physiology. Class activities include studying action potential propagation, the mammalian dive reflex, electrooculography and the physiological effects of exercise. Corequisite: BY360.

Credits: (2), Graded, Semester Calendar

Laboratory, Spring Semesters

Comm Points: 1

BY 363 **Pharmacology of Infectious Disease**

This course will introduce students to the basic principles of immunology and pharmacology with an emphasis on current treatment strategies employed to combat infectious disease. Students will learn how vaccines are used to prevent infection, in addition to the deployment of small molecule drugs and newer antibody-based therapies for the treatment of existing infectious disease. Course information will be disseminated to students in the form of lectures, readings from review and original research articles, and through group discussion that involves case studies and problem-based learning. Prerequisites: BY160

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Terms

BY 368 **Mathematical Biology Seminar**

[Cross-listed with MA 368] The objective of this course is to present recent advances in research that combines biological and mathematical analysis, and to describe opportunities for interdisciplinary summer research in biology and mathematics. Students will receive one credit for attending seminars (6 per semester), reading a journal article prior to each presentation, writing a short review of each seminar, and participating in discussions. This course can be taken for credit more than once. Prerequisites: BY140

and BY160; MA181 or MA131 (or equivalent), or consent of the instructor

Credits: (1), Graded, Semester Calendar

Seminar, Fall Semesters

BY 380 **Techniques in Immunological Research**

This course will provide students with a basic understanding of molecular, cellular and imaging techniques used at the Trudeau Institute to help researchers study the immune system. Students will learn principles and procedures relating to molecular biology, cellular biology, histology, flow cytometry, light microscopy, and cell sorting. The course will cover basic quantification of gene expression at the transcriptional and post-translational level. The course will also cover basic quantification of cell populations using flow cytometers to collect and analyze subpopulations of cells from tissues. Histology and light microscopy techniques will be used to locate similar cell populations within a tissue section. Students will gain confidence in the selection and application of the appropriate cell imaging techniques required to assess mammalian cell tissues. Enrollment is limited to students participating in the Trudeau Semester.

Credits: (3-6), Graded, Semester Calendar

Lecture

(TECH)

BY 383 **Molecular Genetics and Human Disease**

The goal of this course is to learn detailed information related to the structure, packaging and expression of genes within the genome of both prokaryotic and eukaryotic organisms. Not only will the material be discussed in class, but there will be discussion about how the research was performed with critical analysis of current biotechnological techniques and results. A textbook will be used for the course but there will also be regularly spaced journal articles related to the topic. We will also discuss health related issues caused by defects in each of these processes. Prerequisites: BY 160 and BY 214

Credits: (3), Graded, Semester Calendar

Lecture, Odd Fall Semesters

BY 400 **Directed Study in Bioscience**

Students study specialized topics in bioscience not otherwise available in formal courses. Under supervision of a faculty member, a semester-long course of study tailored to professional interests is designed based on readings from relevant texts and primary literature.

Prerequisites: Consent of the instructor.

Credits: (1-4), Graded, Semester Calendar

Independent Study, Given When Needed

BY 401 **Professional Assessment**

This course is designed to assess the professional development of biology majors by (1) completion of a standardized test to assess their level of knowledge in the field of biology, (2) submission of a professional resume, and (3) submission of a personal statement for graduate/professional school or employment. Restriction: Senior standing or consent of the Biology Department Chair.

Credits: (0), P/NC, Semester Calendar

Independent Study

BY 405 **Undergraduate Research in Bioscience**

Students conduct an original bioscience research project based on investigation of a specific problem related to areas of faculty

expertise. Research methodology may involve field, laboratory, computational, or theoretical approaches. Presentation of research results at a scientific meeting or local symposium is strongly encouraged.

Prerequisite: consent of the instructor.

Credits: (1-6), Graded, Semester Calendar

Research, Given When Needed

BY 410 Undergraduate Thesis Research in Bioscience

A formal thesis project is arranged under supervision of a faculty member who guides the student in planning and execution of original research work and preparation of a written thesis. This course is primarily intended for junior or senior biology majors who wish to pursue graduate or professional studies in bioscience. Work done in satisfaction of the requirements for a degree will be assigned a grade when the thesis is submitted and approved.

Prerequisite: consent of the instructor.

Credits: (1-6), Graded, Semester Calendar

Research, Given When Needed

BY 412 Molecular Biology Laboratory

This course will provide students with a hands-on introduction to modern molecular biology techniques. Students will learn techniques such as bacterial transformation and plasmid DNA purification, restriction digest and gel electrophoresis, isolation of DNA and RNA from eukaryotic cells, Southern hybridization, reverse transcription, polymerase chain reaction, and cloning PCR products, and web-based analytical programs. The lectures and reading will cover the theory and applications of these molecular techniques. Prerequisites: BY214 or consent of the instructor.

Credits: (4), Graded, Semester Calendar

Laboratory, Fall Semesters

(TECH)

Comm Points: 1

BY 415 Recent Advances in Immunology Research

The objective of this course is to present recent advances in immunological and microbiological research. Students will receive one credit for attending seminars (9 per semester), reading a journal article prior to each presentation, writing short review of each seminar, and participating in discussions. Prerequisite: BY 160 and BY 162

Credits: (1), Graded, Semester Calendar

Lecture, Fall Semesters

Comm Points: 1

BY 416 Principles of Toxicology and Epidemiology

[Cross-listed with EHS 518] See EHS 416 Occupational Toxicology for description. Prerequisites: EHS 309 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

BY 419 Immunology

An overview of the immune system, with emphasis on current concepts and literature. Topics covered include: cells and tissues of the immune system; structure and function of antibodies; genetic basis of antibody diversity; humoral and cellular immunity; cellular interactions; major histocompatibility complex; the complement system; transplantation; tumor immunity. Prerequisites: BY 140, BY

160 and BY 214, or consent of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

Comm Points: 1

BY 420 Evolution

This course is organized into three sections: History of Life, which covers abiogenesis and the fossil record; Development of Evolutionary Theory, which reviews the origin of evolutionary thought, emphasizing Darwin and the synthesis of genetics and natural history; and Population Biology, which covers the mechanisms by which populations adapt to environmental change.

Prerequisites: BY214.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

BY 424 Experimental Evolution Laboratory

[Cross-listed with BY524] An introduction to experimental approaches used in evolutionary biology. Students will conduct lab experiments using microbes to investigate a range of topics in experimental evolution, observing and exploring evolution as it happens in real time. Topics explored will include adaptive diversification, the evolution of fitness trade-offs, evolutionary loss of redundant traits, and evolutionary rescue. Prerequisites: BY420

Credits: (2), Graded, Semester Calendar

Laboratory, Fall Terms

BY 425 Biological Systems and Environmental Change

Human activities are resulting in dramatic global environmental change, in the forms of biodiversity loss, altered biogeochemical cycles, introduced invasive species, chemical toxification of the environment, climate change, unsustainable exploitation of natural resources, and habitat loss, degradation, and fragmentation. In this course, we will examine how these forms of environmental change disturb biological systems by critically reading key research papers, and discussing their implications for future research and policy action.

Prerequisites: BY222 or graduate standing.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

UNIV/CGI/STS

BY 426 Introduction to Biophysics

[Cross-listed by PH 426] This course concentrates on the fundamental physical processes that occur within living organisms, particularly the cell. Topics include the structure and physics of macromolecules, biological membranes, the thermodynamics of living systems, muscle contraction and the propagation of signals in nerve cells.

Prerequisites: BY160 or BY312 or consent of instructor

Credits: (3), Graded, Semester Calendar

Lecture

BY 427 Advanced Mass Spectrometry: Practical Applications

Practical Applications will introduce the students to mass spectrometry and its applications within different fields, including pharmaceutical and biotech industry, academia, government, forensics, etc. Various types of instruments will be discussed, as well as their application within different fields. The course will then focus on different types of well-known "omics", such as proteomics, metabolomics, glycomics, or lipidomics, but also on specialized types

of “omics” such as peptidomics, post-translational modification-omics (PTM-omics), interactomics, foodomics, microbiomics, venomics, DNA- RNA- & Protein- adductomics, genomics, proteogenomics or transcriptomics. Particular applications of all these kinds of “omics” in biotechnology & pharmaceutical industry, healthcare, biowarfare and forensics will also be discussed. Prerequisites: CM/BY460/560, or consent of the instructor
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

BY 430 **Developmental Biology**

The course will focus on how an organism develops into a complex multicellular organism from a single cell. We will begin with the genetics of development and discuss mechanisms by which genes become sequentially activated as embryogenesis proceeds. The mechanics and genetics of both invertebrate and vertebrate development will be discussed beginning with fertilization and ending as embryogenesis is completed. We will also discuss some additional developmental events that occur during embryogenesis and later in adults. Because of technological advances in developmental biology, topics in this field have also become important societal issues. Throughout the semester, we discuss the ethical implications of using these advances and their impact on society. Prerequisites: BY160 or consent of the instructor
Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Terms

BY 431 **Limnology**

Limnology is the study of physical, chemical, and biological properties of fresh water bodies, e.g. lakes, rivers, reservoirs, and wetlands. This introductory course will provide an array of topics that will, by the multi-disciplinary nature of limnology, call upon students' knowledge of biology, chemistry and physics and place them within the context of aquatic science. The focus of the instruction will be aquatic ecology at all levels of biological organization. Upon completion of the course, the student will be able to characterize the physical, chemical and biological/ecological properties of a freshwater through the selection and application of appropriate sampling methods. Some fieldwork will be required. Prerequisites: BY222 or CM132 or consent of the instructor.

Corequisite: BY 432

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Semesters

BY 432 **Limnology Laboratory**

This co-requisite of Limnology (aquatic science) will provide students the opportunity to engage in water sampling of regional lakes and rivers, analysis of samples in the laboratory, introduction to data synthesis, and report writing. Some fieldwork will be required. Corequisite: BY431

Credits: (2), Graded, Semester Calendar

Laboratory, Even Fall Semesters

(TECH)

BY 440 **Biomedical Engineering Fundamentals**

[Cross-listed with BR 400, ES 402] This interdisciplinary course will introduce students to basic principles of biomedical rehabilitation engineering. The course will present principles of disability and the diverse roles of engineering in medicine and rehabilitation. Students

will use engineering methods to study anatomical and physiological systems including applications in rehabilitation engineering, bioinstrumentation, biosignal and image processing, biomechanics, and biomaterials. Prerequisites: MA131/132, PH131/132, junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 445 **Biological Oceanography**

The goal of this course is to introduce students to the fundamentals of ocean science through an integrative approach that emphasizes physical (circulation, tides & waves), chemical (biogeochemistry) and biological (marine life) principles. Through a series of inquiry based and computational exercises, an exploration of the scientific literature and the use of flipped classrooms, we will consider the future of the world's oceans in light of the contemporary challenges they face such as global climate change, pollution and an ever expanding aquaculture trade. Prerequisites: BY140, BY160, and MA180 or MA131

Credits: (3), Graded, Semester Calendar, Lecture, Even Spring Terms

BY 448 **Medical Microbiology**

This course will systematically examine human pathogens with a focus on why the biologic properties of organisms are important to disease in humans, including the basic principles of the host immune response, laboratory diagnosis, bacteriology, virology, mycology and parasitology. This class will emphasize basic science with clinical practice to understand the clinical relevance of the organisms examined using clinical cases from literature reports to illustrate the epidemiology, diagnosis, and treatment of infectious diseases. The course will emphasize student interaction and exploration of the scientific literature. Prerequisites: BY 160 and BY 214 (or instructor approval)

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

Comm Points: 1

BY 450 **Biochemistry I**

[Cross-listed with CM 460] This course is a one semester introduction to the molecular basis of biological processes. The first part of the course will cover the structure and function of the four major classes of biomolecules - proteins, carbohydrates, lipids, and nucleic acids. The second part covers the organization and regulation of the major energy generating and biosynthetic pathways. Prerequisites: CM241 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 451 **Biochemistry II**

[Cross-listed with CM 461] A continuation of Biochemistry I focusing on autotrophic and anabolic metabolism. Prerequisite: BY450 or equivalent

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

BY 452 **Pharmacology**

[Cross-listed with CM 452] The science of Pharmacology concerns the molecular mechanisms by which drugs act on the human body and the applications of drugs in clinical therapy. This course will introduce students to general principles of drug action and survey selected

classes of drugs according to their physiological effects and uses in the treatment of certain diseases. Prerequisites: BY160 and CM241 or consent of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 453 **Pharmacology Lab**

The goal of this course is to facilitate a greater understanding of key concepts in pharmacodynamics, pharmacokinetics that are discussed in the lecture component and observe how they are applied in the context of the clinical environment. The lab will be simulation based, employing virtual organ bath experiments to derive and interpret dose-response curves, and virtual patient software to investigate drug pharmacokinetics and dosing strategies. Corequisites: BY 160 and BY 452

Credits: (2), Graded, Semester Calendar

Laboratory, Even Spring Semesters

BY 454 **Physiological Psychology**

[Cross-listed with PY 454] A comprehensive investigation of the physiological foundation of behavior. Topics include: perception, motivation, emotion, states of consciousness, learning, memory and mental illness. Prerequisites: PY151 or junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

BY 455 **Cell and Molecular Biology of Cancer**

This course will focus on the cellular and molecular alterations that cause human cancer. Topics include cell cycle regulations, oncogenes and tumor suppressor genes, cancer viruses, multistep tumorigenesis, invasion and metastasis, and new developments in cancer diagnosis and therapy. Emphasis will be placed on student interaction and exploring the scientific literature. Prerequisites: BY160 and BY214 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

Comm Points: 1

BY 458 **Cognitive Neuroscience**

[Cross-listed with PY 458] This course introduces a sampling of the theories and research concerning how various mental processes are accomplished within the brain. Emphasis will be placed on developing an understanding of both the physiological bases of the techniques and the issues involved in relating measures of brain activity to cognitive functioning. Students will be exposed to current topics of study in a number of areas of cognition: perception, language, memory, among others. In this course we will study a number of different techniques for studying the brain, including electrophysiological recording techniques, functional imaging techniques, and methods that involve brain lesions and disrupting neural activity. Prerequisites: PY151 or junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Terms

IGSTS

BY 460 **Neurobiology**

[Cross-listed with PY 460] Neurons are electrically excitable cells that initiate or control many complex functions such as sensory perception, locomotion, memory, and learning. This course introduces the study of neuronal mechanisms at the cellular and molecular level. Topics include: membrane biophysics, ion channels,

electrical signaling, synaptic transmission, glia, sensory transduction, neuromodulation, and neuronal plasticity. Prerequisites: BY160 or BY360 or consent of instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 465 **Molecular and Genome Evolution**

[Cross-Listed with BY565] An overview of the molecular underpinnings of evolution, and how those molecular changes can be used to characterize and understand the evolutionary history of genes, proteins and organisms. Topics include how and why DNA sequences and genomes change, molecular phylogenetics and evolutionary models, gene duplication and the evolution of gene families, and horizontal gene transfer. For BY 565, additional readings and an additional written and oral report will be required. Prerequisite: BY420

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

BY 470 **Biochemistry & Biotechnology Laboratory**

[Cross-listed with CM 470] This course is a one semester course in the fundamental laboratory approaches for biochemistry and biotechnology. While largely a hands-on course, laboratory experiments will be supplemented with lectures that integrate the theoretical and practical principals covered in the exercises. Topics include protein purification, characterization and analysis, enzyme kinetics and molecular modeling. Prerequisites: CM221 and CM223 or BY450/CM460 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Laboratory, Spring Terms

Comm Points: 2

BY 471 **Anatomy and Physiology I**

This course is the first course in a two semester sequence that studies the anatomy and physiology of the human body in detail. Topics covered in this semester include basic cellular activities, anatomy and physiology of skeletal, muscular, circulatory and lymphatic systems. This course is appropriate for students in the pre-PT program as well as pre-health majors in any other health-related field that require a two-semester Anatomy and Physiology sequence. Prerequisites: BY 160 or by consent of the instructor

Corequisite: BY 473

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

BY 472 **Anatomy and Physiology II**

This course is the second course in a two semester sequence that studies the anatomy and physiology of the human body in detail. Topics covered in this semester include the anatomy and physiology of major organ systems as well as homeostasis. This course is appropriate for students in the pre-PT program as well as pre-health majors in any other health-related field that require a two-semester anatomy and physiology sequence. Prerequisites: BY471 and BY473, or consent of the instructor.

Corequisites: BY474.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

BY 473 **Anatomy and Physiology I Lab**

Companion laboratory course to Anatomy and Physiology I, introducing students to anatomical terminology and histology. The

students will focus on anatomy of the human skeletal, muscular and circulatory systems. Prerequisites: BY 160, or by permission of the instructor

Co-requisite: BY471

Credits: (2), Graded, Semester Calendar

Laboratory, Fall Terms

BY 474 Anatomy and Physiology II Laboratory

Companion laboratory course to Human Anatomy and Physiology II, introducing students to anatomical terminology, histology, and organ physiology. The students will focus on human physiology of the major organ systems and the technology used to analyze them. Prerequisite: BY471 and BY473, or consent of the instructor.

Co-requisite: BY472.

Credits: (2), Graded, Semester Calendar

Laboratory, Spring Terms

(TECH)

Comm Points: 1

BY 476 Current Topics in Biology & Medicine

This is a discussion-based seminar course that broadly examines advances and implications of modern biology of interest to society, scientists, and students planning a career in medicine, research, or teaching. Students are required to read a variety of current texts, participate in class discussions, and write a substantive essay. Example topics include the discovery of DNA, genome sequencing, applications of bioinformatics, the revolution in applied biotechnology, human physiology under extreme conditions, intellectual history of biology and medicine as explored by prominent science writers, the prognosis for life on earth. Prerequisites: BY160 or BY214 or consent of instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

Comm Points: 1

BY 480 Advanced Cell Biology

This course will focus on understanding how cells function normally, and how cell dysfunction can cause human disease. Topics include DNA replication and repair, cell cycle control and cancer, cell communication and intracellular signaling, regulation of gene expression, the cell surface and the cytoskeleton. Current methods used in cell and molecular biology research will be discussed. The course will emphasize student interaction and exploration of the scientific literature. Prerequisites: BY160/162 and BY214 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

Comm Points: 1

BY 482 Molecular Genetics

This course will provide students with detailed information on the structure, packages, and expression of genes within the genome of both prokaryotes and eukaryotes. Topics will include chromatin packaging and structure; DNA replication mutation and repair; transcription; RNA splicing; translation; and control of gene expression. Included with each of these topics will be primary research papers, which will be discussed during class. During discussions, experiments in the papers will be analyzed as to how they work (focusing on current biotechnology) and critical analysis of the conclusions. Evaluation will involve exams based on material

presented during the course as well as participation in discussions and written analysis of presented research papers. This course contains advanced topics and is designed primarily for graduate or advanced undergraduate students. Prerequisites: BY160, BY214, BY450, CM103 or 131, and CM104 or 132.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

BY 485 Neural Engineering

[Cross-listed with EE 485, ES 485] This course applies engineering principles to the study of neuroscience and to the design of devices or techniques intended to replace missing or augment existing functions such as seeing, hearing, speaking, and walking. The course provides a detailed overview of sensorimotor systems, neurophysiology, neuroanatomy, neuropathology and clinical neurology. The class sequences through the various sensory and movement systems, providing a quantitative basis for how the nervous systems works for these systems, for how it dysfunctions, for the disability produced, and finally for how function can be restored by neuroprostheses. Students will prepare and present a paper on a neural engineering topic.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 486 Molecular Biotechnology

Molecular biotechnology is a rapidly evolving scientific discipline impacting on many aspects of our daily life. This course will review basic concepts and methodologies in recombinant DNA technology, cover the use of molecular biotechnology for the production of useful products in areas of microbial, plant and animal biotechnology and address social and economic issues rising with the availability of these technologies. Prerequisites: BY160 and BY214, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 488 Stem Cells and Regenerative Medicine

This course will cover biological and medical perspectives of stem cells from their fundamental basic biology and mechanisms of organ regeneration through the use of induced-pluripotent stem cells (iPSCs) for therapeutic benefit. It will deal with mammalian and human embryonic stem cells (hESCs) and focus on how iPSCs generate distinct fates during human development and how this can be used for regenerative therapy of common human diseases. Prerequisites: BY160 and BY214, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 490 Term Integrated Project in Bioscience

This problem-based course will task students to analyze and suggest solutions to a complex problem in the field of infectious disease research. The course is intended to reinforce what they have learned in the other courses during the Trudeau Semester in Bioscience. Enrollment is limited to students participating in the Trudeau Semester. Enrollment is limited to students participating in the Trudeau Semester.

Credits: (3), Graded, Semester Calendar

Project Team, Given When Needed

UNIV/CGI/STS

Comm Points: 1

BY 495 Undergraduate Teaching Assistantship in Bioscience

Students obtain teaching experience by assisting a faculty member in teaching a lecture or laboratory course. Pedagogical activities may include leading laboratory or discussion sections, designing and testing laboratory exercises, and assisting in student assessment.

Prerequisites: Consent of the instructor.

Credits: (1-2), Graded, Semester Calendar

Independent Study, Given When Needed

BY 498 Internship in Bioscience

During the fall semester, spring semester, or summer, a student must complete an off-campus professional experience directly related to a career in the basic or applied biosciences that meets the professional goals of the student and the Clarkson university-wide requirements for a professional experience. The experience should involve minimally 120 hours of training and work, and must be pre-approved by the student's faculty advisor or Chair of Biology. A formal report upon completion of the internship is required.

Prerequisites: Consent of the instructor.

Credits: (0), P/NC, Semester Calendar

Independent Study, Given When Needed

BY 499 Professional Experience in Bioscience

During the fall semester, spring semester, or summer, a student must complete a professional experience that is not necessarily directly bioscience-related, but clearly meets the professional goals of the student and the Clarkson university-wide requirements for a professional experience. The experience should involve minimally 120 hours of training and work, and must be pre-approved by the student's faculty advisor or Chair of Biology. A formal report upon completion of the internship is required.

Credits: (0), P/NC, Semester Calendar

Independent Study, Given When Needed

Civil and Environmental Engineering**CE 1,3,5... Civil and Environmental Engineering Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. (Not offered at Clarkson, for transfer credit only.)

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

CE 2,4,6... Civil and Environmental Engineering Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used as a Professional Elective. (Not offered at Clarkson, for transfer credit only.)

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

CE 212 Introduction to Engineering Design

Introduction to the concepts of engineering design. Computer programs and experimental investigations are used to solve engineering design problems by teams of students. Concepts of design functionality, economics, and ethics are emphasized. (1.5 credits of design) Prerequisites: ES100 and PH131 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Fall Semesters

Comm Points: 1

CE 301 Geographical Information Systems

[Cross-listed with SC 301] An introductory course in the concepts and uses of Geographic Information Systems (GIS) including analysis of GIS-based local and global geographic datasets. Provides basic knowledge of GIS theory and applications using existing state-of-the-art GIS software and current spatial data resources. Applications include: overlay analysis, spatial data query, map generation and terrain surface analysis. Students will also learn the basics of GPS data collection, remote sensing, 3D visualization, probability, statistics, and error analysis. Prerequisite: At least Sophomore standing.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Every Semester

(TECH)

CE 305 Construction Planning and Management

This course will focus on project planning, design services contracts, construction contract documents, construction management, labor relations, construction bonds and insurance, construction scheduling, estimating and bidding procedures, cost control, value engineering, and construction administration. Some topics will be presented by guest lecturers. (1 credit of design) Restriction: Must have Sophomore or above standing.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

CE 310 Geotechnical Engineering I: Soil Mechanics

An introduction to geotechnical engineering. Identification, classification and engineering properties of soil. Topics include stress-strain and strength relationships, consolidation, permeability and compaction of soils. Related geotechnical design problems included. Laboratory experience included. (1 credit of design) Prerequisites: ES222

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Spring Terms

Comm Points: 1

CE 313 Biogeochemical Earth Systems Science

[Cross-listed with EV 313, BY 313] This course will investigate the key concepts and principles of environmental science emphasizing the earth's biogeochemical cycles and how they have been perturbed by human activities. Quantitative analysis of air, soil and water quality on local, regional and global scales will be a significant component of the course. Emerging principles in environmental science, including sustainability, industrial ecology, risk assessment and the precautionary principle will be introduced. In addition to the quantitative aspects, the course will consider the historical, social, and political contexts in which the practice of environmental science takes place. Prerequisites: CM132 (or CM104), or consent of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

(TECH)

CE 315 Geology For Engineers

This course explores the fundamentals of geology with respect to civil engineering. Topics include rock and mineral types, soils, soil formation and properties, geologic structures and topography, active tectonics and earthquake hazards. In addition, course will cover slope stability, landslides, sediments and sediment transport, groundwater, formation and use of earth materials, and alteration of rocks and

minerals. Instruction is conducted through lecture and laboratory exercises. Prerequisite: CM 131 and PH 131

Corequisite: CM 132

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Terms

CE 320 **Structural Analysis**

Linear elastic analysis of structural systems including the computation of internal and external forces and displacements produced by the application of loads. Statically determinate and indeterminate systems are considered. Laboratory experience included. (1 credits of design) Prerequisites: ES222

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Fall Semesters

Comm Points: 1

CE 330 **Water Resources Engineering I**

An introduction to water resources engineering. Topics include flow in pressurized conduits, hydraulic machinery, open channel flow, design of wastewater flow systems, hydrological cycle, rainfall and runoff analysis. Laboratory experience included. (1 credit of design) Prerequisite: ES330.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Fall and Spring Terms

Comm Points: 1

CE 340 **Introduction to Environmental Engineering**

An introduction to the fundamentals of environmental engineering and science. Discussion of the role of engineering in current and emerging environmental issues. Topics include: materials balances, reactor flow models, and chemical fate and transport, with applications in natural and engineered environmental systems. (1 credit of design) Prerequisites: MA131 and CM104 or CM132.

Corequisite: MA232.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Spring Terms

CE 380 **Fundamentals of Environmental Engineering**

This course explores chemical and physical fundamentals in solving environmental engineering problems related to water quality, water and wastewater treatment, air pollution, solid and hazardous waste management, sustainability, and risk assessment. The importance of mass balances and the physical and chemical processes involved in transferring chemicals within and between air, water and soil will be studied. Laboratory experiences included. (1 credit of design). Prerequisites: CH210 or consent of instructor

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Spring Terms

Comm Points: 1

CE 406 **Construction Engineering**

This course develops the procedures for the design and construction for a heavy civil construction project. Estimating resources (labor, materials, and equipment selection) as well as determining the sequence and required planning for a horizontal construction effort and/or a foundation/retaining structure (including: contract documents, project reports, equipment rental rates and equipment brochures and other project information). Students will also develop a distinct project packet to execute a project of this type for presentation to the faculty, potential guests, and students. (2 credits

of design). Prerequisites: CEE junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

CE 407 **Introduction to Construction Estimating and Scheduling**

An introduction to the principles and theories of estimating and scheduling a construction project. Basic and advanced estimating and scheduling techniques will be discussed for both building and heavy/civil projects. The use of computers in estimating and scheduling will be highlighted in the course. Project: the student will estimate the cost of and submit a schedule for a medium sized building project given a complete set of contract documents and other project information.

(2 credits of design) Prerequisites: CEE junior or senior standing

Credits: (3), Graded, Semester Calendar

Lecture, Fall and Spring Terms

CE 408 **Building Info Modeling and Intergraded Project Delivery**

Course provides an introduction to the emerging field of building information modeling and integrated project management for construction projects. Course will cover basic techniques and methods to the use of current/state of the art computer aided design software including Autodesk Revit, and Autodesk Navisworks. (2 credits of design) Prerequisites: CEE Junior or Senior standing

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

CE 409 **Fundamentals of Building Systems**

An examination of building life support systems and technology of interest to civil engineers in the planning, operation, and maintenance of buildings. Topics include human comfort, electrical, mechanical, water and waste, transportation, lighting, and other systems necessary for building utilization. Special cases will be examined in integrated project delivery, sustainable design practices, and energy modeling. Prerequisites: Must have junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

CE 410 **Sustainable Infrastructure and Building**

A study of the use of sustainability rating systems for infrastructure and building projects. Utilizing the USGBC LEED and the ISI Envision rating systems, this course will teach the fundamentals of sustainable building and acquaint students with the processes required to certify/verify projects to meet an independent rating standard. This course will prepare students to take the LEED GA and/or Envision ENV PV exams. Prerequisites: Must have junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

CE 411 **Construction Materials Engineering**

Proper procedures for installation of major construction materials, including soil, concrete, steel, pipe, masonry units, etc. Material production including Portland cement concrete, concrete masonry units, bituminous concrete, and structural steel. Project specifications will be reviewed governing above material, including methods of designing, testing and inspecting construction materials and completed installations. (2 credits of design) Corequisites: CE 441

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

CE 415 Foundations, Stability, and Retaining Structures

Application of principles of soil mechanics to the design of shallow and deep foundations, retaining structures and slope stability. Bearing capacity theory and settlements. Interpretation of soil boring logs as related to geotechnical engineering design. (3 credits of design) Prerequisite: CE310.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CE 420 Computational Methods of Structural Analysis

The matrix stiffness method, theory and implementation in MATLAB, for the analysis for trusses, beams, frames, and grids. Discussion of thermal effects, support settlements, nonlinear effects, and other modeling considerations. Prerequisites: CE320 with minimum grade of C or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CE 430 Water Resources Engineering II

Hydraulic structures, design of open channels, flood routing, runoff models, design of stormwater management systems, groundwater hydrology, transport and mixing processes. (1 credit of design) Prerequisite: CE330.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CE 433 Human Exposure Analysis

Human exposure analysis is an emerging science concerned with how humans come into contact with chemicals in the environment via inhalation, ingestion, and dermal contact. The course focuses on scientific and engineering issues, including direct measurement and model constructs. Students gain an understanding of the complexities, uncertainties, and physical, chemical and biological issues relevant to human exposures resulting from the use and release of toxic compounds. Topics include human exposure analysis terminology, pollutant fate and transport, human activity patterns, occupational exposure, indoor air quality, dosimetry, and statistical and mechanistic tools for exposure assessment. For the final project, the students design and perform a small-scale human exposure study using monitoring instruments and/or exposure models. (2 credits of design.) Prerequisites: Senior or graduate status in engineering or IH or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Terms

CE 434 Sustainable Development Engineering

This course outlines the principles of sustainable engineering for improving sanitation and environmental health in developing communities both internationally and nationally. Topics include sustainable development and appropriate technologies for water and wastewater treatment, water storage and delivery, watershed management, solid waste management, and indoor air quality. The course highlights the importance of community participation and relationship building throughout the development and implementation of engineering projects. At least 2/3 of the course is dedicated to a team-based, sustainable development design project. (2 credits of design) Prerequisite: CE340 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
STS
Comm Points: 1

CE 435 Groundwater Hydrology and Geochemistry

[Cross-listed with EV 435] This class provides fundamental understanding of the key physical and chemical processes impacting groundwater resources and quality. Emphasis is on groundwater geology, physical characteristics of flow, and geochemical properties of groundwater. Groundwater contamination and contaminant transport and modeling will be introduced. The course will prepare students to qualitatively and quantitatively analyze fluid and contaminant flow in varied geologic systems. Prerequisites: CM132 (or CM104/106), and MA131, and (or EV/BY280)

Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Terms

CE 441 Reinforced Concrete Design

The investigation and design of reinforced structural elements such as beams, slabs, columns and footings to meet ACI 318 code requirements. (3 credits of design) Pre-requisite: ES 222; Corequisite: CE 320

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CE 442 Steel Design

Determination of loads for design; behavior and design of tension members, columns, beams, beam-columns, bolted connections, and welded connections; use of LRFD specifications and the Uniform Building Code. (3 credits of design) Prerequisite: CE320 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CE 445 Timber Design

This course develops concepts for the design of structures using timber. (3 credits of design) Prerequisites: CE320

Corequisites: CE442
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CE 448 Introduction to Architectural Engineering

This course will examine the integration of architecture and engineering disciplines in building design and will include introduction to the architectural design process; historical development of architecture/engineering; issues of structural, electrical, HVAC, plumbing, environmental, and acoustical engineering in buildings; economic, construction, and spatial maintenance considerations; professional practice and building codes. Students will be assigned graphic, freehand drawing/sketching, calculation and written exercise as well as a final project. (2 credits of design) Prerequisites: ES220 and CE212, or consent of instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CE 449 Experimental Methods in Structures

This course will introduce fundamental principles, procedures, and applications of experimental methods in structures. Topics covered in this course include sensors, data acquisition, vibration measurement, signal processing, similitude law, system identification, and structural modeling. Students will learn Labview programming to design a simple experiment. If time allows, state-of-the-art experimental methods such as hybrid simulation will be presented. The course consists of lectures and hands-on laboratory sessions. Prerequisites:

CE 320

Credits: (3), Graded, Semester Calendar,
Lecture, Given When Needed

CE 453 Properties & Performance of Concrete Materials

This course explores the materials science aspects of properties and behavior of Portland Cement Concrete, including the properties of raw materials in concrete such as cement, aggregates, mineral and chemical admixtures, and fibers. Topics include: physical and chemical aspects of cement hydration and the role of binder types, the influence of type and morphology of hydrates, fresh and hardened concrete properties, introduction to fracture behavior of concrete, and concrete durability issues such as freezing and thawing, sulfate attack, and corrosion of reinforcing steel. (1 credit of design) Prerequisite: ES260.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CE 461 Transportation Systems Design

Planning and design of transportation systems with emphasis on highway geometric design components, highway pavement, airport and other selected topics. (3 credits of design) Prerequisites: At least junior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CE 463 Railroad Engineering

[Cross Listed with CE563] This course focuses on principles of railroad transportation and covers the following topics: Railroad engineering efficiency, economics, and energy; Cost-benefit analyses of rail transportation systems; Route selection; Geometric design of railroad alignment; Train speed, power, and acceleration requirements; Railroad engineering materials characterization (rail, crosstie, ballast, sub-ballast, and subgrade); Subgrade design and construction and drainage; and High Speed Rail (HSR) design and construction.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CE 468 Traffic Engineering

This course focuses on the collection and synthesis of information to aid in the planning, design, and operation of traffic engineering systems. Major aspects of the course include capacity and level of service analysis, traffic studies, and the design of traffic signal control systems. (1.5 credits of design) Prerequisites: Must have junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CE 470 Stream Riparian System and Fluvial Morphology

This course provides fundamental understanding of hydrologic, hydraulic, and geomorphic processes of the stream riparian system and their ecological impacts. Emphasis will be given to fluvial geomorphology and hydraulic design of stream restoration projects. Computer modeling of river hydraulics and stream dynamics with applications to stream restoration design will be introduced. Prerequisites: CE330 or CE340; or permission of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

CE 477 Atmospheric Chemistry

[Cross-listed with CM 476] This course will cover the evolution of the atmosphere from its initial formation to its natural background condition to its current state perturbed by human activities and reviews appropriate legislation; detailed descriptions of the chemistry of the carbon, nitrogen and sulfur cycles; characterization of the atmospheric aerosol and its role in heterogeneous reaction and materials transport; stratospheric ozone and problems with its depletion; airborne radio-activity and its role in atmospheric ion chemistry. Prerequisites: CM370 or CM371 or ES340.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CE 478 Solid Waste Management and Landfill Design

This course provides a basic understanding of the essential concepts of solid waste management to include identification, collection, transport, processing and disposal of solid wastes. Emphasis is placed upon the legal requirements and practice resulting from the Resource Conservation and Recovery Act (RCRA) and applicable state law. Solid waste issues include characterization, generation, collection, routes, recycling, landfills, and siting. The design and operation of collection routes, transfer stations, Material Recovery Facilities (MRFs), and landfills are covered. Composting and thermal processing operations are also included. (2 credits of design) Prerequisites: Must have junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CE 479 Water and Wastewater Treatment Design

A study of physical and chemical operations and biological processes utilized in the treatment of water and wastewater for municipalities and industry. The course emphasizes theoretical and design aspects of these processes. Prerequisites: ES330, CE340, or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters
Comm Points: 1

CE 480 Chemical Fate and Transport in the Environment

This course covers the basic principles of chemical behavior in the environment including factors that control movement and fate. The processes involved in transferring chemicals within and between air, water and soil will be studied. Factors influencing interphase equilibrium, reactions, transport processes and the lifetime of chemicals in the environment will be investigated. (1 credit of design) Prerequisite: CE340 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
Comm Points: 1

CE 481 Hazardous Waste Management Engineering

This course is an introduction to the emerging field of hazardous waste management. This course provides an understanding of environmental regulations, management techniques to minimize the generation and disposal of hazardous wastes, and technologies to treat wastes and remediate disposal sites. Prerequisite: CE340 or Corequisite: CE340.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters
Comm Points: 1

CE 482 Environmental Systems Analysis Design

This course presents the basic principles of systems analysis as applied to resource allocation and design problems commonly encountered in the field of environmental engineering. Central to the material covered is the concept of optimal problem solution and its use in choosing among alternative designs or policies. All students will complete a semester project; a greater level of quantitative analysis will be expected from students taking the course for graduate credit. (2 credits of design) Prerequisites: CE340 or CE579 or equivalent course, EC350, or consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Terms

CE 486 Industrial Ecology

An exploration of the methods necessary for designing and implementing changes in manufacturing processes to increase sustainability. This course will identify the impacts associated with resource consumption and environmental pollution, and present the quantitative tools necessary for assessing environmental impacts and to design for sustainability. Topics include: industrial ecology, life cycle analysis and the integration of the environment into economic activities. (1 credit of design) Prerequisites: prior college level exposure to the concepts of mass and energy conservations, one of the following: CE340, CH220, ES330, ES340, CH301, CH271 or consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Terms

CE 490 Senior Design (Structures, Trans, Geotech, Constr, Arch/Facilities)

A comprehensive design of an open ended project related to structural, foundation/geotechnical, architectural/facilities and/or transportation design as well as construction management will be developed by teams of students. The design will be based on knowledge acquired in prior courses, professional ethics and engineering economics. Written reports and oral presentations about the design will be made to the faculty, potential guests, and student peers. (3 credits of design) Prerequisites: Senior standing
Corequisites: CE310, and either CE441 or CE442 (or consent of the instructor)
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms
(TECH)
Comm Points: 1

CE 491 Senior Design (Water Resources, Environmental)

A comprehensive design of an open ended project related to water resource and environmental engineering design will be developed by teams of students. The design will be based on knowledge acquired in prior courses, professional ethics and engineering economics. Written reports and oral presentations about the design will be made to the faculty and student peers. (3 credits of design) Prerequisites: Senior standing and CE430, CE479, CE480, CE481, CE478 or CE586, or consent of instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
(TECH)
Comm Points: 1

CE 492 Senior Design (Building, Architectural)

A comprehensive open ended project related to building design with architectural, structural, geotechnical/foundation, environmental

quality and construction management issues will be developed by teams of students. The design will be based on knowledge acquired in prior courses, sustainability, professional ethics and engineering economics. Written reports and oral presentations including physical or virtual models of the design will be made to the faculty and student peers. (3 credits of design) Prerequisites: Senior standing, CE415 and CE441
Corequisites: CE 448 and CE 442 (or consent of the instructor)
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
(TECH)
Comm Points: 1

CE 493 Senior Design (Transportation Systems)

This course provides students with an opportunity to work in teams to conduct an open-ended transportation systems design project. Examples of project components include performance evaluation of existing systems, geometric design of highways, drainage and pavement design, design of traffic control systems, and cost or economic analysis. Each project team is required to prepare a written report and to give two oral presentations of project findings. (3 credits of design) Prerequisites: Senior Standing and CE461 or CE468.
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
(TECH)
Comm Points: 1

CE 495 Special Projects in Civil and Environmental Engineering

An individual project is undertaken by the student under the guidance of a staff member. A complete report is required.
Prerequisite: consent of the department chair.
Credits: (1-3), Graded, Semester Calendar
Independent Study, Fall Semesters

CE 496 Special Projects in Civil and Environmental Engineering

An individual project is undertaken by the student under the guidance of a staff member. A complete report is required.
Prerequisite: consent of the department chair.
Credits: (1-3), Graded, Semester Calendar
Independent Study, Spring Semesters

CE 499 Fundamentals of Engineering Exam Preparation

This course provides preparation for students taking the NCEES Fundamentals of Engineering (FE) Exam. Topics covered will mirror the materials covered specific to the Civil Engineering and Environmental Engineering FE examinations. Lectures will be provided by faculty from across the department facilitated by the department office.
Credits: (0), P/NC, Semester Calendar
Lecture, Spring Terms

Chemical Engineering

CH 1,3,5... Chemical Engineering Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.
Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

CH 2,4,6... **Chemical Engineering Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used as a Professional Elective.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

CH 210 **Molecular Properties**

Kinetic theory of gasses, reaction dynamics, surface chemistry and catalysis, electrolyte solutions, electrochemistry, physical chemistry of macromolecules, photochemistry. Prerequisites: CM132 (or CM104), MA132 and PH131

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory

CH 220 **Material Balances**

Students will learn how to set up flow sheets for chemical processes with multiple units and perform material balances accounting for chemical reactions, phase equilibria, multistage separations, and recycle. While emphasis will be on steady state operations, unsteady processes will also be considered. A case study will be performed in teams. Prerequisites: CM 132 (or CM 104), MA 132, and PH 131

Corequisite: CH 210 or CM 371
Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Spring Semesters

CH 260 **Thermodynamics & Energy Balances**

The fundamentals of thermodynamics, including real fluids, thermodynamic properties of gases. Application of conservation of energy principles in chemical engineering. Prerequisites: CH210

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CH 320 **Phase Equilibria**

Thermodynamics of pure components and solutions. Fugacities, activities, and equilibrium, calculations. Prerequisites: CH 260 or ES340

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CH 330 **Transfer Process Fundamentals**

Fundamentals of fluid mechanics, heat and mass transfer relevant to transfer processes: Newtonian and non-Newtonian flow behavior, hydrostatics, macroscopic and microscopic balances, flow measurement, dimensional analysis, laminar and turbulent flow in ducts and over immersed bodies, Fourier's law, steady and unsteady conduction in rectangular, cylindrical, and spherical geometries, fins, convective heat transfer in flow through ducts and over immersed objects, natural convection, Fick's law, diffusion in binary and multicomponent systems, correlations for heat and mass transfer. Prerequisites: MA232;

Corequisites: CH210 and CH220
Credits: (3), Graded, Semester Calendar
Lecture

CH 350 **Chemical Engineering Laboratory**

A series of experiments in fluid mechanics, heat transfer, complementing the junior ChE courses, are performed. Laboratory safety, data analysis, and communications skills stressed. Does not meet each week; schedule will be posted. Prerequisites: CH330
Corequisites: CH370

Credits: (1), Graded, Semester Calendar
Laboratory, Spring Semesters
Comm Points: 1

CH 360 **Chemical Reactor Analysis I**

The principles of chemical reactor design for homogeneous and heterogeneous reactions. Analysis of the chemical reactor from a kinetic and thermodynamic point of view, including design methods for flow and non-flow reactors and experimental methods.

Prerequisites: CH330 and CH210
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CH 370 **Transfer Process Design**

Fundamentals of transfer process design, design of pipes, flow meters, pump calculation, heat transfer equipment design, correlations for various heat transfer coefficients, pressure drop in heat transfer equipment, pumping requirements for heat transfer equipment, mass transfer equipment, tray, rotating, pulsed, packed column design, efficiency concept, transfer unit concept, membrane separations, chromatographic separation methods. Prerequisites: CH330

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CH 390 **Undergraduate Research Project**

A theoretical or experimental investigation of an original problem under the supervision of a faculty member. Student should select topic from list in ChE office and discuss with indicated faculty member.

Credits: (1-4), Graded, Semester Calendar
Research, Every Term

CH 391 **Undergraduate Research Project**

A theoretical or experimental investigation of an original problem under the supervision of a faculty member. Student should select topic from list in ChE office and discuss with indicated faculty member.

Credits: (1-4), Graded, Semester Calendar
Research, Every Term

CH 392 **Undergraduate Research Project**

A theoretical or experimental investigation of an original problem under the supervision of a faculty member. Student should select topic from list in ChE office and discuss with indicated faculty member.

Credits: (1-4), Graded, Semester Calendar
Research, Every Term

CH 410 **Chemical Engineering Laboratory**

A series of experiments complementing the ChE senior courses are conducted. The student will gain familiarity with the equipment, practices, tools, and scope of Chemical Engineering. Extensive report writing. Laboratory safety and applied statistics and data analysis stressed. Does not meet each week; schedule will be posted. Prerequisites: CH330

Credits: (2), Graded, Semester Calendar
Laboratory, Fall and Spring Terms
Comm Points: 2

CH 420 **Process Economics & Conceptual Design**

Engineering economics, conceptual design principles, equipment costing, safety considerations. Prerequisite: CH330
Corequisites: EC350, or the combination of EC150 and EC200, or the combination EC151 and EC200.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory
(TECH)

CH 430 **Chemical Process Safety**

Applications of chemical process principles to process safety and hazards analysis, mitigation and prevention, with emphasis on the chemical process industries. Corequisite: CH420

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

CH 434 **Air Pollution Control**

This course covers the sources, history, and effects of air pollution; regulatory trends; measurement techniques; and the engineering control of particulate and gaseous pollutants. Prerequisites: CM131 or CM103, and a minimum of junior standing

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Semesters
(TECH)

CH 441 **Introduction to Nanophotonics**

This course introduces the principles of nanophotonics-an emerging frontier at the nexus of nanotechnology and photonics. Nanophotonics deals with light-matter interactions on the nanometer length scale, and provides enormous opportunities for fundamental research and new applications. The course will cover the theoretical foundations of nanoscale optical interactions, growth and characterization of optical nanomaterials, nanolithography, plasmonics, metamaterials, manipulation and integration of nanostructured architectures, nanoscale optical microscopy, nanophotonic devices and systems, as well as a review of applications of nanophotonics, especially in biotechnology and nanomedicine. The students will be exposed to various new concepts, properties and phenomena in a bright nanoworld. Prerequisites: PH132 and MA232

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

CH 456 **Experimental Projects**

One or more project experiments related to various chemical processes are conducted. Selection of experiments is based on the student's needs and interests, and may involve existing experiments or the development of new ones.

Credits: (1-3), Graded, Semester Calendar

Lecture, Every Semester

CH 460 **Process Dynamics and Control**

Process systems analysis and control. Methods for the analysis of systems and the use of these methods in the design of control systems. Prerequisites: CH220, CH330, and MA231.

Credits: (3), Graded, Semester Calendar

Lecture

CH 465 **Biochemical Engineering**

Use of microorganisms and enzymes to carry out industrial scale production of useful products. Enzyme and cell growth kinetics, reactor types, design principles and operating processes (agitation,

aeration, sterilization, separations), and examples of some typical industrial processes. Prerequisite: CH330

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Terms

(TECH)

CH 482 **Design Project**

A comprehensive design is performed independently. When possible, the work will be done in a team. Prerequisite: CH420

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CH 484 **Polymer Engineering**

For Transfer Credit Only

Principles of polymer rheology from both continuum and molecular viewpoints, including differences in the flow behavior of polymers and Newtonian fluids. Application to polymer processing operations, extrusion, fiber spinning and injection molding. Prerequisites: must have a 2.0 GPA, CH301 or ES330 (either can be taken as a corequisite.)

Credits: (3), Graded, Semester Calendar

Lecture, Transfer Credit Only

CH 486 **Industrial Chemistry**

[Cross-Listed with CH586/CM486/586] This course will benefit junior and senior undergrads plus grads in chemistry and chemical engineering, and allow them to learn of real ways such talents are used in the professional world. It will involve different industrial chemists and chemical engineers to come to Clarkson University for each of 12 of the 14 weeks of a semester and give two lectures of about 1 hour 15 min each - one on an afternoon and the other following morning. The first lecture will relate the areas of chemistry their company was known for; the second lecture an in-depth discussion on how one project was carried out at the bench and the pitfalls that had to be resolved along the way to achieve success. The intent is to select lecturers from Clarkson Chemistry and Chemical Engineering major alumni at various lengths of time they have been professionals. Prerequisites: Junior or Senior Standing

Credits: (1), Graded, Semester Calendar

Lecture, Spring Terms

CH 490 **Elementary Transport Phenomena**

Principles of transport of momentum, energy, and mass will be covered from a fundamental perspective, pointing out analogies where appropriate. Topics include the Navier-Stokes and continuity equations, analysis of one dimensional flows, boundary layer theory, the energy and species conservation equations, energy transport by conduction and convection, steady two-dimensional problems, and unsteady one-dimensional problems. Enrollment is restricted to seniors who will graduate in the calendar year in which the course is offered. Prerequisites: CH330 and 3.5 GPA or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

Chemistry**CM 1,3,5...** **Chemistry Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (1-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

CM 2,4,6... **Chemistry Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Science Foundation Curriculum Requirement.

Credits: (1-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

CM 31 **HEOP Introduction to General Chemistry I**

Introduction to the foundations of major theories of chemistry and their practical applications. Topics include; foundation of measurement, chemical calculations and dimensional analysis, the concept of the mole, reaction stoichiometry, basic thermo-chemical principles, and the structure and organization of the periodic table. Prerequisite: For HEOP students only.

Credits: (2), Graded, Semester Calendar
Lecture, Summer Semesters

CM 103 **Structure and Bonding**

An introduction to the electronic and geometric structures of representative inorganic and organic molecules, to the relations between structure and chemical and physical properties, and to the principles of chemical bonding. This course is designed for students majoring in chemistry.

Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Fall Semesters

CM 104 **Chemical Equilibrium and Dynamics**

This course is an introduction to chemical equilibrium and kinetics. It includes some basic thermodynamics and the evaluation and use of equilibrium constants, and also the measurement and mechanistic interpretation of the rates of chemical reactions. Examples are selected to cover a wide spectrum of chemical problems and to stress experimental techniques as well as theory. Prerequisites: CM103 or CM131

Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Spring Semesters

CM 105 **Chemistry Laboratory I**

Some fundamental principles underlying the experimental study of chemical phenomena. Some typical reactions of inorganic and organic compounds will be studied. This course will include introductions to various fields of chemical experimentation. Corequisites: CM103

Credits: (2), Graded, Semester Calendar
Laboratory, Fall Semesters

CM 106 **Chemistry Laboratory II**

Experimental studies of the equilibria and rates of some chemical reactions, employing some volumetric and gravimetric analysis and including introductions to spectrophotometric and potentiometric measurements and to the use of computers in chemical experimentation. Prerequisites: CM105 or, with consent of the instructor, CM131.

Corequisite: CM104.

Credits: (2), Graded, Semester Calendar
Laboratory, Spring Semesters

CM 121 **Freshmen Seminar**

A course to acquaint incoming freshmen with activities and facilities in the Chemistry Department, provide a forum for discussion of curriculum choices and career options in chemistry.

Credits: (1), Graded, Semester Calendar
Seminar, Spring Semesters

CM 131 **General Chemistry I**

A general overview of chemistry, including principles and theories as well as descriptive chemistry of important elements and compounds. Laboratory experiments augment lecture topics to provide a small group hands-on learning experience.

Credits: (4), Graded, Semester Calendar
Laboratory, Discussion, Lecture, Fall and Spring Terms

CM 132 **General Chemistry II**

A continuation of CM 131. Chemical principles, theories, and descriptive chemistry with laboratory experiments to provide additional exposure to lecture topics in a small group environment. Prerequisites: CM131

Credits: (4), Graded, Semester Calendar
Laboratory, Discussion, Lecture, Spring Semesters

CM 221 **Spectroscopy**

A study of spectroscopic techniques, including both their analytical applications and the use of molecular spectroscopy in the identification and characterization of chemical compounds. The techniques discussed include atomic emission and absorption, fluorescence, visible-ultraviolet, infrared and mass spectroscopy and nuclear magnetic resonance spectroscopy. Prerequisites: CM104 or CM132

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CM 223 **Spectroscopy Laboratory**

This laboratory course accompanies CM 221. Prerequisites: CM106 or CM132

Corequisites: CM221
Credits: (3), Graded, Semester Calendar
Laboratory, Fall Semesters
Comm Points: 2

CM 241 **Organic Chemistry I**

An introductory course in organic chemistry dealing with the structures, names, chemical and physical properties, preparations, spectroscopy and reaction mechanisms of organic compounds. Prerequisites: CM104 or CM132

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CM 242 **Organic Chemistry II**

A continuation of CM 241. Prerequisite: CM241

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CM 244 **Organic Chemistry Laboratory I**

In this laboratory course, procedures for the synthesis of typical organic compounds are combined with spectroscopic and other physical and chemical techniques to illustrate the study of functional-group chemistry and the characterization and identification of organic compounds. Prerequisite: CM 241, Organic Chemistry I

Corequisite: CM 242, Organic Chemistry II
Credits: (3), Graded, Semester Calendar
Laboratory, Spring Semesters
Comm Points: 2

CM 300 Instrumental Laboratory

Laboratory work designed to illustrate principles discussed in CM 320, CM 371 and CM 372. Prerequisite: CM371

Corequisite: CM320

Credits: (3), Graded, Semester Calendar

Laboratory, Spring Semesters

(TECH)

Comm Points: 2

CM 312 Survey of Inorganic Chemistry

A review of fundamental chemical principles and a study of the qualitative description of binding in inorganic molecules and of the properties, structures and reactions of elements and their compounds. Prerequisites: CM371 or equivalent

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

CM 320 Separations and Electrochemistry

This course deals with techniques of separation and electrochemical techniques used in research and analysis. It includes single- and multistage techniques of separation, with emphasis on chromatographic methods; and the principles and applications of potentiometric, polarographic, voltammetric and some other electroanalytical techniques. Prerequisites: CM221

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

CM 342 Food Chemistry

Food chemistry is a one-semester course that will teach about basic structural principles of food essentials and their chemistry. The course will teach specifically: (i) Molecular basis for the sensation of flavor; (ii) Structure and properties of edible polysaccharides, proteins, and fats; (iii) Chemical and physical changes that these molecules undergo under different food-related treatments (e.g. heating, cooling, mechanical processing); (iv) Brief chemistry of digestion (enzymatic and microbial). Prerequisites: CM241 with a grade of B or higher

Corequisites: CM242

Credits: (2), Graded, Semester Calendar

Lecture, Fall Terms

CM 345 Advanced Laboratory

Advanced techniques in manipulation of chemical compounds and their isolation and characterization are studied. Examples are low temperature and inert atmosphere reaction conditions, synthesis of both inorganic and organic compounds in the form of fine particles, use of thermal analysis, electron microscopy and X-ray diffraction to determine product shapes and composition, and spectroscopic evaluation of metallo-organic complexes having industrial relevance. Course involves extensive use of library facilities to identify background materials as well as details for techniques employed. Course also includes a final presentation based on laboratory and literature findings. Prerequisites: CM242 and CM244

Credits: (4), Graded, Semester Calendar

Laboratory, Fall Semesters

Comm Points: 2

CM 371 Physical Chemistry I

[Cross-listed with PH 371] This course covers the gaseous state, kinetic theory and chemical thermodynamics, with applications to

chemical and phase equilibria. The emphasis is on mathematics and problem solving. Prerequisites: CM104 or CM132, MA132, PH131

Corequisites: PH132

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

CM 372 Physical Chemistry II

[Cross-listed with PH 372] A continuation of CM 371. Topics may include quantum mechanics, atomic structure, chemical bonds, intermolecular forces, spectroscopy, molecular symmetry, optical activity, photochemistry and photobiology. Prerequisites: CM371 or equivalent

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

CM 391 Independent Study

An opportunity for junior chemistry majors to undertake research under a faculty member's direction. The research work to be arranged with the faculty member who assists in the choice of a problem and in the planning and execution of the work. A written report must be submitted at the end of each semester summarizing the work and results to date.

Prerequisites: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Independent Study, Every Semester

CM 409 Ugrd Teaching Assist in Chem

Assisting a faculty member in a chemistry course as an undergraduate teaching assistant. Students should check with their major department to determine whether these credits can be used to meet their degree requirements.

Credits: (1-2), Graded, Semester Calendar

Lecture, Every Semester

CM 413 Carbon Capture and Sequestration

[Cross-listed with CH 413] Sustainable energy generation is seen as one of the largest challenges of our generation. All long-term solutions rely on the direct or indirect conversion of solar energy, yet these solutions appear to be years from implementation. In the coming decades then, while the relative importance of fossil fuels will decrease, absolute use of fossil fuels will not. Carbon Capture and Sequestration (CCS) employed on a global scale can sustain the world's energy use and help mitigate alarmingly high carbon dioxide levels in the atmosphere. The goal of this course is to provide students with a modern view of current and emerging research in CCS. Topics will include our current understanding of carbon dioxide in and around the planet, the geological storage of carbon dioxide, and the science and technology of capturing carbon dioxide with focus on material chemistry aspects. Development of analytical methods and characterization tools for assessing CCS properties and materials will also be discussed. Through this series of lectures, students will learn about the contemporary research related to CCS, as well as learn to develop, analyze, and compare various CCS solutions.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

CM 417 Directed Research in Inorganic Chemistry

Students will carry out research in inorganic chemistry under the supervision of a faculty member. Topics will be determined by faculty research programs. A formal report is required at the conclusion of

this course.

Credits: (1-3), Graded, Semester Calendar
Research, Every Term

CM 422 Advanced Mass Spectrometry: Practical Applications

Practical Applications will introduce the students to mass spectrometry and its applications within different fields, including pharmaceutical and biotech industry, academia, government, forensics, etc. Various types of instruments will be discussed, as well as their application within different fields. The course will then focus on different types of well-known "omics", such as proteomics, metabolomics, glycomics, or lipidomics, but also on specialized types of "omics" such as peptidomics, post-translational modification-omics (PTM-omics), interactomics, foodomics, microbiomics, venomics, DNA- RNA- & Protein- adductomics, genomics, proteogenomics or transcriptomics. Particular applications of all these kinds of "omics" in biotechnology & pharmaceutical industry, healthcare, biowarfare and forensics will also be discussed. Prerequisites: CM/BY460/560, or consent of the instructor
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CM 425 Advanced Bioanalytical Chemistry

The goal of this course is to provide graduate students and advanced undergraduates with a modern view of current and emerging research in bioanalytical technologies, analytical method development and validation and their applications. Topics include: biomolecules (enzymes, DNA, antibodies), biochemical aspects, kinetics and energetics, analysis and quantification of biomolecules, biomolecular recognition, bio-immobilization, chromatography of biomolecules, spectroscopic methods in bioanalysis, principles and applications of electrophoresis, immunochemical techniques, fundamentals of bio-analytical sensors, single molecule detection and single cell analysis, analytical method validation. Prerequisites: CM 221 or consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CM 427 Directed Research in Analytical Chemistry

Students will carry out research in analytical chemistry under the supervision of a faculty member. Topics will be determined by faculty research programs. A formal report is required at the conclusion of the course.
Credits: (1-3), Graded, Semester Calendar
Research, Every Term

CM 428 Directed Study in Analytical Chemistry

The study of a subject not otherwise available in analytical chemistry courses may be undertaken under the supervision of a faculty member.
Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

CM 430 Colloids and Interfaces

Physico-chemical principles and experimental techniques related to the characterization and investigation of colloidal systems and interfaces are covered on an introductory level. From the many areas of application, the emphasis will be on those situations that are encountered in everyday life such as environmental problems (aerosols, water treatment), biological aspects (transport and absorption of fat, biological membranes), foods and cosmetics

(emulsions), detergency and various technological processes.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CM 432 Fine Particle Characterization

This course is intended to familiarize the students with the analytical techniques routinely used to characterize the size, size distribution, shape, composition, structure, and surface properties (composition, charge, topography) of individual particles as well as the properties of dispersion particles. In conjunction with the latter, the course will discuss many concepts covered by colloids and surface science courses.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 435 Better Materials through Chemistry

[Cross-Listed with CM535] Our physical world relies on a broad spectrum of materials of different properties around us to fulfill their functions to serve our daily life. It is one of the missions of chemists to improve and optimize materials chemically to make them more efficient and effective in diverse processes and devices. In this course, subsequent to a brief survey of the fundamental chemistry and physics of polymers, ionic liquids, carbon nanomaterials and composite materials their potential and current applications will be treated. Particularly, preparations, characterizations and applications of porous polymers and carbons, membranes and "smart" materials will be delineated. Prerequisites: CM241
Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Terms

CM 437 Directed Research in Colloid Chemistry

Students will carry out research in colloid chemistry under the supervision of a faculty member. Topics will be determined by faculty research programs. A formal report is required at the conclusion of the course.
Credits: (1-3), Graded, Semester Calendar
Research, Every Term

CM 441 Physical Organic Chemistry

Current views of the collection and interpretation of data relating to organic reaction mechanisms and reactive intermediates. Prerequisite: CM242 or consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 442 Advanced Organic Chemistry

The course will cover essential topics of organic chemistry including dynamic stereochemistry, conformational analysis, photochemistry, pericyclic reactions, and chemistry of free radicals.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 444 Medicinal Chemistry

Various classes of medicinal agents will be discussed in relation to the diseases that they are used to treat. The history and development of these drugs will be covered as well as attempts to correlate chemical structure with biological activity. Prerequisite: CM242.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 445 Organometallic Chemistry

[Cross-listed with CM545]The course will provide introduction into structure and properties of compounds possessing metal-carbon bonds and their reactions with emphasis on homogeneous catalysis. Graduate students will do additional course work. Prerequisites: CM242

Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Terms

CM 446 Modern Spectroscopic Methods in Organic Chemistry

This course deals largely with the applications of spectroscopic techniques to the identification of organic compounds. Heavy emphasis will be given to nuclear magnetic resonance techniques for protons, carbon and other nuclei. Practical and theoretical aspects of FT NMR will be emphasized. Prerequisites: CM242 and CM371.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 447 Directed Research in Organic Chemistry

Students will carry out research in organic chemistry under the supervision of a faculty member. Topics will be determined by faculty research programs. A formal report is required at the conclusion of the course.

Credits: (1-3), Graded, Semester Calendar
Research, Given When Needed

CM 448 Directed Study in Organic Chemistry

The study of a subject not otherwise available in organic chemistry courses may be undertaken under the supervision of a faculty member.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

CM 450 Introduction to Polymer Chemistry

An introduction to the chemistry of synthetic and natural polymers, emphasizing the unity of principles inherent in describing polymeric systems. Prerequisites: CM242 and CM372.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 451 Manufacturing Implications of Adv Materials Processing

The processing of materials into manufactured goods requires an understanding of the chemical composition of the starting substrates, the nature of intermediates, and the properties of final products. This course focuses on the preparation, modification, characterization, and the applications of fine, ultra-fine, and nanosize metallic particles. The objectives are to: a) provide an overview of the relevant theoretical and practical aspects related to the preparation, characterization, and modification of fine particles in general and metallic particles in particular, b) familiarize students with the industrial approaches for developing and manufacturing fine particles on large scale, and c) teach students how the properties of the resulting particles/colloids can be tailored in order to ensure optimal performance in specific applications. During the semester the students will also participate in several practical sessions in which metal colloids will be prepared and characterized.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 453 Introduction to Biomaterials

This course deals with biomaterials in medical and pharmaceutical applications. Basic concepts and requirements of biomaterials will be introduced. Classification and properties of a wide range of biomaterials will be discussed according to their particular applications, such as drug delivery, artificial organs, implants and devices. In addition, standard testing and evaluation aspects of the biomaterials will also be addressed. Prerequisites: CM241 and CM242.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CM 457 Directed Research in Polymer Chemistry

Students will carry out research in polymer chemistry under the supervision of a faculty member. Topics will be determined by faculty research programs. A formal report is required at the conclusion of the course.

Credits: (1-3), Graded, Semester Calendar
Research, Given When Needed

CM 458 Directed Study in Polymer Chemistry

The study of a subject not otherwise available in organic chemistry courses may be undertaken under the supervision of a faculty member.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

CM 460 Biochemistry I

[Cross-listed with BY 450] This course is an introduction to the molecular basis of biological processes. The first part of the course will cover the structure and function of the four major classes of biomolecules - proteins, carbohydrates, lipids and nucleic acids. The second part covers the organization and regulation of the major energy generating and biosynthetic pathways. Prerequisites: CM241 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CM 461 Biochemistry II

[Cross-listed with BY 451] A continuation of Biochemistry I dealing mainly with metabolic pathways, intermediary metabolism, protein synthesis, membrane transport, DNA replication and RNA transcription. Prerequisite: CM460 or equivalent.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 463 Protein Chemistry & Proteomics

This course will introduce the chemistry of proteins and current approaches for their structural and functional characterization. It will include protein descriptions along with analytical biochemistry and protein chemistry based approaches used to characterize them. It will introduce mass spectrometry and its applications in biology and biochemistry to characterize individual proteins (protein identification and analysis of post-translational modifications), groups of proteins (protein-protein interactions) or the whole proteome. Examples of proteomics approaches with medical significance for biomarker discover, validation and monitoring will also be discussed. Prerequisites: BY450 or CM460 (Biochemistry I)

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 466 Bioelectronics & Bionanotechnology

This course covers novel areas in science and technology that have high importance for fundamental science and practical applications. Bioelectronics is a scientific and technological area that includes electronic coupling of biomaterials (enzymes, DNA, recognition proteins, biological cells) with electronic devices. The bioelectronic systems can be used to develop sensing devices (enzyme-based biosensors, DNA sensors, immunosensors, etc.) and to develop biofuel cells (implantable biofuel cells for biomedical applications, self-powered biosensors, autonomously operated devices). New methods and new materials (functionalized nanoparticles, quantum dots, carbon nanotubes, etc.) developed due to the tremendous recent success in nanotechnology pave the way for the novel possibilities to couple biomaterials and electronic transducers, thus resulting in the new technological field named Bionanotechnology. The students will be introduced into the most important areas of Bioelectronics and Bionanotechnology. Prerequisites: CM372, CM460.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 467 Directed Research in Biochemistry

Students will carry out research in biochemistry under the supervision of a faculty member. Topics will be determined by faculty research programs. A formal report is required at the conclusion of the course. Credits: (1-3), Graded, Semester Calendar
Research, Every Term

CM 468 Directed Study in Biochemistry

The study of a subject not otherwise available in biochemistry courses may be undertaken under the supervision of a faculty member. Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

CM 470 Biochemistry & Biotechnology Laboratory

[Cross-listed with BY 470] This course is a one semester course in the fundamental laboratory approaches for biochemistry and biotechnology. While largely a hands-on course, laboratory experiments will be supplemented with lectures that integrate the theoretical and practical principals covered in the exercises. Topics include protein purification, characterization and analysis, enzyme kinetics and molecular modeling. Prerequisites: CM221 and CM223 or BY450/CM460 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Laboratory, Spring Terms
Comm Points: 2

CM 471 Fundamental Chemical Kinetics

Basic principles. From stoichiometry and rate law to mechanism. Simple gas-phase reactions. Collision and transition-state theories. Temperature effects. Catalysis. Prerequisites: CM104 or CM132, MA132 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 472 Chemistry at Surfaces: Structure and Catalysis

This senior undergraduate and graduate course will survey the field of surface chemistry, with specific attention dedicated to the structure of solid surfaces and chemical processes at solid interfaces. This course will cover the basics of the structure of periodic solids, relate that understanding to solid interfaces, and finally address how

surface structure and reduced dimensionality impact chemical reactions (i.e. heterogeneous catalysis). Analytical techniques common to this discipline will also be discussed. Graduate students will be assessed differently than undergraduates in this course. Graduate students will have the additional responsibility of delivering a presentation discussing one of several primary research articles germane to the field that were selected by the instructor, while undergraduate students will submit a paper describing one of these articles in detail. Prerequisites: CM371 and CM372, or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture

CM 475 Sustainable Nanotechnology

The goal of this course is to provide graduate students and advanced undergraduates with a modern view of current and emerging research in nanotechnology. Topics will include: fundamental nanoscale properties and applications, green manufacturing and assembly in functional devices, interaction of nanomaterials with biological systems, the physical and chemical phenomena at nano-bio interfaces, fate, transport and transformation of engineered nanomaterials, environmental and health impact, nanometrology, nanotoxicology and hazard identification of nano-based products. Development of analytical methods and characterization tools for assessing nanoscale properties and materials will also be discussed. Students will be exposed to interdisciplinary topics and an integrated training bridging material and environmental sciences with biology and analytical chemistry. Students will be able to demonstrate a basic awareness of risks and benefits of emerging technologies and evaluate overall environmental and societal impact.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CM 476 Atmospheric Chemistry

[Cross-listed with CE 477] The course will cover the evolution of the atmosphere from its initial formation to its natural background condition to its current state perturbed by human activities; detailed descriptions of the chemistry of the carbon, nitrogen and sulfur cycles; characterization of the atmospheric aerosol and its role in heterogeneous reactions and materials transport; stratospheric ozone and problems with its depletion; airborne radioactivity and its role in atmospheric ion chemistry. Prerequisites: CM370 or CM371 or ES340.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CM 477 Directed Research in Physical Chemistry

Students will carry out research in physical chemistry under the supervision of a faculty member. Topics will be determined by faculty research programs. A formal report is required at the conclusion of the course.

Credits: (1-3), Graded, Semester Calendar
Research, Every Term

CM 483 Introduction to Polymer Science

[Cross-listed with PH 483] This course is about fundamental aspects of polymer science. It introduces the world of chain molecules from synthesis and properties to applications. Basic knowledge from polymer chemistry and physics are combined in the one course in a form appropriate for undergraduates and graduates in chemistry, physics and engineering to develop the understanding of polymeric

behavior in synthetic materials and natures. Prerequisites: Junior standing or permission of instructor
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CM 484 **Functional Polymer Systems**

[Cross listed with CM584] This senior undergraduate and graduate course will introduce students to the world of polymer materials, which deliver concrete functions and may serve our daily life in our modern society. These polymer systems exist in different structural forms and can have multicomponents, including surfactants, fillers, etc. The role of the interfacial phenomena in controlling specific functions and materials performance is strongly emphasized in the course through the fundamentals of polymer and colloid science. Main modern tendencies in polymer advanced materials (nanocomposites, smart polymer materials, (nano)porous materials, membranes, biocompatible polymeric materials, applications of polymers in electrochemical energy devices, sensor design and actuator fabrication) are covered in the course. Students are encouraged to take CM483/CM583 before participation of this course. Graduate students will do additional work. Restriction: Senior standing or permission of the instructor
Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Terms

CM 485 **Nanostructured Materials**

[Cross-listed with PH 585] This course reviews the methods to make nanoscale building blocks and approaches to arrange the building blocks into functional architectures for advanced materials. The list of topics includes: chemical patterning and lithography, layer-by-layer self assembly, synthesis and self assembly of nanoparticles, nanotubes and nanowires, properties of nanoclusters and self assembled structures (photonic crystals, plasmonic effects, quantum dots, porous materials, biomimetics). Prerequisites: Senior Standing or consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

CM 486 **Industrial Chemistry**

[Cross-Listed with CM586/CH486/586] This course will benefit junior and senior undergrads plus grads in chemistry and chemical engineering, and allow them to learn of real ways such talents are used in the professional world. It will involve different industrial chemists and chemical engineers to come to Clarkson University for each of 12 of the 14 weeks of a semester and give two lectures of about 1 hour 15 min each - one on an afternoon and the other following morning. The first lecture will relate the areas of chemistry their company was known for; the second lecture an in-depth discussion on how one project was carried out at the bench and the pitfalls that had to be resolved along the way to achieve success. The intent is to select lecturers from Clarkson Chemistry and Chemical Engineering major alumni at various lengths of time they have been professionals. Prerequisites: Junior or Senior Standing
Credits: (1), Graded, Semester Calendar
Lecture, Spring Terms

CM 487 Applications of Synchrotron and Electron Based Techniques

The purpose of the course is to familiarize all students with the x-ray and electron based experimental techniques available at Brookhaven National Lab and other similar facilities. Students will be cognizant of the applications of these cutting edge facilities, and well positioned

to use them in their own research. This course is suitable for graduate students, postdocs, and advanced undergrads in physical sciences and engineering, as well as students in biological, environmental, and chemical sciences who may have the interest to learn more about the techniques they may use for their research. Prerequisites: PH132 or consent of the instructor; ES260 and/or PH231 are recommended prerequisites
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CM 491 **Undergraduate Thesis**

Research work to be arranged with the consent of a staff member who assists the student in the choice of a problem and in the planning and execution of work on it. For senior chemistry majors.
Prerequisite: consent of a department faculty member.
Credits: (6), Graded, Semester Calendar
Research, Fall Terms

CM 492 **Undergraduate Thesis**

A continuation of CM 491. A written thesis is required at the end of the course.
Prerequisite: consent of a department faculty member.
Credits: (6), Graded, Semester Calendar
Research, Spring Terms
Comm Points: 2

CM 495 **Internship/Co-op in Chemistry & Biomolecular Science**

Students will gain practical work experience in chemistry or biomolecular science under direction and supervision of professionals outside their department. Students must submit a formal report describing work performed as well as the Internship/Co-op learning opportunities. Report approval is required for the award of credit. Feedback will be provided by their Internship/Co-op field supervisor. This course will be graded on a pass/no-credit basis.
Credits: (1), P/NC, Semester Calendar
Independent Study

CM 497 **Directed Study**

The study of a subject not otherwise available in formal courses may be undertaken under the supervision of a faculty member.
Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

CM 499 **Directed Study**

The study of a subject not otherwise available in formal courses may be undertaken under the supervision of a faculty member.
Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

Communication

COMM 1,3,5... **Communication Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.
Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

COMM 2,4,6... **Communication Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Foundation Curriculum Humanities Requirement.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

COMM 100 **2D Digital Design**

[Cross-listed with DA 100] [Formerly COMM 221] This introductory studio course explores many of the key principles, techniques and dialogues governing the creative potential of digital technologies within art and design. Topics of study include bitmap and vector-based digital imaging together with digital approaches to time-based media. The goal of the course is to empower students with an artistic and technological understanding of the subject, while encouraging an experimental approach to digital media.

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

IA

Comm Points: 1

COMM 101 **Introductory Writing**

Credit for this course is awarded only on the basis of an incoming student having taken a college-level introductory writing course at another college or university. The focus of this type of course is the teaching of writing itself, and typical titles include 'Freshman Composition,' 'Composition 1,' 'Expository Writing,' 'Freshman English,' and 'Writing and Critical Thinking,' among others. The two communication points associated with COMM101 can be counted toward the Clarkson Common Experience's communication requirement.

Credits: (3), Graded, Semester Calendar

Lecture, Transfer Credit Only

Comm Points: 2

COMM 190 **Writing Center Tutor**

Students will be introduced to Writing Center theory which includes collaborative learning, the writing process, rhetorical concepts, disciplinary genres, and interpersonal communication skills. Students will also apply these concepts by conducting writing conferences with members of the Clarkson community. In the process, students will deepen their understanding of the dynamics of interpersonal communication, develop their writing skills and their knowledge of writing in the disciplines.

Prerequisite: Admission by invitation from the Director of the Writing Center. Students may enroll in COMM190 only twice.

Credits: (0), P/NC, Semester Calendar

Independent Study, Every Semester

Comm Points: 1

COMM 210 **Theory of Rhetoric for Business, Science, and Eng**

[Formerly TC 210] This course introduces students to a rhetorical perspective of communication. Students will develop their abilities to: identify and analyze communication problems and issues in a given context; develop effective arguments; and communicate with others using various communication media (written, electronic, oral, visual). The course contains a substantial reading component, as well as instruction, practice, and feedback in writing and speaking.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

Comm Points: 2

COMM 217 **Introduction to Public Speaking**

This lecture and laboratory course is designed to enhance the individual's effective public communication by giving him or her a

variety of speaking roles in different situations. The objective of the course is to develop an awareness of the speaking potential of each student with emphasis on listening ability, nonverbal behavior, idea organization and effective use of language and visual aids.

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

Comm Points: 2

COMM 219 **Introduction to Social Media**

This course is geared toward understanding and utilizing the various social media channels for personal, professional and community benefit. In this course we will: Assess a variety of social media channels, examine successful users of new media, construct/refine our social media presence, relate social media attributes to our future paths, understand the social media climate through current articles, case studies, readings, and reports, Skype with industry professionals to gain varied insight, create a social media campaign to help spread awareness on some component of Clarkson University, understand how some component of social media campaigns could impact your future aspirations.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

IG

Comm Points: 2

COMM 226 **Short Film Screenwriting**

[Cross-listed with FILM 226] In this course, you will learn the process of writing short screenplays for narrative fiction films of any genre. Short films can be anywhere from 30 seconds to 40 minutes long, though the majority of them fall between seven and fifteen minutes. Each student will complete two short scripts and then revise one of these from the ground up. Since this is a workshop, you are expected to comment thoughtfully on your classmates' work, as they will comment thoughtfully on yours. Though there is some reading in this course, your primary concern should be writing, writing, writing!

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

IA

Comm Points: 2

COMM 229 **Principles of User-Experience Design**

This course introduces the processes and practices of user experience design (UXD) as it applies to websites, applications, and product development, and includes grounding in theories and techniques for developing websites,

user-interfaces, media artifacts, and products. Students think critically about and practice design thinking and iteration, analyze and theorize design choices, communicate ideas in multimedia, collaborate with others, perform research, hypothesize, conduct tests, and report data. By the end of the course, students will have a solid understanding of major user-experience design methodologies.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

IA(TECH)

Comm Points: 2

COMM 310 **Mass Media and Society**

This course consists of readings in and analysis of modern media communication and its influence. It includes the history of the media, media control, and various media effects on special audiences and on the development of other media. The course centers on an analysis

of how society controls the media and how the media controls society. The course is based on discussion of opinion pieces and other readings.

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

UNIV/CGI/STS

COMM 312 **Public Relations**

This course will introduce students to the history, nature, theory and practice of public relations in the United States by examining the activities of public relations professionals and firms. Attention will be given to the communication process and how persuasion is employed to influence various publics via traditional PR strategies and approaches, as well as how emerging media are changing current practice in various fields (e.g., health care, entertainment, government, and non-profits). Frequent practical exercises, communication tasks, and activities could include developing written and/or video press releases, maintaining a blog, running a press conference, planning events for a PR campaign in coordination with a client's goals, creating 'press kits,' developing strategies for building relationships with the media, developing a crisis communication plan for an organization, and associated oral presentations.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

Comm Points: 2

COMM 313 **Professional Communication**

This course presents students opportunities to learn how to design and present effective professional documents. The course emphasizes a rhetorical approach to analyzing the issues and details important to the communication to be produced (e.g., audience, style, format, purpose). Students will practice writing both individually and collaboratively and will be expected to present their work orally on occasion. Students will encounter topics such as, but not limited to, abstracts, email, instructions, letters, memoranda, proposals, and various types of reports. Students of any major may take this course. Prerequisites: Must have junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

Comm Points: 2

COMM 314 **Placemaking, Marketing and Promotion**

This course includes a foundational understanding of the construct of Placemaking or the ways in which people in places at various geographic scopes (neighborhood, community, town, or region) explore collaboratively their needs and develop planning and entrepreneurial strategies for more livable, sustainable and productive communities. This exploration interrogates multiple disciplines and fields including physical geography, architecture, community planning, sustainability certification programs (e.g., LEED), civic engagement, entrepreneurship, regulatory frameworks, as well as current trends in the literature and practice. A focus will also be on Creative Placemaking initiatives that put artists and The Arts at the forefront of community development. The course also builds on this foundation to examine the various ways in which communities utilize Placebranding as well as Marketing and Promotional Strategies to reach their goals including tourism, residential growth and sustainable, economic development.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/EC/IA

Comm Points: 1

COMM 322 **Typography and Design**

This course introduces students to typography as a design discipline. We will discuss the history and current state of typography, analyze the ways that type and design contribute to different meanings, and produce specific designs using type and other graphic elements in print and online forms. Prerequisites: COMM/DA 100 or DA120

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

IA

Comm Points: 2

COMM 326 **Feature Film Screenwriting**

In this course, you will learn the process of writing a feature-length screenplay. You will devise an original story idea, craft intermediate documents (i.e. logline, treatment, and beat sheet), and then write a first draft. Our goal is not to complete a polished draft (most screenplays go through at least a dozen revisions), but rather to execute a full draft in proper screenplay format that hits all the dramatic turning points, fleshes out characters and dialog, and leaves you with a document ready for substantive revision - now that you know what you're writing. Since this is a workshop, you are expected to comment thoughtfully on your classmates' work, as they will comment thoughtfully on yours. Along the way, you will read several professional scripts and complete a brief critique of each. We will also learn about the profession of screenwriting, including what to do with finished scripts, how to seek representation, and what the Writers Guild of America is. Though there is a good amount of reading in this course, your primary concern should be writing, writing, writing!

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

IA

Comm Points: 2

COMM 327 **Digital Video Production I**

As the WWW becomes better equipped to transmit multimedia, the uses of digital video to enhance and fulfill a variety of communication objectives is increasing. This course presents students with a hands-on opportunity to gain knowledge and experience in digital video production (conceptual development scripting, production planning, execution, and editing). Students will work together in small teams to write and produce creative, instructional, training, and public relations videos. Although a text will be used, emphasis will be on practical exercises.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

IA

Comm Points: 1

COMM 329 **Front-End Development for the Web**

This course focuses on the technical, rhetorical, and critical knowledge necessary to produce web and mobile applications, focusing especially on developing proficiency with the core technologies: HTML5, CSS3, and JavaScript (including frameworks, pre-processors, and script libraries). Students will invent, critique, and develop standards-compliant websites and applications, write and debug code, produce visual and informational designs, collaborate

with others, and articulate principles of workflow, user-experience, and design. Prerequisites: COMM 229 or permission of the instructor. Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms
(TECH)
Comm Points: 1

COMM 330 **Science Journalism**

Popular media has a tremendous influence on the production and reception of modern science. News and magazine articles, television shows, and movie documentaries influence public policy on science, research funding, the general public's interest in and understanding of scientific research, and even young people's willingness to choose a career in science. Drawing on student research experience in undergraduate science, students will learn about reporting science using a range of approaches and media. The class will investigate the influence popular accounts of science have on multiple audiences including specialist and non-specialist groups. Assignments will challenge students to understand the societal implications of scientific research and to identify and address different constituent positions and interests. Prerequisites: COMM210 and six (6) hours of a science, or permission of the Comm & Media department
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
STS
Comm Points: 2

COMM 345 **Information Design**

Information Design explores ways to structure complex data into usable information in genres including websites, computer interfaces, information visualizations, charts, interactive media, and audio. Drawing on theories and practices from disciplines including communication theory, cognitive psychology, visual theory, and new media, students will learn to understand users and their contexts, select appropriate media, and design effective and efficient informational texts. Prerequisite: COMM229
Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Terms
IA
Comm Points: 2

COMM 360 **Sound Design**

This course covers basic concepts and practices in sound design, including acoustics, microphones, effects, recording, and editing. Students will learn methods for developing solutions for audio requirements in video games, videos, interviews, and sound installation. This course will include both readings about sound design concepts and practices and hands-on work in audio production.
Credits: (3), Graded, Semester Calendar
Lecture,
IA(TECH)
Comm Points: 2

COMM 391 **Special Topics Course**

These courses reflect ongoing developments in communication practice and theory, often related to the particular faculty member's research interests.
Prerequisites: one course in communication or consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

COMM 392 **Special Topics Course**

These courses reflect ongoing developments in communication practice and theory, often related to the particular faculty member's research interests.
Prerequisites: one course in communication or consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

COMM 393 **Special Topics Course**

These courses reflect ongoing developments in communication practice and theory, often related to the particular faculty member's research interests.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

COMM 394 **Special Topics**

These courses reflect ongoing developments in communication practice and theory, often related to the particular faculty member's research interests.
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

COMM 395 **Special Topics**

These courses reflect ongoing developments in communication practice and theory, often related to the particular faculty member's research interests.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

COMM 410 **Theory and Philosophy of Communication**

This course exposes students to a range of communication theories, including those allied to rhetoric, linguistics, psychology and philosophy. Through reading and discussion, students do in-depth studies of such concepts as self-knowledge, listening and nonverbal communication, propaganda and persuasion, prejudice and stereotypes, professional jargon, communication motivations and words and values. Classical as well as modern theories are covered, and assignments require students to test theory against real or hypothetical rhetorical situations.
Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters
IG
Comm Points: 1

COMM 412 **Organizational Comm and Public Relations Theory**

This course examines the nature of the organization and the strategic communication processes that build relationships between organizations and their publics. Through assigned readings, lectures, and class discussion and analysis, students are exposed to communication theory and trends relevant to the workplace. Students will examine the communicative implications of such topics as organizational structure and goals; corporate culture; managerial schools of thought; leadership styles; superior-subordinate relationships; and communication consulting. In addition, students will address communicative implications in a changing economy; employee loyalty and dissent; gender and the workplace; and corporate image in crisis situations. This course seeks to provide students with insight into the organizational context, not only to make them more effective communicators but also to help them make informed choices in their careers.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
IG
Comm Points: 1

COMM 420 **Communication: Independent Study**

Designed primarily for a student who wishes to pursue special interests in communication for one or more semesters, this series of courses allows individual students to define independent study projects.

Prerequisites: one course in communication, consent of the instructor.

Credits: (1-9), Graded, Semester Calendar
Independent Study, Every Semester

COMM 421 **Communication: Independent Study**

Designed primarily for a student who wishes to pursue special interests in communication for one or more semesters, this series of courses allows individual students to define independent study projects.

Prerequisites: one course in communication, consent of the instructor.

Credits: (1-9), Graded, Semester Calendar
Independent Study, Every Semester

COMM 422 **Communication: Independent Study**

Designed primarily for a student who wishes to pursue special interests in communication for one or more semesters, this series of courses allows individual students to define independent study projects.

Prerequisites: one course in communication, consent of the instructor.

Credits: (1-9), Graded, Semester Calendar
Independent Study, Every Semester

COMM 423 **Communication: Independent Study**

Designed primarily for a student who wishes to pursue special interests in communication for one or more semesters, this series of courses allows individual students to define independent study projects.

Prerequisites: one course in communication, consent of the instructor.

Credits: (1-9), Graded, Semester Calendar
Independent Study, Every Semester

COMM 424 **Communication: Independent Study**

Designed primarily for a student who wishes to pursue special interests in communication for one or more semesters, this series of courses allows individual students to define independent study projects.

Prerequisites: one course in communication, consent of the instructor.

Credits: (1-9), Graded, Semester Calendar
Independent Study,

COMM 425 **Communication: Independent Study**

Designed primarily for a student who wishes to pursue special interests in communication for one or more semesters, this series of courses allows individual students to define independent study projects.

Prerequisites: one course in communication, consent of the instructor.

Credits: (1-9), Graded, Semester Calendar
Independent Study, Given When Needed

COMM 427 **Digital Video Production II**

COMM 427 builds on the concepts and skills learned by students in COMM 327 (Digital Video Production I). This is a hands-on course that will include: conceptual, aesthetic and technical production of the film-style, single-camera, 30-second spot; instructional and training program development; and live multi-camera studio production for interactive video teleconferencing and streaming media on the WWW. Although a text will be used, emphasis will be on practical exercises, with students frequently working in small teams.

Prerequisites: COMM327, or permission of the Comm & Media department.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
Comm Points: 2

COMM 428 **Environmental Communication**

[Cross-listed with EV 428] The past twenty-five years have seen environmental issues increasingly debated both in public and in scientific forums. This course will focus on a variety of documents related to current environmental issues, many relevant to northern New York, in order to examine the rhetoric deployed in such documents by industry, environmental organizations, scientists, and politicians. Examples of topics include acid rain, pollution of the St. Lawrence River, and cleanup of an EPA Superfund site. Using contemporary rhetorical theories, we will examine the processes readers and writers engage in as they attempt to create effective environmental documents. Students will engage in discussion, critical reading, case studies, individual research, and possibly, field trips.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
UNIV/CGI/STS

COMM 450 **Leading Innovation**

Today's emphasis on 'innovation everywhere' has created a big need for people who can lead others around innovation. The questions around this are many--for example, how to lead innovation efforts within teams, R&D settings, new ventures, organizations of all kinds, and how to enact the role of Chief Innovation Officer. This course assumes that effective innovation leadership requires inspiration, creative direction and vision, finding ways to effectively communicate this, and finding ways to get others on board. With this, the course examines how to artfully create innovation vision, fashion innovation narratives and styles, communicate these through multiple means and media, and effectively design innovation systems. The course uses a studio-based, live-case format where you will take a challenge that an actual innovation leader is facing, creatively work on it using arts-based methods within a studio format, present your solutions to the relevant stakeholders, and get feedback on your ideas. We will work on innovation leadership cases from a variety of settings; e.g., technology companies, creative industries, eco-focused & sustainability enterprises, social enterprises, manufacturing, and retail.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/IA/IG
Comm Points: 2

COMM 470 **Communication Internship**

These internships are designed to provide practical work experience for the communication major or concentration student. Students work with a professional on communication projects areas such as public relations, publication design, advertising, editing, or digital media design. Students can earn credit for only one course for each internship experience.

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

COMM 480 **Undergrad Teaching Assistantship in Comm & Media**

Students assist a faculty member in teaching a Communication & Media course. Students engage insubstantial pedagogical work beyond mastery of the target course material. Such activities might include mentoring students in course work, leading class discussions or demonstrations, designing or assessing course modules.

Prerequisites: the student will have already taken the course in a previous semester or receive consent from the instructor.

Credits: (1-3), Graded, Semester Calendar
Independent Study

COMM 490 **Senior Communication Internship**

These internships are designed to provide practical work or research experience for the senior communication major or concentration student. Generally, students work with a professional on projects in the field of public relations, publication design, advertising, editing, and/or digital media design and production. Prerequisites: Senior Standing

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

Computer Science**CS 1,3,5...** **Computer Science Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. Check with major department to determine whether credits count toward graduation.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

CS 2,4,6... **Computer Science Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Programming Foundation Curriculum Requirement.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

CS 110 **Introduction to Business Intelligence and Data Analytics**

[Cross-listed with IS 110] This course is an introduction to the underlying technology components of modern information systems used in businesses. It is important for organizations to utilize technology to collect data and use modern analysis tools and techniques to transform that data into tactical and strategic information. Emphasis is on introducing students to the main building blocks of information systems in organizations, and how such systems can be used to support individual and organizational decision making. Students will gain hands on experience in using data gathering and analysis tools such as Microsoft Excel and Enterprise Resource Planning software. Offered Fall and Spring semesters. Prerequisites: Not open to students who have taken or are taking CS courses

numbered 200 or higher or have taken or are taking IS courses numbered 300 or higher, without the permission of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
(TECH)

CS 141 **Introduction to Computer Science I**

This course is an introduction to basic concepts of computer science, with emphasis on programming. Computer programming is to the study of computer science what writing is to the study of literature. It is a primary tool for implementing algorithms in computer science. Fundamental techniques for software design and implementation will be covered and these concepts demonstrated in a programming language like C++. Additional topics include top-down modular design, developing general-purpose software tools, procedural and data abstraction, algorithms, and an introduction to recursion and dynamic data structures. The course consists of three hours of lecture and a one hour computer laboratory session per week.

Credits: (4), Graded, Semester Calendar
LectureLaboratory, Every Semester
(TECH)

CS 142 **Introduction to Computer Science II**

This course will further develop and expand upon the topics introduced in CS 141. Advanced programming techniques will be covered, with extensive use of recursion and dynamic data structures. Abstract data types, including lists, queues, trees and graphs, will be studied. Specific emphasis will be given to tree traversals and binary search trees. Algorithms for searching and sorting will be explored along with methods of comparative analysis. The topics in this course provide an essential foundation for the further study of computer science. Prerequisites: CS 141 or equivalent

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
(TECH)

CS 241 **Computer Organization**

An introduction to computer organization and assembly language programming. Topics include the functional organization of computer hardware; data representation, and computer arithmetic; instruction sets, addressing modes and low-level I/O. Introduces machine and assembly language, and systems programming techniques in the programming language C. This course serves as a foundation for courses on operating systems, compilers, networks, and computer architecture. Prerequisites: CS 142 or equivalent

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CS 242 **Advanced Programming Concepts in Java**

This course builds upon the foundation topics covered in CS 142, and covers concepts and skills required for real-life, modern programming. Topics will include basic object-oriented programming design, graphical user interfaces (GUIs), exception handling, multithreading and synchronization, networking, and client/server applications. The programming language Java with its companion OOP/GUI libraries will be used to illustrate these topics. This course will emphasize team programming on a large-scale project with a realistic deadline. Prerequisites: CS142, EE262, or EE361

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

CS 341 **Programming Languages**

This course examines the major paradigms underlying modern programming languages. The course currently focuses on object-oriented and logic programming. The rationale of the paradigms is discussed along with typical programming idioms used with them. Programming exercises are used to illustrate concepts--the course does not aim to make students proficient programmers in all the languages that will be studied. Prerequisites: CS142, EE262, or EE361
Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

CS 344 **Algorithms and Data Structures**

The primary goal of this course is to build on the programming skills gained in CS 141 and 142 to introduce students to more sophisticated algorithms and data structures and the notion of algorithm design. The course also introduces the basic formalism and concepts used in the analysis of algorithms. The relative efficiency of the algorithms studied is estimated by informal application of these ideas. The algorithms and data structures discussed include those for sorting and searching, pattern matching, set representation, graph problems, dynamic programming and others. Programming exercises based on 'realistic' applications help students to understand the often difficult process of reducing a real-world problem to a standard algorithmic question. Prerequisites: CS142 or EE262 or EE363, and MA132
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CS 345 **Automata Theory and Formal Languages**

[Cross-listed with MA 345] This course gives an introduction to formal languages and their relation to automata. Topics include deterministic and non-deterministic finite automata, regular expressions and languages, closure properties and decision procedures for context-free languages, recursive and recursively enumerable sets, Turing machines, and decidability. Some aspects of computational complexity may also be explored. Prerequisites: CS 142, EE262, or EE361, and MA211
Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

CS 350 **Software Design and Development**

Working in teams, students will learn tools and strategies for designing and implementing medium/large software projects. Suitable project ideas will be solicited from the community in order to match student teams with real users where possible. Students will learn to elicit requirements from users and to work in an effective team. Students will learn and practice techniques for software testing including black-box testing, stress testing, performance testing, code reviews, and code coverage tools. Students will produce documentation that is appropriate at various stages in the software life cycle including for example, requirements documents, project plans and user manuals. The work will include oral presentations and written reports. Prerequisites: CS344 or CS242.
Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms
Comm Points: 2

CS 407 **Directed Study in Computer Science**

This is a directed study course that will allow the student the opportunity to pursue special interests in Computer Science.
Credits: (1-15), Graded, Semester Calendar
Research, Given When Needed

CS 408 **Directed Study in Computer Science**

This is a directed study course that will allow the student the opportunity to pursue special interests in Computer Science.
Credits: (1-15), Graded, Semester Calendar
Research, Given When Needed

CS 411 **Directed Study in Applied Computer Science**

This is a directed study course that will allow the student the opportunity to pursue special interests in Applied Computer Science.
Credits: (1-15), Graded, Semester Calendar
Independent Study, Given When Needed

CS 412 **Directed Study in Applied Computer Science**

This is a directed study course that will allow the student the opportunity to pursue special interests in Computer Science.
Credits: (1-15), Graded, Semester Calendar
Research, Given When Needed

CS 442 **Computational Complexity**

The complexity of a computational problem is the amount of computer resources it requires. Computational complexity theory studies the complexity of computational problems as well as relationships between different types of resources. This course will cover both classical and research-related topics in computational complexity, such as: complexity measures and complexity classes for sequential machines and Boolean circuits, reductions and completeness, hierarchy theorems, relativization, circuit complexity, and proof complexity. Prerequisites: CS345 or equivalent MA345.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CS 443 **Parallel Programming**

The performance of single microprocessors is no longer increasing rapidly, and most of the increase in computing power in the future is anticipated to come from multiprocessor and parallel systems. But parallel programming is much more difficult than writing single-threaded sequential programs, and this course will introduce students to the techniques, design strategies, and programming interfaces for creating reliable and efficient parallel programs. Students will program for clusters of workstations using the MPI parallel message passing library, and will write multi-threaded programs for shared-memory multiprocessors. Students will learn methods and tools for predicting and measuring the performance of parallel algorithms.
Credits: (3), Graded, Semester Calendar
Lecture

CS 444 **Operating Systems**

This course is an introduction to the concepts of operating systems, their structures and organization. Major topics include process management (asynchronous processes, interprocess communication and synchronization, multithreading, deadlock and starvation, scheduling), storage management (paging/segmentation, virtual memory, file systems), protection and security issues, and an introduction to distributed systems. To demonstrate these concepts, case studies of operating systems will be presented, and a programming project will be an integral part of the course. Prerequisites: CS 344; and CS241 or EE360 or EE264
Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Spring Semesters

CS 445 Compiler Construction

A study of compiler design. Overview of the compilation process. Formal definition of syntax, lexical scanning, parsing including LL and LR grammars, run-time structures, intermediate code generation, and storage allocation. Students are expected to develop a compiler for a substantial subset of a high-level language using compiler tools such as lex and a compiler yacc. Prerequisites: CS344, CS345, CS241 and CS341

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

CS 447 Computer Algorithms

[Cross-listed with MA 447] This course will study and contrast a variety of computational algorithms and develop tools for algorithm analysis. Methods and topics such as dynamic programming, greedy algorithms, graph algorithms, circuits, parallel algorithms, matrix and polynomial algorithms, string matching, and geometrical algorithms will be explored. The theory of NP-completeness and methods of managing NP-complete problems will also be covered. Prerequisites: CS344 and MA211

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

CS 449 Computational Learning

[Cross-listed as MA 449] Computational learning studies algorithmic problems for inferring patterns and relations from data. This course describes the mathematical foundations of learning and explores the important connections and applications to areas such as artificial intelligence, cryptography, statistics, and bioinformatics. A list of relevant topics may include perceptron and online learning, graphical models and probabilistic inference, decision tree induction and boosting, analysis of Boolean functions, sample complexity bounds, cryptographic and complexity hardness, and reinforcement learning. Basic ideas from computer science and mathematics are employed to describe the main ideas and major developments in computational learning. Prerequisites: CS344 and CS345, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CS 451 Artificial Intelligence

This course is a comprehensive introduction to core concepts in artificial intelligence and surveys active research areas. Fundamental ideas in knowledge representation and search will be emphasized. Methods for encoding knowledge will include predicate logic, production rules, semantic networks, frames and other schemata. Data-driven and goal-driven search strategies will be covered, along with heuristic search algorithms. Additional topics will be drawn from knowledge-based systems, reasoning under uncertainty, planning, natural language understanding, neural networks and learning. Throughout the course, students will learn AI programming techniques and applications using languages such as LISP or Prolog. Prerequisites: CS344 (CS250 and CS341 recommended)

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

CS 452 Computer Graphics

[Cross-listed with EE 465] An introduction to computer graphics. Graphics hardware, algorithms for generating and displaying two and three-dimensional geometric figures, animation, interactive displays.

Programming projects using OpenGL will be assigned. Prerequisites: CS142 or EE361, and MA232 or MA239 (or MA339 as a corequisite)
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CS 455 Computer Networks

[Cross-listed with EE 407] This course covers layered networking protocols with an emphasis on common Internet protocols such as TCP, IP, HTTP, and SMTP. It also covers local area networking, focusing on link layer standards such as the IEEE standards for Ethernet and wireless. Additional topics such as security and congestion control will also be covered. EE407 and CS455 are offered each fall as one course with multiple listings. Prerequisites: One of course in computer architecture (EE264, CS241 or IT502 or equivalent). One course in computer programming (EE261, CS141 or equivalent.) Note: IT501 also satisfies the programming requirement.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Fall Semesters

CS 456 Cryptography

[Cross-listed with MA 456] Cryptography is the discipline which studies the making of 'secret' codes. This course will examine some of the methods of cryptography together with many surprising applications. The language of modern cryptography is primarily number theory, and various tools of number theory will be developed as needed. No background in number theory or cryptography will be necessary, but some mathematical sophistication and familiarity with proofs will be assumed. Topics will include: one-way functions, public-key cryptosystems, digital signatures, probabilistic encryption, primality testing, interactive proof systems, and methods of secret sharing. Prerequisites: CS142, EE262, or EE361, and MA211 (CS 344 recommended)

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

CS 457 Computer and Network Security

[Cross-listed with EE 410] Attacks on networked computer systems are an increasingly important problem. This course covers the types of vulnerabilities that are present in modern computer systems and the types of malicious software that exploit these vulnerabilities. It also covers best practices for preventing, detecting and responding to such attacks including anti-virus software, defensive programming techniques, intrusion detection systems, honeypots and firewalls.

Prerequisites: A general course in computer networking such as CS455/555 or EE407/507. Programming experience to the level of CS142 or EE361.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CS 458 Formal Methods for Program Verification

Formal methods are algorithms and techniques that actually prove that a program meets its design criteria, and are the only way to guarantee that a program works correctly. As computer software increases in size and complexity, formal methods are becoming an essential part of software engineering. This is especially true of safety critical and life critical systems, where software errors can have life threatening consequences. Until recently, formal methods have had limited application because they were difficult to use. This is changing, and they are receiving greater acceptance from software engineers in industry and government. This course introduces students to the basic concepts and methods of program verification.

A variety of techniques and tools will be covered, and students will gain experience in applying the tools to actual programs. After completing the course, students will have sufficient expertise to learn new methods as they become available. Prerequisites: MA211 or MA346; and CS344

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CS 459 **Human-Computer Interaction**

This course provides an introduction to the field of human-computer interaction (HCI). This discipline focuses on the design, evaluation and implementation of interactive computing systems from a user's point of view. The course will give a broad overview of the ideas, techniques, and tools in the subject, with a systematic approach to designing visual interfaces and evaluating their effectiveness. Case studies of existing interfaces, technologies, and data display methods will be discussed and critiqued. Topics include: programming and command languages; menus and forms graphical user interfaces, computer-supported cooperative work, information search and visualization; input/output devices; and display design. A collaborative course project will explore issues in HCI and design. Prerequisites: CS242 or EE408

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

CS 460 **Database Systems**

[Cross-listed with EE 468] An introduction to database systems. The entity-relationship and relational models are presented and applied to the design of typical databases. New developments in object-oriented and multimedia databases are presented. Emphasis will be placed on database design for applications in the context of an existing database management system such as ORACLE or ACCESS. Prerequisites: Programming experience in a high-level language

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CS 461 **Mixed Reality**

[Cross-Listed with CS561] This course provides an introduction to the mathematics and computing underlying virtual (VR) and augmented reality (AR). Students will learn stereo camera geometry for VR, recovery of 3D scene structure from images for content manipulation in AR, acquiring of illumination maps for photorealistic AR, and capture of human interaction for virtual environments. Students will perform several short and long projects as part of the course. Prerequisites: CS142/EE361, and MA232/MA239 or corequisite of MA339.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CS 465 **Mobile Robotics and Human-Machine Interaction**

This course provides an introduction to robotic systems and human interaction methods with such systems from a computational perspective. In this course we will consider the definitional problems for robotics with a human-centric flavor, and look at how they are being solved in practice and by the research community. The emphasis is on algorithms, inference mechanisms and behavior strategies although we will also survey the kinds of mechanical and electronic systems that constitute a robot today. Prerequisite: CS 344

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CS 466 **Blockchain Technologies**

Blockchain technologies are the underlying technological foundation of almost all digital currencies, such as Bitcoin and Ethereum. Without the need of a trusted authority or central server, Blockchain technologies can securely archive and are inherently resistant to modification of data. The course will cover the basics and advanced topics of Blockchain technologies. The basics include public key cryptography and cryptocurrency, hashing algorithms, mining process, proof of work, block structures, transactions and wallets. Advanced topics may include consensus algorithms, smart contracts, blockchain network security and applications. We will discuss the limitations of current applications and explore new systems and proposals that overcome them. The course will offer many hands-on lab components and a blockchain-based course project. Students should already have had solid programming skills, such as C, C++ or Python, to take the course. Prerequisites: CS344

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CS 469 **Quantum Information and Computation**

This course studies information and computation based on quantum mechanical laws. The first part of the course will cover the relevant background in quantum information theory. A brief discussion of several universal quantum computational models will be given. The second part will cover algorithmic techniques important for developing quantum algorithms. Topics to be covered include amplitude amplification, quantum walks, phase estimation, hidden subgroup problems, and quantum protocols. Background in physics would be helpful but is not required. Prerequisites: CS344 and MA232 or MA339

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CS 470 **Deep Learning**

This course will cover the principles of modern deep learning architectures from a theoretical and practical perspective. Course topics covered will include an introduction to machine learning and basic neural network architectures, and in-depth discussions on convolutional neural networks, recurrent neural networks based on units such as LSTMs and GRUs, and, if time permits, GANs. Students will be required to implement programming assignments and projects that apply deep learning architectures to solve classification and regression problems. Prerequisites: CS142, EE262, or EE361, and MA339.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CS 471 **System Administration and Network Operations**

This course is designed to give students the basic skills and knowledge to administer Unix/Linux machines as standalone workstations or in a network environment. For example, students will learn to install and configure the Linux operating system, create and maintain system users and groups, maintain and administer a file system, configure and maintain network services, troubleshoot system and network problems, and secure the system and network environment. Comprehensive hands-on labs throughout the course will reinforce learning and develop skills and competency. Prerequisites: CS241, EE260, or EE264

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CS 497 Undergraduate Research I

Students engage in computer science research with a faculty member. The topic will be determined by student interest and faculty research programs. This course may be repeated for credit.

Prerequisites: consent of the instructor.

Credits: (1-3), Graded, Semester Calendar

Research, Given When Needed

CS 498 Undergraduate Research II

A continuation of CS 497.

Prerequisites: consent of the instructor.

Credits: (1-3), Graded, Semester Calendar, Research

CS 499 Professional Experience

This course records successful completion of an approved professional experience meeting the requirements of the Clarkson Common Experience. Typical activities include internships and co-ops, directed research, and suitable semester-long class projects.

Credits: (0), P/NC, Semester Calendar

Independent Study

CS 999 Special Graduate Topics

A graduate level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (1-10), Graded, Semester Calendar

Lecture, Transfer Credit Only

Digital Arts**DA 1,3,5... Digital Arts Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

DA 2,4,6... Digital Arts Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Common Experience Requirement.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

DA 100 Introduction to Digital Art: Time & Image

[Cross-listed with COMM 100] This introductory studio course explores many of the key principles, techniques and dialogues governing the creative potential of digital technologies within art and design. Topics of study include bitmap and vector-based digital imaging together with digital approaches to time-based media. The goal of the course is to empower students with an artistic and technological understanding of the subject, while encouraging an experimental approach to digital media. Prerequisites: DA&S Majors or permission of the Comm & Media department.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

IA

Comm Points: 1

DA 110 Drawing

This perceptually based studio course serves as one of the foundations for the DA&S major. Students will learn the importance of line, value, perspective, and human anatomy through the use of

media such as graphite, charcoal, and ink. The translation of the 3D world to the 2D world through drawing will be emphasized. Prerequisites: DA&S Majors or permission of the Comm & Media department.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

IA

Comm Points: 1

DA 120 Elements of Design

In this traditional studio art course, the foundations of visual design will be studied, particularly in the fields of color theory and two and three dimensional design. Students create projects with a strong focus on basic elements such as: line, shape, texture, value, color, composition, plane, volume, and space. Other concepts, such as form vs. function and conceptual vs. perceptual creativity will also be studied. Prerequisites: DA&S Majors or permission of the Comm & Media department.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

IA

Comm Points: 1

DA 140 Introduction to Digital Art: Form & Code

This course introduces the key principles of computer programming. Through workshops, presentations, quizzes, readings, and project-based exercises and assignments, the course embarks on an investigation into the creative possibilities of computer programming within the digital arts. The skills and concepts taught in this course set a foundation for higher level DA&S courses within e.g. game design, web programming, and computational arts.

Credits: (3), Graded, Semester Calendar

Lecture

DA 200 3D Digital Modeling & Imagery

This studio course introduces the creation of 3D imagery through the use of the computer. Students will gain experience through the creation and rendering of polygonal models, textures, and lights. This course will demonstrate the importance this medium has in fine art, film, advertising, and video games. Prerequisites: DA100/COMM100 (or permission of the Comm & Media department).

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

IA

DA 207 Media Landscapes I

Students will watch, discuss, and critique media objects such as movies and other forms of popular culture. The course focuses on historical and contemporary examples of work that offer ongoing cultural legacies and represent significant achievements within their genre. Prerequisites: DA&S Majors or permission of the Comm & Media department.

Credits: (1), Graded, Semester Calendar

Lecture, Given When Needed

DA 208 Media Landscapes II

Students will watch, discuss, and critique media objects such as movies and other forms of popular culture. The course focuses on historical and contemporary examples of work that offer ongoing cultural legacies and represent significant achievements within their

genre. Prerequisites: DA&S Majors or permission of the Comm & Media department.

Credits: (1), Graded, Semester Calendar
Lecture, Given When Needed

DA 212 **Art in Context**

This course offers a critical exploration of the key themes, ideas, and dialogues that inform and guide contemporary art practices. Through readings, writings, and discussions, students will analyze artists and art movements through both historical and theoretical perspectives with a special emphasis on the position of new media technologies in contemporary art and culture. Prerequisites: DA&S Majors or permission of the Comm & Media department.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

DA 225 **Digital Painting and Illustration**

This studio course teaches painting and illustration through the use of digital tools such as the computer and pen tablet. Building on the student's previous knowledge of color theory, drawing, and design, this course will introduce a raster-based media that facilitates the digital creation of concept art, comics, paintings, and 3D textures. Prerequisites: DA100/COMM100, and DA110 or DA120 (or permission of the Communications & Media department).

Credits: (3), Graded, Semester Calendar
Lecture, Every Term

DA 250 **Interactive & Algorithmic Art**

In this course, students will be introduced to artistic expressions unique to digital art. They will experiment with creating forms, motions, and interactions through the design of algorithms and the manipulation of math functions. They will learn to conceive and design art works as a dynamic process and as an inseparable combination of audience participation and its visual manifestation. Prerequisite: DA&S majors and CS 141 or DA 140, or permission of the Comm & Media department.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

DA 300 **3D Imagery & Animation**

An advanced studio course in which students apply their 3D modeling knowledge to camera and object animations. Students will explore advanced procedures while incorporating their experience with digital video and sound editing into each project. Projects will include both digital still imagery and 3D animation shorts. Prerequisites: DA200 or permission of the Comm & Media department.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

DA 320 **Moving Images: Motion Graphics & Animation**

Focusing predominantly on the software applications Adobe After Effects and Flash, this course explores creative and experimental uses of time-based media as both a form of artistic expression and as a vehicle for presenting data and information. While primarily a studio course, techniques and skills will be taught within a wider critical framework that explores the historical and theoretical precedents and contexts surrounding motion graphics and time-based art practices. Prerequisites: DA&S Majors and DA100, or permission of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

DA 340 **Virtual Reality (VR) and Mixed Reality**

This exploratory class will delve into the use of virtual reality devices such as the Oculus Rift and HTC Vive for interactive content creation. Students will explore a mix between real-time, 360 video, and pre-rendered methods in order to produce challenging content which will explore the potential of what can be achieved with these exciting new platforms. Emphasis will be placed on the experimental application of techniques towards innovative content. Prerequisite: CS141 or DA100

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
IA(TECH)

DA 391 **Special Topics: Digital Arts & Science**

In DA&S Special Topics courses, students study topics not otherwise available in formal courses under the supervision of a faculty member. The specific topic and the course description for a special topics course are listed when it is offered. These courses reflect ongoing developments in digital art media and practice, which often are related to the particular faculty member's research interests. These courses are intended primarily for advanced students who wish to pursue special interests in the field.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

DA 392 **Special Topics: Digital Arts & Science**

In DA&S Special Topics courses, students study topics not otherwise available in formal courses under the supervision of a faculty member. The specific topic and the course description for a special topics course are listed when it is offered. These courses reflect ongoing developments in digital art media and practice, which often are related to the particular faculty member's research interests. These courses are intended primarily for advanced students who wish to pursue special interests in the field.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

DA 393 **Special Topics: Creative Apps**

This course is an introduction to designing and creating apps for smartphones and mobile touchscreen devices. Students will learn creative approaches and practical strategies for small screen application development through various technical frameworks that cater to varying skill levels such as Application Craft, PhoneGap and Unity3D. The class will involve hands-on workshops and a larger discussion of "app culture". Students will be expected to produce an app for their final project. Note: We will use code simulators, so students do not have to own a smartphone or tablet to develop and test their apps.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

DA 394 **Special Topics in Digital Arts & Sciences**

In DA&S Special Topics courses, students study topics not otherwise available in formal courses under the supervision of a faculty member. The specific topic and the course description for a special topics course are listed when it is offered. These courses reflect ongoing developments in digital art media and practice, which often are related to the particular faculty member's research interests. These courses are intended primarily for advanced students who wish

to pursue special interests in the field.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

DA 400 **Directed & Collaborative Study**

A studio course available to advanced students wishing to pursue further research in a specific area of interest. Meeting at the same time as DA300, this course provides an opportunity for collaboration & directed research in the specified area. This optional course gives the student a chance to expand their portfolio in preparation for a career in the digital arts. Prerequisites: A 300-level DA course, DA&S major, and permission of the Comm & Media department.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

DA 410 **Directed & Collaborative Study**

A studio course available to advanced students wishing to pursue further research in a specific area of interest. Meeting at the same time as DA310, this course provides an opportunity for collaboration & directed research in the specified area. This optional course gives the student a chance to expand their portfolio in preparation for a career in the digital arts. Prerequisites: A 300 level DA course, DA&S majors only, and permission of the Comm & Media department

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

DA 420 **Digital Arts Independent Study**

Designed primarily for a student who wishes to pursue special interests in Digital Arts for one or more semesters, this series of courses allows individual students to define independent study projects. Prerequisites: One course in Digital Arts and permission of the Comm & Media department

Credits: (1-3), Graded, Semester Calendar
Independent Study

DA 421 **Digital Arts Independent Study**

Designed primarily for a student who wishes to pursue special interests in Digital Arts for one or more semesters, this series of courses allows individual students to define independent study projects. Prerequisites: One course in Digital Arts and permission of the Comm & Media department

Credits: (1-3), Graded, Semester Calendar
Independent Study

DA 423 **Digital Arts Independent Study**

Designed primarily for a student who wishes to pursue special interests in Digital Arts for one or more semesters, this series of courses allows individual students to define independent study projects. Prerequisites: One course in Digital Arts and permission of the Comm & Media department

Credits: (1-3), Graded, Semester Calendar
Independent Study

DA 480 **Internship in Digital Arts**

These internships are designed to provide practical work or research experience for the Digital Arts & Sciences majors. Generally, students work with a professional on projects in the field of digital arts, interactive design, advertising, and/or digital media design and production. Prerequisites: DA&S Majors or permission of the Comm & Media department

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

DA 490 Undergraduate Teaching Assistantship in Digital Arts & Sci

Students assist a faculty member in teaching a Digital Arts & Science course. Students engage in substantial pedagogical work beyond mastery of the target course material. Such activities might include mentoring students in course work, leading class discussions or demonstrations, designing or assessing course modules.

Prerequisites: the student will have already taken the course in a previous semester or receive consent from the instructor.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

DA 491 **Professional Practice**

This is the first semester in the advanced studio sequence in which the DA&S major applies the knowledge and skills developed in the program to design a visual portfolio under the directed study of a specific faculty member. Each student should choose the proper section which correlates with the faculty member who they wish to work with for the semester. Prerequisites: Any 300 Level DA course and open to DA&S Majors only (or by permission of the Comm & Media department)

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

Comm Points: 2

DA 492 **Senior Studies**

The capstone of the advanced studio sequence in which DA&S seniors integrate the knowledge and skills developed in the program to complete their portfolios by working independently on a large-scale project. Each student should choose the proper section which correlates with the faculty member who they wish to work with for the semester. Prerequisites: DA491 and Senior standing in DA&S

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

Comm Points: 1

Data Science**DS 241** **Introduction to Data Science**

This course introduces the basics of data manipulation and pre-processing to analyze data for statistical decision-making, building the skills required to organize, visualize, and communicate using data. The course seeks to help students address this question: given data from the world of science, engineering, medicine, etc., collected from multitude of sensors and sources, how do you begin to make sense of that data – and how do you use it? The primary tool for coding will be R/RStudio, but supporting Python syntax and libraries may also be introduced. The course emphasizes not only the low-level coding skills, but also the higher-level critical and quantitative reasoning skills required to analyze real-world datasets. Topics introduce key concepts such as descriptive statistics and sampling distribution (as a means to view large and very large data sets) and the basic analysis tools of Linear Regression and Data Mining. Additional topics may include social network data, unstructured data, and natural language text processing. Corequisite: STAT282, or STAT383, or STAT318

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

DS 392 **Ethics in Data Science and Applied Mathematics**

This course will consider real situations in which computational or data science delivers capabilities that may conflict with societal values. Students will analyze frameworks for promoting ethical decision making, such as audits, codes of conducts, and legal

regulations. They will discuss how data-driven decision making can be aligned with societal values. (Discussion topics may include things like data stewardship, secondary-effect analysis, political and legal roles of mathematical professionals, and representative workforce.) Guest speakers from both physical and social sciences will introduce relevant, real-world examples, with a portion of course time dedicated to discussion of daily news items that relate to the topics of this course. Prerequisites: Any STAT or DS Course

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

Comm Points: 1

English for Academic Purposes

EAP 1,3,5...

EAP Elective

[Formerly ESL 1] A college level English for Academic Purposes, English as a Second Language, or English for Specific Purposes course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

EAP 2,4,6...

EAP Elective

A college level English for Academic Purposes, English as a Second Language, or English for Specific Purposes course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

EAP 250

Academic Writing for Undergraduates I

[Formerly ESL250] This course, designed for non-native speakers of English at a low-advanced level of proficiency in written English, focuses on reading and writing for the academic context. Students read material from a variety of fields and develop their writing skills in definition, description, comparison and contrast, and analysis. The course also includes vocabulary-building techniques and a review of grammatical structures needed for effective writing.

Prerequisite: placement test.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EAP 255 Acad Spoken Comm Skills for TAs and Int UGRAD Sdnts

The course focuses on development of effective communication skills (including appropriate grammar and vocabulary) for various academic purposes (e.g., making presentations on a variety of academic themes, answering audience questions). As a group and individually, students also work on pronunciation, intonation patterns, and other features of fluent American English.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EAP 350

Academic Writing for Undergraduates II

[Formerly ESL350] This course integrates academic reading, writing, and critical thinking for non-native speakers of English who are at an advanced level of proficiency in written English. Students read short academic articles on various topics by a variety of authors, discuss and evaluate ideas, and write a number of analytical and argumentative papers, including a documented paper based on outside sources. Attention is given to key academic writing skills, e.g., summary, paraphrase, use of citations, and effective support of ideas. Prerequisites: Placement test or grade of C or better in EAP250.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

EAP 354

Advanced Academic Writing for Undergraduates

[Formerly ESL354] This writing seminar will provide high advanced non-native speakers of English with tools and teacher feedback to shape their writing skills for university level writing requirements. This seminar will focus primarily on the American cultural expectations/conventional structures for successful academic writing courses; students will enhance their tone, form, and structure of texts.

Prerequisites: Placement exam or completion of EAP250 with a grade of C or better.

Credits: (2), Graded, Semester Calendar

Lecture, Every Semester

Comm Points: 1

Economics

EC 1,3,5...

Economics Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

EC 2,4,6...

Economics Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

EC 150

Principles of Microeconomics

(May be used with EC 151 to satisfy a CUSB M.B.A. or M.S. foundation requirement.) An introduction to microeconomics covering the role of the price system in and public policies toward the allocation of resources and the distribution of income. Included are the basic concepts of industry, supply and demand, technological change, private and social costs, market structures, analysis of firm behavior, household behavior and the gains from international trade. Students will be expected to use personal computers. Restriction: Not open to Chemical, Civil, or Environmental Engineering majors. Students may not be granted credit for EC150 as well as EC350.

Credits: (3), Graded, Semester Calendar

Lecture, Fall and Summer Semesters

EC

EC 151

Principles of Macroeconomics

(May be used with EC 150 to satisfy a CUSB (Clarkson School of Business) M.B.A. or M.S. foundation requirement.) An introduction to macroeconomics including the analysis of national income determination, monetary and fiscal policy, aggregate economic growth and international economics. Price stability, balance of international payments and economic growth and development will also be examined. Students will be expected to use personal computers and prerequisite software. Restriction: Not open to Chemical, Civil, or Environmental Engineering majors. Students may not be granted credit for EC151 as well as EC350

Credits: (3), Graded, Semester Calendar

Lecture, Spring and Summer Semesters

EC

EC 200 **Engineering Economics**

A course to supplement EC150 for those students who are required to complete EC350 or its equivalent. The course will cover the topic of engineering economic analysis and provides preparation for the Fundamentals of Engineering Exam and the Professional Engineering Exam. Requisite: The course will only be offered to those students who have completed EC150. Prerequisite: EC150 or EC151
Credits: (1), Graded, Semester Calendar
Lecture

EC 311 **Introduction to Econometrics**

Introduction to econometric techniques and statistical procedures required in analysis of economic problems. The course focuses on problems in estimation and inference of linear regression models. Topics include estimation and hypothesis testing using simple and multiple linear regression models under classical assumptions, binary variables, estimation and inference when the classical assumptions are violated, and basic time series analysis. This course requires the use of computers. Prerequisites: MA181 or equivalent and STAT282 or equivalent.
Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

EC 313 **Mathematical Economics**

This course aims to have students be able to understand and apply mathematical concepts in the context of a wide range of fields in economics, including microeconomics, macroeconomics, finance, economics of risk and uncertainty, economic development, international trade, environmental economics, and industrial organization. The course will build upon basic economic theory and mathematical concepts to focus on topics such as: comparative statics, financial mathematics, unconstrained and constrained optimization, dynamic optimization, and applications in contexts of uncertainty and strategic behavior. Prerequisites: EC150, EC151, MA131, and MA132
Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms
Comm Points: 2

EC 315 **Entrepreneurship and Economic Devel in the Adirondacks**

[Cross-listed with EV 315] This course will explore the characteristics of the entrepreneurs of the park while also understanding the opportunities and challenges that these entrepreneurs face. It will also explore the theories of externalities and public goods applied to pollution and environmental policy. The students will analyze the options for encouraging entrepreneurship and achieving economic development goals within the Adirondack Park. Enrollment is limited to students participating in the Adirondack Semester Program.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
EC

EC 350 **Economic Principles and Engineering Economics**

An introduction to microeconomic concepts in a market type economy. Some of the issues covered are the role of supply, demand, market price determination, consumer behavior, production theory and cost, and market structure. An introduction to macroeconomic concepts including the analysis of national income determination, monetary and fiscal policy, aggregate economic growth, international economics and inflation. This course also includes a segment on

engineering economic analysis. Engineering students should take this course rather than EC150 and EC151 because it provides preparation for the Professional Engineering exam. Prerequisite: Sophomore Standing, and Engineering or Engineering and Management majors only. Students cannot enroll in EC 350 if they have credit for EC 150 or EC 151
Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
EC

EC 357 **Intermediate Microeconomics**

The study of how producers and consumers, acting through the market, determine the prices and outputs of goods and the allocation and income of productive resources. Empirical materials are used, and emphasis is placed on the uses and limitations of economic reasoning. Prerequisites: EC/EM150 or EC350.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EC 358 **Intermediate Macroeconomics**

Macroeconomics is the study of the economy as a whole and is concerned with some of the most important questions in economics such as: Why is there unemployment? What are the sources of rapid inflation? What causes recessions? Why are some nations rich while others are poor? Why do some economies grow faster than others do? Can policymakers "fine-tune" the economy? This course analyzes the economy in a "general equilibrium" framework, where the performance of the economy in terms of output, employment and unemployment, inflation and international capital flows is determined by the simultaneous interaction of the goods, labor, money, and international markets. The course will highlight the critical difference between the economy in the short and long run, the important role that expectations about the future play in macroeconomic analysis, and the role, limits, and transmission mechanisms of fiscal and monetary policy in efforts at economic stabilization. Prerequisites: EC150, EC151, and EC313
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

EC 360 **Environmental Economics**

[Cross-listed with EV 360] Economic analysis of problems caused by the impact of economic activities of society on the environment, and of the public and private policies that could be used for environmental improvement. Prerequisites: EC/EM150 or EC350.
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms
UNIV/EC/IG

EC 367 **International Economics**

A survey of current theory and practice of international trade and finance. Topics covered include international trade theory, tariffs and quotas, international commodity agreements, balance of payments, foreign exchange markets, adjustment mechanisms and the international monetary system. Attention is given to the role of multinational corporations in the international economy. Prerequisite: At least one course in Economics (EC)
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EC 370 **Economics of Innovation**

This course is designed to introduce students to microeconomic concepts relating to innovation, learning, technology adoption, and intellectual property protection. Various economic models of innovation are addressed. Topics include: incentives to innovate, market effects of innovation, and models of firm behavior and investment in innovation under conditions of uncertainty, and the importance of network effects/externalities and standardization in technology adoption. Throughout the course, students will be exposed both to economic theory as well as existing real-world case studies. Prerequisites: Sophomore Standing and EC150. Credits: (3), Graded, Semester Calendar, Lecture, Fall Semesters

EC 384 **Game Theory and Economic Strategy**

This course is designed to introduce students to the various rudimentary elements of game theory with the goal of providing the student with the tools and the ability to enhance their capabilities for strategic thinking. Applications are drawn from a wide variety of areas such as business, politics, international relations, and biology. Cases can incorporate entry and deterrence strategies, advertising, pricing and product quality, auctions, issues of technology standards, and problems of compatibility. The course will include the main elements of games and their structure, decision analysis, solution concepts, uncertainty and information, cooperation, and bargaining. Prerequisites: EC/EM150 or EC350 and MA181 or MA131. Credits: (3), Graded, Semester Calendar Lecture, Given When Needed

EC 451 **Industrial & Supply Chain Economics**

This course studies the economics of industrial organization within the framework of supply chain management. Models of industry structures are covered along with the study of business clusters and networks. Material includes horizontal and vertical integration, transaction costs and outsourcing, incentive contracting, product differentiation, and pricing strategies. Topics are illustrated through selected industry case studies. Prerequisites: EC150 or EC350 and MA181 or MA131. Credits: (3), Graded, Semester Calendar Lecture, Spring Semesters

EC 468 **Financial Markets and Institutions**

[Cross-listed with FN 468] Emphasis is placed on understanding the basics of managing financial institutions, such as banks, the flow of funds, markets, and regulatory agencies that affect the institutions. The course addresses risk management, term structure of interest rates, international and domestic market operations and policy questions about financial markets and related topics. Prerequisite: FN361. Credits: (3), Graded, Semester Calendar Lecture, Given When Needed

EC 475 **Personnel Economics**

This course makes use of economic theory and empirical evidence concerning personnel issues and the way incentives are structured within an organization. Topics include issues such as hiring standards, learning of worker productivity, compensation mechanisms, labor turnover, layoffs and buyouts, and various other personnel issues. Prerequisite: EC150. Credits: (3), Graded, Semester Calendar Lecture

EC 487 **Special Projects in Economics**

An investigation of a problem or in-depth topic undertaken by the student under the guidance of a faculty member. Prerequisites: permission of the instructor. Credits: (1-3), Graded, Semester Calendar Research, Given When Needed

EC 490 **Internship**

An unpaid internship that is related to the student's professional goals. Prerequisites: Permission of the instructor. Credits: (1-3), Graded, Semester Calendar Independent Study, Given When Needed

Education**ED 300** **Field Experience**

(Minimum of 20 hours) Candidates are observers in a variety of education and education-related settings. Apart from community and after-school programs, there must also be a range of school and classroom experiences (e.g., urban, suburban, rural; high-and low-performing schools)-all taking place at the secondary level-so that candidates have a broad experience and learn as much as possible about secondary learners and secondary education philosophy. Credits: (1), Graded, Semester Calendar Field Studies, Fall and Spring Terms

ED 360 **The Modern Teacher**

This course is designed to acquaint students with current school reform issues while exposing students to the large number of digital resources, websites, strategies, software and hardware that will help them in their classroom today. Students will be able to analyze and evaluate the school reform movement from a historical perspective, differentiate instruction within their class using digital means and modern pedagogy, work cooperatively to teach their classmates about school reform and technology, and design a school reform proposal using digital means. Credits: (3), Graded, Semester Calendar Lecture, Spring Terms

Electrical & Computer Engineering**EE 1,3,5...** **Electrical and Computer Engineering Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. Credits: (2-4), Graded, Semester Calendar Lecture, Transfer Credit Only

EE 2,4,6... **Electrical and Computer Engineering Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. Credits: (2-4), Graded, Semester Calendar Lecture, Transfer Credit Only

EE 211 **ECE Laboratory I**

An introductory course that presents the fundamentals of electrical instrumentation while developing laboratory skills. Experiments explore basic electrical properties of analog and digital circuits. The development of sound techniques for circuit construction and troubleshooting are emphasized, as is the role of the computer in a laboratory environment. Use of CAD/CAE tools such as Pspice and LabView is integrated into the course. Lab safety and the

documentation and reporting of laboratory results are covered.

Corequisites: EE221 and EE264.

Credits: (3), Graded, Semester Calendar

Laboratory, Lecture, Spring Semesters

Comm Points: 1

EE 221 **Linear Circuits**

Steady state response of linear circuits to both sinusoidal and periodic inputs. AC steady-state power. Magnetically coupled circuits. Network functions, transfer functions, gain and phase shift. Bode plots. Fourier series. Laplace transform. The relationship between the time and frequency domain solutions. Prerequisites: ES250.

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

EE 260 **Embedded Systems**

An introductory course covering the fundamentals of microcontroller hardware and software. Topics include microcontroller systems, input/output (I/O) standards and data communication protocols, interfacing with memory systems and sensors, data collection, display, and control of peripheral modules and actuators. The microcontroller will be programmed in the C programming language. Interfacing assembly language to high level language code will be treated as well. A comprehensive term project will allow student teams to apply the theoretical concepts for solving a practical problem using a microcontroller and peripheral devices. Prerequisite: CS141

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

EE 261 **Introduction to Programming and Software Design**

A first course in programming and software design. Assumes no prior programming experience. The focus is upon the design of well-structured programs using problems selected from engineering applications. Topics include: fundamentals of software engineering design; elements of modern C-family programming language (such as Java, C, or C++); object oriented programming; the specification, design and implementation of numerical algorithms.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Fall Semesters

EE 262 **Intro to Object-Oriented Programming and Software Design**

A thorough introduction to Object Oriented Programming, including classes, inheritance and subtyping, overloading, and overriding. Dynamic memory management. Debugging. Introduction to Testing Driven Development. Introduction to fundamental data structures. Prerequisite: CS141

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

EE 264 **Introduction to Digital Design**

An introductory course covering the fundamentals of computer system hardware. Topics include data representation using number systems and codes, Boolean algebra and logic, digital logic devices, combinational and sequential circuits, arithmetic logic units and simple processor organization including registers, memory, addressing and processing of machine instructions.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

Comm Points: 1

EE 291 **Special Project in Electrical and Computer Engineering**

Students are involved, individually or working in groups on a special project under the direction of a faculty member. Topics are ordinarily suggested by the faculty member. These projects are limited in scope, ordinarily not requiring a degree of expertise beyond the sophomore year. Not to be used as a professional elective in the Electrical Engineering program or in the Computer Engineering program.

Prerequisites: consent of the department chair.

Credits: (1-3), Graded, Semester Calendar

Independent Study, Every Semester

EE 301 **ECE Area Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy an Area Elective.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

EE 311 **Electrical Engineering Laboratory II**

This laboratory course provides students with a series of experiments based on material in required sophomore and junior level courses. The experiments are designed to emphasize model identification, validation, and use. The course includes one or more design projects which include team oriented design, development, testing, and documentation components.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Fall Semesters

Comm Points: 1

EE 316 **Computer Engineering Junior Laboratory**

A design laboratory in computer engineering emphasizing the fundamentals of designing and testing computer system components. Sub-system level digital circuits are designed, constructed, and tested using standard small- and medium-scale integrated circuits and programmable logic devices. Software components which interface with hardware and operating systems are also designed, written and tested. All design projects employ a team based approach. Prerequisites: EE211 or experience with electronics, EE363 and EE365.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Spring Semesters

EE 321 **Systems and Signal Processing**

Characterization, classification and representation of signals and systems. Convolution. Fourier transforms. Discrete time systems and z transforms. Sampling theorem. Stability.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

Comm Points: 1

EE 324 **Dynamical Systems**

[Cross-listed with AE 324, ME 324] Dynamic systems classification, mathematical modeling of mechanical, electrical and mixed dynamic systems, state space representation, equilibrium points and linearization, solution of linear input/output and state equations, Laplace transforms, transfer functions and block diagrams, first and second order systems, stability, frequency response and simulation techniques. Prerequisites: MA232.

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

EE 331 **Energy Conversion**

Properties of magnetic materials. Magnetic circuits and transformers. Fundamentals of rotating magnetic-field machines. Synchronous machines. Induction machines. Phasor diagrams and equivalent circuits of transformers, induction machines and transformers. DC machines. Prerequisite: ES250.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EE 333 **Power System Engineering**

Transmission line and transformer models. Per unit. Power transfer equations and their solution and interpretation. Maximum power transfer. Symmetrical components and fault current calculation. Computer analysis methods for power systems. Prerequisites: EE221.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

EE 341 **Microelectronics**

Theory of semiconductor materials, p-n junctions, bipolar and field effect transistors. Analysis of device characteristics, device modeling and equivalent-circuits. PSpice simulation of electronic circuits. Applications including study of biasing, low frequency amplifiers, switching circuits and digital logic operations. Prerequisites: ES250.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EE 360 **Microprocessors**

An introductory course covering the fundamentals of microcomputer hardware and software. Topics include microprocessor system hardware, assembly language programming, input/output devices and bus discipline. Memory systems, serial interfacing, and interfacing assembly language to high level language code will be treated as well. Prerequisite: EE264.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

EE 361 **Fundamentals of Software Engineering**

This is a foundation course in the design of computer software. It covers fundamental techniques and methodologies for software design and implementation. Topics include the software engineering life cycle, object-oriented design, data and procedural abstraction, recursion, iteration, file I/O, and elementary data structures. Prerequisite: EE262 Introduction to Object Oriented Programming and Software Design

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

EE 363 **Software Components and Generic Programming**

This course is concerned with software design principles that foster creation of reusable software components. Topics include abstract data types, behavioral inheritance and subtyping, generics, interface design, dependency injection, and analysis of algorithmic behavior. Students will gain experience with software development best practices including design of test scenarios, unit testing, code reviews, refactoring and version control in the context of a modern integrated development environment. Prerequisites: EE262 Introduction to Object Oriented Programming & Software Design

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

EE 365 **Advanced Digital Circuit Design**

An advanced course in digital circuit design. This course begins with an overview of electrical characteristics of logic gates, various standards for I/O buses and communication interfaces. Topics include hierarchical and modular design of digital logic circuits, simulation and synthesis of digital systems on programmable logic devices using computer-aided design software, and debug and verification of design using embedded and standalone logic analyzers. Prerequisites: EE264 or equivalent.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

Comm Points: 1

EE 368 **Software Engineering**

Study of the principles and practices of software engineering. Topics include software quality concepts, process models, software requirements analysis, design methodologies, software testing, and software maintenance. Hands-on experience building a software system using the waterfall life cycle model and CASE tools. Students working in teams develop all life cycle deliverables: requirements document, specification and design documents, system codes, and user manuals. Prerequisites: CS344 or EE363 and CS242 or EE408.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

EE 381 **Electromagnetic Fields and Waves**

Review of electrostatics and the steady magnetic field. Stokes' theorem and the divergence theorem. Time varying fields and Maxwell's equations. Uniform plane wave propagation; reflection and refraction of plane waves. Transmission lines. Introduction to radiation theory. Prerequisites: MA231 and PH132.

Credits: (3), Graded, Semester Calendar

Lecture, Spring and Summer Semesters

EE 401 **Digital Signal Processing**

An introduction to discrete-time signal processing. Topics include: A review of orthogonality, Fourier series, Fourier transforms and sampling theory. Smoothing, interpolation, D/A conversion. Digital filters, windows. Design of nonrecursive filters, recursive filters. Correlation and spectra of random signals, spectral estimation. Prerequisites: EE321.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

EE 407 **Computer Networks**

[Cross-listed with CS 455] This course covers layered networking protocols with an emphasis on common Internet protocols such as TCP, IP, HTTP, and SMTP. It also covers local area networking, focusing on link layer standards such as the IEEE standards for Ethernet and wireless. Additional topics such as security and congestion control will also be covered. EE407 and CS455 are offered each fall as one course with multiple listings. Prerequisites: One of course in computer architecture (EE264, CS241 or IT502 or equivalent). One course in computer programming (EE261, CS141 or equivalent.) Note: IT501 also satisfies the programming requirement.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Fall Semesters

EE 408 **Software Design For Visual Environments**

This course is an introduction to object-oriented, event-driven windowing environments. The primary focus will be interface design

and development, with an emphasis placed on the event-driven paradigm. Topics will include: a thorough investigation of the underlying windowing framework selected, an examination of static and dynamic control objects used for system input and output, virtual functions, multithread programming, code synchronization and locking, and resource sharing. Several programming projects will be assigned throughout the semester. Prerequisite: EE262.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

EE 410 Computer and Network Security

[Cross-listed with CS 457] Attacks on networked computer systems are an increasingly important problem. This course covers the types of vulnerabilities that are present in modern computer systems and the types of malicious software that exploit these vulnerabilities. It also covers best practices for preventing, detecting and responding to such attacks including anti-virus software, defensive programming techniques, intrusion detection systems, honeypots and firewalls. Prerequisites: A general course in computer networking such as CS455/555 or EE407/507. Programming experience to the level of CS142 or EE361.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EE 412 Senior Design

A series of one or more design projects. Projects typically involve planning, analysis, preliminary design, simulation, construction, testing and evaluation, documentation, class demonstrations and oral presentations. The thrust of this course is to provide the student with an opportunity to develop a complete solution to one or more design problems and to develop broad engineering skills, including communication skills. Prerequisite: EE311.

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Every Semester
(TECH)
Comm Points: 1

EE 416 Computer Engineering Senior Laboratory

In conjunction with EE464, students develop specifications for design, build, test, debug and document a complete digital system based on an embedded microcomputer and supporting integrated circuits. Prerequisite: EE316 and EE360, Corequisite: EE464 and EE466

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Fall Semesters
(TECH)
Comm Points: 1

EE 418 Software Engineering Senior Design

Working in a team environment, students will design and develop a complex software system. Using sound software engineering techniques, the students will take a conceptual idea for a software system and turn it into a well-engineered product. Prerequisites:

EE368 and EE462.

Corequisite: EE408.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters
(TECH)
Comm Points: 2

EE 422 Signal Processing and Applications

This project-driven course involves qualitative and quantitative descriptions of DSP algorithms, software and applications. The class covers applications in engineering, computing, music, and the arts, with MATLAB, Java and mobile simulations. Prerequisites: MA132 or equivalent, or instructor approval.

Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Terms

EE 423 Introduction to Biometrics

Biometrics is the automated recognition of an individual based on their physiological or behavioral characteristics. This course is an introduction of fingerprint, face, voice, and iris recognition, as well as related aspects of system design, security, privacy, performance evaluation, and novel biometric modalities.

Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Spring Semesters

EE 430 High-Voltage Techniques and Measurements

Generation of high-voltage AC, DC and impulse. High-voltage dielectric loss measurements. Discharge measurements. High-voltage insulation problems.

Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Semesters

EE 431 Power Transmission and Distribution

Unbalanced fault current calculation, current and voltage transformer characteristics. Distribution system protection, transmission line protection. Generator, bus and transformer protection. Power system controls. Transient stability. Prerequisite: EE331

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

EE 438 Alternate Energy Systems

[Cross-listed with ES 438] The basic technology of emerging renewable or non-carbon based energy sources will be considered, and contrasted with traditional sources of energy. Topics will include photovoltaic, wind and others. The impacts of energy storage and electrified transportation will be discussed. The capability of these technologies will be assessed, and barriers to implementation will be explored. The role of the electric power grid in enabling alternate energy technologies will be covered. Prerequisite: ES250 or permission of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Semesters

EE 439 Dielectrics

Dielectric properties of materials and polarization models. Complex permittivity and relaxation spectra. Electric breakdown in gases, liquids and solids.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Semesters

EE 441 Electronic Devices for IC Simulation

Study of modern electronic devices, p-n junctions, bipolar junction transistors (BJTs) and metal-oxide-semiconductor field-effect transistors (MOSFETs), for integrated circuit applications. SPICE device models are introduced, and several SPICE simulation projects are given for integrated circuit design and analysis. This course provides a foundation for understanding SPICE device models and the

basics of the microelectronic technology. Prerequisites: ES260 and EE341.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

EE 442 **CMOS IC Design**

An introduction to CMOS integrated circuit design and simulation. Students will learn CMOS device models and study design, simulation and layout of digital CMOS integrated circuit blocks. Prerequisites: EE264 and EE341.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EE 443 **Semiconductor Material and Devices for Engineers**

[Cross-listed with EE544] Fundamentals of quantum mechanics, energy band concept in crystalline materials, band structure modeling, band structure modification, semiconductor device physics, carrier recombination processes, carrier transport phenomena, lattice vibrations, advanced concepts in quantum device technology.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

EE 450 **Control Systems**

[Cross-listed with ME 450] Introduction to the analysis and design of continuous-time feedback control systems. Topics include: mathematical representation of physical systems with linear differential equations, Laplace transforms, transfer functions, block diagrams and signal flow graphs, feedback, sensitivity, transient specifications, steady-state tracking errors, stability, root locus plots, compensator design, simulation. Prerequisites: AE/EE/ME324 or Corequisite: EE321.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

EE 451 **Digital Control**

Introduction to the analysis and design of discrete-time feedback control systems. Topics include: mathematical representation of physical systems with linear difference equations, z-transforms, transfer functions, sampling, A/D and D/A converters, sampled-data systems, discrete equivalent systems, transient specifications, steady-state tracking errors, stability, controller design, quantization effects. Prerequisites: EE321.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

EE 452 **Optimization Techniques in Engineering**

Introduction to optimization techniques in engineering. Topics include: engineering applications of optimization, types of optimization problems, linear programming and the simplex method, one-dimensional optimization, unconstrained nonlinear programming, nonlinear programming with equality and inequality constraints, advanced optimization techniques, practical aspects of optimization. Prerequisites: MA339 or equivalent or consent of instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

EE 455 **Robotics I**

[Cross-Listed EE555] The course presents an introduction to the fundamentals of mobile robotic systems including common

mechanical configurations with sensors and actuators, as well as the typical sensory, perceptual, and cognitive layers that comprise the field of study. Topics explored will include: Mobile Robot Locomotion (e.g., Legged, Wheeled, and Aerial), Mobile Robot Kinematics (e.g., Models and Constraints, Maneuverability, Workspace Analysis, and Motion Control), Mobile Robot Perception (e.g., Exploration of Sensors, Fundamentals of Computer Vision, Fundamentals of Image Processing, Feature Extraction, and Place Recognition), Mobile Robot Localization (e.g., Noise and Aliasing, Localization-Based Navigation, Map Representations, Probabilistic Map-Based Localization and Autonomous Map Building), and Planning and Navigation (Path Planning, Obstacle Avoidance, and Navigation Architectures). Throughout the course, students will work in teams with a supplied robotics kit of parts to design and implement a mobile robot system that demonstrates various aspects of the course applied to a real-world problem. Prerequisites: EE321, EE/ME324, or MA339; or instructor permission

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

EE 456 **Robotics II**

The course presents an introduction to the fundamentals of industrial robotics. Topics explored will include: Robotic manipulation, direct kinematics, inverse kinematics, workspace analysis and trajectory planning, differential motion and statics, manipulator dynamics, robot control, robot vision and task planning. Throughout the course, students will work in teams with a supplied robotics kit of parts and appropriate software tools to design and implement a robot manipulator that demonstrates various aspects of the course applied to a real-world problem.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

EE 462 **Software System Architecture**

A study of system software components in the context of a modern operating system such as UNIX, together with the necessary tools and utilities for software development. Topics will include software development tools, operating system interfaces and utilities, and network access methods. Emphasis will be placed on conceptual understanding and practical use of system software components rather than on detailed implementation. Prerequisites: EE261 or CS141 or equivalent programming experience in C.

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Spring Semesters

EE 464 **Digital Systems Design**

A study of embedded microcomputer system design. Topics include CPU architecture, memory organization, interrupts, real-time operation, and interfacing with a wide range of external devices. Practical problems in digital design, testability, hardware and software trade-off analysis are covered. In addition to the technical topics, students develop teamwork skills, learn project management, system specification and documentation. Each student does both significant written documentation and oral presentations of his or her work. This course and the senior lab (EE 416) together provide both the conceptual knowledge and practical skills necessary to design application-oriented digital systems. Prerequisites: EE316 and EE360
Corequisites: EE466 and EE416

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters
Comm Points: 1

EE 465 Computer Graphics

[Cross-listed with CS 452] An introduction to computer graphics. Graphics hardware, algorithms for generating and displaying two and three-dimensional geometric figures, animation, interactive displays. Programming projects using OpenGL will be assigned.

Prerequisites: Programming experience in C/C++ family language, basic concepts in linear algebra and matrices. Prerequisites: CS142 or EE361, and MA232 or MA239 (or MA339 as a corequisite)

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

EE 466 Computer Architecture

A study of modern processor system architecture including set design and performance enhancement of computer systems will be discussed. Topics include pipelining, cache organization, memory management, and multiprocessors. Tradeoffs in system design and the impact of hardware/software interactions will be discussed. Prerequisite: EE264.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EE 468 Database Systems

[Cross-listed with CS 460] An introduction to database systems. The entity-relationship and relational models are presented and applied to the design of typical databases. New developments in object-oriented and multimedia databases are presented. Emphasis will be placed on database design for applications in the context of an existing database management system such as ORACLE or ACCESS. Prerequisites: Programming experience in a high-level language

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

EE 469 High Performance Computing

Principles and practices of high-performance computing (HPC) programming, associated computer architectures, and techniques for computing performance optimization. Topics include concepts of parallel and distributed computing, multicore CPU architecture, POSIX threads programming, OpenMP (Open Multi-Processing), GPGPU (General purpose GPU) architecture, NVIDIA CUDA programming, computer cluster management system, MPI (Message Passing Interface) programming, and case studies regarding large-scale engineering applications through HPC and computing performance improvement. Hands-on assignments utilizing Linux based open source tools and compilers will be assigned. Students must have basic C/C++ programming skills to enroll. Suitable for junior and senior undergraduate and graduate students in all engineering and computer science majors. Prerequisites: EE262 or CS142, or consent of instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

EE 470 Coding and Info Transmission

Error detecting and error correcting codes. Encoding of signals and data compression. Huffman codes. Concepts of information. Limits on attainable data compression. Limits on data rates for reliable or errorless transmission. Corequisite: MA/STAT381 or MA/STAT383 (MA/STAT381 is preferred.)

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EE 471 Principles of Digital and Data Communications

Amplitude modulation, double and single sideband, quadrature AM. Frequency and phase modulation. Stationary and ergodic random processes, correlation and spectral density. Noise models, filtering of random signals. Data transmission, frequency and phase shift keying, pulse amplitude modulation, pulse shaping, partial response signaling, channel equalization. Threshold decision receivers. Pulse code modulation, quantization, digital transmission lines. Prerequisites: EE321 and MA/STAT381 or MA/STAT383 (MA/STAT381 is preferred.)

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

EE 485 Neural Engineering

[Cross-listed with BY 485, ES 485, EE 585] This course applies engineering principles to the study of neuroscience and to the design of devices or techniques intended to replace missing or augment existing functions such as seeing, hearing, speaking, and walking. The course provides a detailed overview of sensorimotor systems, neurophysiology, neuroanatomy, neuropathology and clinical neurology. The class sequences through the various sensory and movement systems, providing a quantitative basis for how the nervous systems works for these systems, for how it dysfunctions, for the disability produced, and finally for how function can be restored by neuroprostheses. Students will prepare and present a paper on a neural engineering topic. Prerequisites: MA132 and PH132 or PH142.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EE 491 Directed Study in Electrical and Computer Engineering

Investigation of a special topic in consultation with a designated faculty member.

Credits: (1-3), Graded, Semester Calendar

Independent Study, Every Semester

Environmental Health Science**EHS 1,3,5... Industrial Hygiene Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Lecture, Transfer Credit Only

EHS 2,4,6... Industrial Hygiene Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Science Foundation Curriculum Requirement.

Credits: (2-4), Graded, Semester Calendar

Lecture, Transfer Credit Only

EHS 309 Industrial Hygiene

This course will focus on the basic areas of responsibility of the industrial hygienist including recognition, evaluation and control of workplace hazards. Additional topics will include environmental, health and safety regulations and a survey of the health effects of typical workplace stressors such as toxic and hazardous chemicals, noise, and temperature extremes.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EHS 310 Introduction to Industrial Hygiene Laboratory

This is a lab course that meets for three hours a week. The course consists of weekly labs. Students must prepare lab reports on a weekly basis. These lab reports are evaluated for consistency, accuracy, presentation and overall quality. The course ends with students individually presenting scenarios that encompass knowledge gained over the length of the course. Students are expected to communicate knowledge of both environmental health and public health. In addition, each student must prepare a final report to accompany their presentation. The written material will be critiqued by the instructor and feedback will be provided to each student. A portion of the labs will be dedicated to instruction on writing and presentation skills. Prerequisites: Students majoring or minoring in BY, EHS, ES&P, or CM or consent of the instructor.

Credits: (2), Graded, Semester Calendar

Laboratory, Spring Semesters

Comm Points: 1

EHS 330 Safety Analysis - Environment, Health, and Safety Assess

This course will provide students with an overview of the contemporary Environmental, Health and Safety (EHS) management techniques for occupational settings. The EHS management systems of today have evolved over many years. The Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency are the primary regulatory organizations in the United States. However, compliance is the minimum standard of care. Cost effective systems to minimize risk among the community and workers and ensure compliance with state and federal regulation must include a comprehensive and integrated Environment, Health, and Safety Management System (EHS-MS) that is sustainable for the long term within manufacturing and service organizations. Safety analysis can be practically applied to environmental, health and safety risks. The course will introduce techniques used to assess the risk of injury including job safety analysis, fault tree analysis, hazard and operability studies, systems safety and design for safety. In addition, this course will provide the students with the fundamental elements of environmental, health, and safety responsibilities and integrated EHS management systems. The course will be a combination of lectures, case studies and projects.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EHS 405 Methods and Analysis

IH405, Methods and Analysis, is a combined lecture/laboratory course. Students complete nine full laboratory assignments requiring complete reports (~10 pages) to be turned in weekly or bi-weekly.

Students are provided feedback on content and writing mechanics (technical reporting) and are offered (sometimes requested) the opportunity to resubmit. Prerequisites: EHS 309 and open to students majoring in EHS, ES&P and Chemistry only. Two years of college chemistry is recommended.

Credits: (4), Graded, Semester Calendar

Lecture, Laboratory, Fall Semesters

Comm Points: 1

EHS 406 Industrial Hygiene Control Methods

Various ways to prevent and solve common industrial hygiene problems will be considered; topics will include typical engineering controls, administrative controls and personal protection to control chemistry exposure and releases. In addition controls for temperature extremes, noise and vibration exposure, and ergonomic

stressors will be studied. About two-thirds of the course is devoted to industrial exhaust ventilation design. (2 credits of design, for Civil and Environmental Engineering Majors) Prerequisite: EHS309 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

EHS 416 Principles of Toxicology and Epidemiology

[Cross-listed with BY 416] This is an introductory course in toxicology and epidemiology. Toxicology is the study of the harmful interactions, including absorption, distribution, metabolism and disease effects, of chemical, biological and physical agents with biological systems, when administered by accident or design. Epidemiology is the study of the distribution and determinants of disease frequency in populations exposed to these toxicants and stressors. The first two thirds of this course will focus on the toxicological interaction and effects of environmentally and occupationally derived toxicants with the human body. The last third of the course will focus on the epidemiological tools to evaluate the risk of exposure to such toxins, and will examine, in detail, several important historical and recent case studies of toxic exposures to individuals and populations in the home, the outdoor environment, and the work place. Toxicology and Epidemiology are important sciences that provide a sound basis for developing measures to reduce the risk of human exposure to toxic chemicals and agents. Prerequisites: EHS 309 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

EHS 481 Adv Topics in Environmental and Occupational Health

This course is a project based course that requires students to work on a broad array of topics in environmental health. Students will have multiple projects (6-8) running simultaneously and each will require writing assignments and presentations. Literature and text reviews will be necessary for most of the projects. Group communication skills are also developed as some projects are done in groups. Course work and lab preparation call for combining both lab work and lecture material in a cohesive and accessible format. The course also involves consistent review of student work by the instructor, in the form of both written and oral feedback. IH481 also requires for a minimum of three oral presentations by individuals. Prerequisite: senior standing in the Industrial Hygiene program or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

Comm Points: 1

EHS 490 Internship/Co-op

Students who obtain a (summer) internship/co-op position may obtain credit for the work experience by registering for this course the semester following the position. Students will be required to keep a daily journal of work activities and submit the journal entries to the EHS Program Director every two weeks. During the semester following the internship/co-op, a 10-page report on some aspect of their work experience and a 30 minute presentation will be required. Prerequisite: Open to EHS or ES&P major or minor only, or by consent of the program director

Credits: (0-3), Graded, Semester Calendar

Independent Study, Every Semester

EHS 494 Directed Research for Undergraduates

A research project will be completed; research projects may include laboratory projects or individual study of industrial hygiene topics not available in other industrial hygiene courses. Prerequisite: Open to EHS or ES&P major or minor only, or by consent of the program director

Credits: (1-3), Graded, Semester Calendar
Research, Every Term

EHS 495 Directed Research for Undergraduates

A research project will be completed; research projects may include laboratory projects or individual study of industrial hygiene topics not available in other industrial hygiene courses. Prerequisite: Open to EHS or ES&P major or minor only, or by consent of the program director

Credits: (1-3), Graded, Semester Calendar
Research, Every Term

EHS 497 Directed Study

A research project will be completed; research projects may include laboratory projects or individual study of industrial hygiene topics not available in other industrial hygiene courses. Prerequisite: Open to EHS or ES&P major or minor only, or by consent of the program director

Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

Engineering & Management**EM 1,3,5... Engineering and Management Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

EM 2,4,6... Engineering & Management

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used as a Professional Elective.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

EM 120 Team-based Design and Innovation

The first in a two-course sequence, this course is required for all first-year students in the Engineering & Management Program. Students will undertake a yearlong project to design, produce, and potentially commercialize a product. Projects will require the application of both engineering and management tools and principles. The primary focus of the fall semester is to build functional teams, introduce design tools and complete a conceptual design of the product. Open only to E&M, University Studies, Engineering Studies, and Science Studies first-year students unless approved by E&M Director.

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Fall Semesters
Comm Points: 1

EM 121 Technological Entrepreneurship

The second in a two-course sequence, this course is required for all first-year students in the Engineering & Management Program. Students will undertake a yearlong project to design, produce, and potentially commercialize a product. The primary focus of the spring

semester is to build a business plan from the fall semester conceptual design. Open only to E&M, University Studies, Engineering Studies, and Science Studies first-year students unless approved by E&M Director. Prerequisite: EM120.

Credits: (2), Graded, Semester Calendar
Laboratory, Lecture, Spring Semesters
(TECH)
Comm Points: 1

EM 190 Independent Study

An investigation of an interdisciplinary socio-technical problem undertaken by an upperclass student under the guidance of a faculty member.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

EM 205 Introduction to Financial and Managerial Accounting

[Cross-listed with AC 205] An introductory survey of accounting information to guide and improve decision making. Many course topics involve cost planning and control techniques used to evaluate and improve the financial performance of organizations and/or products. Prerequisites: Restricted to E&M majors only

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

EM 211 Intro to Enterprise Information Systems

[Cross-listed with IS 211] This course will introduce students to enterprise information systems, their components, integration, and use as part of the business process. The distributed, accurate, real time flow of information is a critical success factor for most organizations. The ability of an organization to collect and analyze this information is crucial in today's data-driven economy. The focus of this course is on the functional and strategic use of enterprise resource planning (ERP) software, its application, input devices, implementation issues and use. Hands-on experience with SAP ERP is integral to this course. Offered fall and spring semesters. Prerequisites: students may not receive credit for IS200 as well as EM211 and restricted to E&M majors.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
(TECH)

EM 286 Organizational Behavior I

[Cross-listed with OS 286, PY 286] (May be used to satisfy a CUSB MBA or MS foundation requirement.) An introduction to the processes required to manage contemporary organizations with a focus on individual behaviors as they relate to the functions of planning, organizing, controlling, and leading. The most recent concepts of behavioral science in the practice of management are presented to assist the student in gaining understanding of the pervasiveness of the discipline in all types of organizations and processes. Topics include motivation, leadership, perceptions, personality theory, learning theory, personnel issues, stress management, organizational culture, and decision making. Prerequisites: sophomore standing and restricted to E&M majors.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
IG

EM 310 E&M Professional Experience

Project-based professional experience in engineering & management, related to student career interests and/or field of study. Fulfills Clarkson Common Experience Professional Experience requirement for E&M students. Course registration requires E&M approval of application. Completion of course requires approval of E&M Director. Credits: (0), P/NC, Semester Calendar
Independent Study, Every Semester

EM 314 Database Design & Management

[Cross-listed with IS 314] This course provides the student with in-depth knowledge of database analysis, design, and implementation principles. Students who successfully complete this course will be able to use the entity-relationship data model to represent business data requirements, to translate that model into a relational schema, to normalize this schema and to build and use a relational database that implements the schema, using the Standard Query Language (SQL). Prerequisite: Restricted to E&M students
Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

EM 331 Operations & Supply Chain Management

[Cross-listed with OM 331] (May be used to satisfy a CUSB MBA and MS foundation requirement.) An introduction to the planning, analysis and control of production systems. Topics include product and service design, manufacturing processes, aggregate production planning, inventory models and MRP, just-in-time systems, facility layout, forecasting/demand planning, project management, and quality management. Students acquire problem solving experience using ERP software. Prerequisites: STAT 282 or STAT 383 or MA 330, and at least sophomore standing
Corequisite: IS 211 (CUSB majors) or IS 200 (non-CUSB majors)
Credits: (3), Graded, Semester Calendar
Lecture, Every Term

EM 333 Elements of Operations Research

Application of optimization models to typical engineering and management situations and problems. Topics include: optimization theory (linear programming, transportation and assignment models), decision analysis under uncertainty, queuing theory and Monte Carlo simulation. Prerequisites: STAT383 and at least junior standing, and restricted to E&M majors only.
Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

EM 341 Supply Chain Design & Management

[Cross-listed with OM 341] Fierce competition in today's global markets has forced business enterprises to focus on reducing costs while meeting rising customer expectations by designing and managing effective and sustainable supply chains. This course focuses on a systems approach to review state-of-the-art models and practical tools for inventory and materials management, design for supply chain, as well as supply chain integration. Topics covered include managing inventories in the supply chain, the bullwhip effect, risk pooling, delayed differentiation, measuring the financial performance of supply chains, the value of information and the role of information technology in the supply chain, coordination and collaboration with channel partners, supply chain related strategic alliances, and outsourcing/off-shoring/reshoring trends. Several team projects and hand-on experiences are utilized to demonstrate real

world issues and applications. Prerequisites: EM331 and restricted to E&M majors.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

EM 356 Invention Development and Protection

[Cross-listed with SB356] In this course, students learn how to develop inventions and protect them. Students will work in small teams to develop and describe their inventions in a form suitable for filing provisional patent applications with the U.S. Patent and Trademark Office. Aspects of intellectual property laws in the US and other countries will be covered to guide the student inventing process. Open only to E&M students. Requirements: E&M major and Junior standing
Credits: (3), Graded, Semester Calendar
Lecture, Every Term

EM 361 Supply Chain Environmental Management

[Cross-listed with SB 361] This course aims to gain a greater understanding of supply chain environmental management by examining: (i) the advantages and business risks of adopting and implementing environmental practices and technologies in the supply chain, (ii) the role of suppliers and customers to facilitate the adoption/ implementation of environmental practices and technologies, and (iii) the implications of such supply chain activities on an organization's operations strategy. This course consists of a mix of lectures and class discussion. Prerequisite: EM331 and restricted to E&M majors.
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

EM 371 Strategic Sourcing

This course provides an in-depth analysis of the procurement process and supplier management, with strong emphasis on managing a supplier base for both products and services. Topics covered include the strategic role of sourcing in supply chains, the identification and evaluation of requirements, the strategic make versus buy decision, supplier selection, development and evaluation processes, the supplier coordination and control mechanisms, the relationship between product design and the supplier base and the impact of information technology on strategic sourcing. Both theoretical and quantitative perspectives will be offered. In addition, the topics will be addressed from strategic, financial, sustainability and global perspectives. Students will also develop practical skills in using quantitative tools to select and evaluate suppliers. Prerequisites: OM/EM331 and at least junior standing
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

EM 380 Project Management

[Cross-listed with OM 380] This course will introduce students to all phases of project management from project initiation to termination. Topics covered include project selection, organization, contracts, planning and scheduling (PERT and CPM), estimating, budgeting and cost control, procurement, resource allocation, variance analysis, auditing and termination procedures. Project management software, case studies, and student team projects will be an integral part of the course. Requisites: Enrollment is limited to students in E&M, or consent of instructor.
Corequisites: STAT 383

Credits: (3), Graded, Semester Calendar
Lecture, Every Term
EC

EM 381 **Logistics Management**

[Cross-Listed SB381] Logistics involves planning, implementation and control of the forward and reverse flow and storage of goods, services, and information in the supply chain in order to effectively meet customer demand. Primary topics covered include management and location of facilities, management of channel networks, warehousing, transportation, management and design of integrated logistics networks, distribution strategies, third-party logistics, international logistics, and vehicle routing. In addition to lectures, case studies, numerical assignments and simulation of logistics systems may be utilized. Prerequisites: MK 320 and OM/EM 331

Credits: (3), Graded, Semester Calendar
Lecture

EM 415 **Data Warehousing for Analytics**

[Cross-listed with IS 415] This course covers the fundamental concepts, design, management and application of data warehouses and business/enterprise intelligence systems. Specific topics covered include the logical design of a data warehouse, the data staging area and extraction-transformation-loading process, the design, implementation and utilization of multi-dimensional data analysis systems, as well as key business/enterprise intelligence concepts, processes and techniques including knowledge discovery and exploratory analysis. Offered Fall semesters. Prerequisite: EM314 or CS460/EE468 and Restricted to E&M students.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

EM 432 **Organizational Policy and Strategy**

[Cross-listed with OS 432] A capstone course designed to integrate the functional areas and tools of management studied in previous courses within a strategic planning framework giving due attention to ethical and social responsibility concerns and international business issues. Emphasis is placed on the business environment in a global economy, industry analysis, tactical planning, overall strategic planning, policy establishment and implementation. Case analysis, in the small group setting, is utilized, enabling students to share their expertise and explore their value structure. Students present results via written and oral reports. Prerequisites: FN361, EM331, EM286, MK320, senior standing, and restricted to E&M majors.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
Comm Points: 2

EM 441 **Advanced Topics in Global Supply Chain Management**

[Cross-listed with SB 441] This course introduces several emerging topics in supply chain management, including: demand management, revenue management, risk management, supply chain agility and flexibility, supply chain disruption management, and supply chain contracts. This course also provides students with the opportunity to gain experience dealing with complex supply chain issues by utilizing a simulation game. The simulation deals with both strategic and tactical aspects of managing the supply chain. Prerequisite: EM341 and restricted to E&M majors.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EM 451 **Quality Management & Lean Enterprise**

[Cross-listed with OM 451] This course will introduce the students to both the managerial and technical aspects of quality improvement. The course emphasizes statistical applications to quality related topics such as process/product design, process capability, quality control, design of experiment, and inspections/sampling. Other topics of interest include: Juran quality trilogy, six-sigma project methodology, and cost of quality. The course consists of a series of lecture and problems solved in class. Prerequisites: STAT 383 and restricted to E&M majors.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

EM 456 **Process Engineering and Design**

This course is a capstone design experience for students who have completed a foundation engineering science education. Primarily designed for the Engineering & Management (E&M) program, this course involves solution of a real world technical problem. Requires both written reports and oral presentations. Senior Standing in E&M or iE&M.

Prerequisites: ES220, and two of ES250, ES330, or ES340.
Pre- or Co-requisite: EM331, EM333, and EM380.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
(TECH)
Comm Points: 1

EM 476 **Management of Technology**

[Cross-listed with OM 476] Management of technology links together the engineering, science, and management disciplines to plan, develop, and implement technological capabilities to be competitive in the global arena. Students taking the course will gain an understanding of the following topics: innovation, product life cycles, product development process, concurrent engineering, management of technology strategy, selecting technical projects, management of the R&D process, initiating new ventures, international technology transfer, and the management of complex projects. Prerequisites: EM331 and restricted to E&M majors.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
STS

EM 482 **Systems Engineering and Management**

Systems Engineering (SE) is an iterative process of top-down synthesis, development, and operation of real-world systems that combines technical leadership and systems management. Technical leadership is necessary for incorporating and balancing the contributions of structural, mechanical, electrical, software, systems safety, and power engineers, among others, to produce a coherent whole. Through the interdisciplinary approach of SE, systems management is focused on effectively and efficiently managing the development and operation of complex systems that result from integrating physical, smart, software, and connectivity components. Students taking this course will gain an understanding of how to create a design that considers both the business and technical needs of all customers with the goal of providing a quality product that meets customers' needs and maintain its integrity throughout its life cycle. Topics include but are not limited to fundamental concepts of systems theory and systems thinking used for SE, life cycle process models, technical and management processes, end introduction to model-based systems engineering. In addition to lectures, case

studies, numerical assignments, and simulation may be utilized.
 Requisites: Junior or Senior standing in an engineering or EM major,
 or permission by the instructor
 Credits: (3), Graded, Semester Calendar
 Lecture, Every Term

EM 484 **Advanced Project Management**

[Cross listed with OM484] This course builds on the foundation of EM/OM380 (Project Management) by introducing advanced topics in decision making, risk, and cost control as well as providing comprehensive knowledge of project scheduling and other PM tools. This course also provides an opportunity for students to further extend their PM skills in managing and controlling projects by applying the PM methods in a project management simulation using typical project management software. Students are exposed to advanced research topics in the emerging PM areas. Prerequisite: EM/OM380
 Credits: (3), Graded, Semester Calendar
 Lecture, Every Term

EM 487 **Special Project in Engineering and Management**

An investigation of a problem or in-depth topic undertaken by the student under the guidance of a faculty member. Prerequisites: Permission of instructor
 Credits: (1-3), Graded, Semester Calendar
 Research, Given When Needed

EM 490 **Internship**

An investigation of a problem or in-depth topic undertaken by the student under the guidance of a faculty member. Prerequisite: Permission from the instructor.
 Credits: (1-3), Graded, Semester Calendar
 Independent Study, Given When Needed

EM 494 **Directed Research**

A research project will be completed; research projects may include laboratory projects, literature research, or individual study of interdisciplinary engineering and management topics not available in other Clarkson courses. Restriction: Open to Engineering and Management majors only
 Credits: (1-3), Graded, Semester Calendar
 Research, Given When Needed

Engineering Science

ES 1,3,5... **Engineering Science Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.
 Credits: (2-4), Graded, Semester Calendar
 Independent Study, Transfer Credit Only

ES 2,4,6... **Engineering Science Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used as a Professional Elective.
 Credits: (2-4), Graded, Semester Calendar
 Independent Study, Transfer Credit Only

ES 41 **Spatial Thinking Skills**

This course develops 3D spatial visualization skills through tutorials and exercises. Coverage includes (as time permits): surfaces and

solids of revolution, combining solid objects, isometric drawings and coded plans, orthographic drawings, orthographic projections and inclined and curved surfaces, flat patterns, rotation of objects about axes, object reflections and symmetry, and cutting planes and cross sections.

Credits: (1), Graded, Semester Calendar
 Lecture, Given When Needed

ES 100 **Introduction to Engineering Use of the Computer**

[Cross-listed with HP 103] Introduction to computer programming using equation solving software applied to engineering problems.
 Credits: (2), Graded, Semester Calendar
 Lecture, Laboratory, Spring Semesters

ES 110 **Engineering and Society**

Engineers apply scientific knowledge and principles, and use the engineering design process to develop technology. While engineers frequently develop solutions to problems in controlled environments, the products that are developed are used by 'real people' in the 'real world.' Thus, it is essential that engineers have an understanding of the interactions between engineering, technology development, and society. This course will highlight the diverse applications of engineering and technological skills in addition to ethical and other concerns about the societal consequences of technological developments. Students will gain an understanding of ways that conceptual models can be used to frame how both science and technology shape society and how society can shape science and technology. Students will be introduced to the engineering design process and use it to solve a simple engineering problem. Then, through case study, they will apply the societal models and gain an understanding of how the design process can be used to solve complex, open-ended, 'real-world' problems in the context of social, economic, and environmental considerations. Corequisites: MA 180 or equivalent. Open to all majors - engineering majors must be first year students to enroll.

Credits: (3), Graded, Semester Calendar
 Lecture, Every Semester
 STS(TECH)
 Comm Points: 1

ES 147 **First Year Research Experience**

The student conducts research under the guidance of a research advisor. Appropriate for paid or voluntary non-credit bearing research experiences. By permission of research advisor or academic advisor only. Pass/no credit only.
 Credits: (0), P/NC, Semester Calendar
 Research, Every Term

ES 220 **Statics**

Fundamental concepts of the statics of rigid bodies using a vector analysis approach; force systems, analysis of simple structures, centroids and centers of gravity, free body diagrams, equilibrium, friction and moments of inertia. Prerequisites: MA131 and PH131
 Credits: (3), Graded, Semester Calendar
 Lecture, Tutorial, Every Semester

ES 222 **Strength of Materials**

Elementary analysis of the strength and deformation of deformable bodies; stress and strain at a point, Mohr's circle, axial loads, flexure, torsion, deflections and column action. Introduction to design concepts. Prerequisites: ES220 or consent of instructor

Credits: (3), Graded, Semester Calendar
Lecture/Tutorial, Every Semester

ES 223 Rigid Body Dynamics

Introduction to the basic principles of Newtonian mechanics. Topics covered include kinematics of particles; Newton's laws of motion, energy and momentum methods; systems of particles; planar kinematics of rigid bodies; planar dynamics of rigid bodies; forces and acceleration energy and momentum methods. Special topics such as non-inertial reference frames may be introduced. Prerequisites: ES220 and MA232 (for CE students, MA232 is a co-requisite)

Credits: (3), Graded, Semester Calendar
Lecture, Spring and Summer Semesters

ES 238 Introduction to Energy Systems

The focus of this course is to introduce fundamental energy principles and discuss various energy resources and options currently available, including the supply and availability as well as the demand for these energy resources. Primary consideration is given to current strategies for energy production, conversion and use, with a brief overview of renewable technologies. The course topics are presented within a social, economic, political, and environmental context to provide a comprehensive understanding of the role of energy in our current and future society. Students examine the sustainability of our current and future systems of energy resource consumption, including U.S. and global energy consumption rates as well as societal and environmental impacts. Issues such as energy efficiency, conservation, systems analysis and life cycle analysis, and the environmental and economic consequences of various sources, will be discussed. Finally, implications and relationships between global climate change and growing global energy use in the 21st century will be examined.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
STS(TECH)

ES 241 Solid-State Material Systems for Advanced Technologies

Topics include: Crystal structure of solid-state materials system, structural stability of materials, electronic properties of materials, optoelectronic properties of materials, engineered materials, metamaterials, low-dimensional materials, introduction of solid-state materials-based device technologies. Prerequisites: PH131, CM103 or CM131, and MA131

Corequisites: MA132
Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

ES 243 Introductory Undergraduate Research I

The student participates in the research process under the guidance of a faculty research advisor. May include some independent work. For 1-2 credits, student prepare a short paper or report. For 3-4 credits, student prepares a paper and gives an oral presentation. By permission of research advisor only.

Credits: (1-4), Graded, Semester Calendar
Research, Every Term

ES 244 Introductory Undergraduate Research II

A Continuation of ES 243. By permission of research advisor only.

Credits: (1-4), Graded, Semester Calendar
Research, Every Term

ES 245 Introductory Undergraduate Research III

A Continuation of ES 244. By permission of research advisor only.

Credits: (1-4), Graded, Semester Calendar
Research, Every Term

ES 247 Sophomore Research Experience

The student conducts research under the guidance of a research advisor. Appropriate for paid or voluntary non-credit bearing research experiences. By permission of research advisor or academic advisor only. Pass/no credit only.

Credits: (0), P/NC, Semester Calendar
Research, Every Term

ES 250 Electrical Science

Network concepts. DC circuits: mesh and node equations, network theorems, operational amplifiers. Complex numbers, effective values, sinusoids and phasors. AC circuits: phasor diagrams, power. Time domain solution of first order circuits. Corequisites: MA232, PH132

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

ES 260 Materials Science and Engineering I

The fundamentals of the interactions between structure, processing, properties and applications of solid metals, non-metallic elements, inorganic compounds, and polymers. Topics include atomic bonding, structure, imperfections, diffusion, mechanical properties, deformation and strengthening mechanisms, failure. Possible additional topics include phase diagrams, phase transformations, electrical properties, processing, composites, corrosion, thermal properties, and environmental consideration. Prerequisites: PH131, CM103 or CM131, MA131

Co-requisite: MA132
Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
(TECH)

ES 330 Fluid Mechanics

Basic principles of fluid mechanics. Topics include statics, forces on plane and curve surfaces, kinematics of fluid motion, integral and differential representation of conservation of mass, balance of linear and angular momenta, the first Law of Thermodynamics, Bernoulli's equation, dimensional analysis, and elementary viscous flow. Frictional losses, simple pipeline analysis and steady channel flow are covered. Understanding of the physical phenomena is stressed and vector notation is used wherever suitable. Prerequisites: MA232 or MA231 and ES220.

Credits: (3), Graded, Semester Calendar, Lecture, Every Semester

ES 340 Thermodynamics

The fundamental concepts of thermodynamics and their application to pure substances. Topics include: properties of pure substances; work, heat, energy and the First Law of Thermodynamics; technique of First Law analysis; disorder, entropy and the Second Law of Thermodynamics; technique of Second Law analysis. Prerequisites: MA231 and PH132

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

ES 347 Junior Research Experience

The student conducts research under the guidance of a research advisor. Appropriate for paid or voluntary non-credit bearing

research experiences. By permission of research advisor or academic advisor only. Pass/no credit only.

Credits: (0), P/NC, Semester Calendar
Research, Every Term

ES 360 **Materials Science and Engineering II**

Continuation of the study of the science and engineering of materials. Emphasis is placed on the processing of materials to achieve optimum engineering properties. Topics include: heat treatment of metals and ceramics to yield strength and toughness at high temperatures; formation of composite materials (directionally solidified superalloys, transformation strengthened ceramics, fiber reinforced polymers); processing of amorphous materials for optical applications (lens, fibers, lasers); processing of magnetic materials for both hard and soft applications; and, protection of materials in corrosive environments. Prerequisites: ES260.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

ES 361 **Fine Particle Technology**

An introduction to the characterization, processing and applications of ceramic, metal and polymer fine particles and composites. Analysis of property-structure relationships. Formation of novel bulk materials from fine powders through sintering. Prerequisite: CM104 or CM132.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

ES 365 **Polymer Materials**

An introduction to the chemical and physical properties of polymeric materials, including basic polymer chemistry, elementary rheology, polymerization processes and polymer properties. Prerequisites: CM104 or CM132 and at least junior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Semesters

ES 375 **Directed Study**

Special reading or laboratory study of a specific problem or subject area under the direction of a member of the faculty.

Credits: (1-4), Graded, Semester Calendar
Independent Study, Given When Needed

ES 380 **Special Topics: Biomechanics**

[Cross-listed with ME 380] This course will examine the application of engineering principles to biologic systems. The structure and function of biologic tissue will be examined in the context of engineering mechanics. Emphasis will be placed on the biomechanics of human movement, including the basic principles of orthopedic biomechanics. Students will develop the skills necessary to explore biomechanics in the contemporary scientific literature and will write a term paper on a biomechanics topic of their choice. Prerequisites: PH131 and MA132

Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Fall Semesters

ES 400 **Numerical and Engineering Computing**

Topical coverage includes numerical methods for solving single nonlinear equations, matrix computations, systems of nonlinear equations, ordinary differential equations, partial differential equations, differential algebraic equations, and much more. Prerequisite: ES100 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

ES 402 **Biomedical Engineering Fundamentals**

[Cross-listed with BR 400, BY 440] This interdisciplinary course will introduce students to basic principles of biomedical rehabilitation engineering. The course will present principles of disability and the diverse roles of engineering in medicine and rehabilitation. Students will use engineering methods to study anatomical and physiological systems including applications in rehabilitation engineering, bioinstrumentation, biosignal and image processing, biomechanics, and biomaterials. Prerequisites: MA131/132, PH131/132, junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

ES 405 **Design of Experiments and Analysis of Data**

Modern techniques for the analysis of data and for the planning of experiments in research and in manufacturing. Includes use of software to design factorial and response surface method experiments, interpret the results, and fit data to equations. Prerequisites: MA232 or MA239 or MA339

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

ES 422 **Signal Processing and Applications**

This project-driven course involves qualitative and quantitative descriptions of DSP algorithms, software and applications. The class covers applications in engineering, computing, music, and the arts, with MATLAB, Java and mobile simulations. Prerequisites: MA132 or equivalent, or instructor approval.

Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Terms

ES 432 **Risk Analysis**

Risk assessment entails the evaluation of the hazardous properties of substances, the extent of human exposure to them and the characterization of resulting risk. It is a systematic approach to organizing and analyzing the scientific knowledge regarding potentially hazardous activities or substances. Variability and uncertainty are used to estimate the level of confidence in the risk assessment. The general approach to risk assessment including the use of default assumptions and uncertainty analysis will be presented along with illustrative examples. Graduate Students will be required to do an additional work at the graduate level. Prerequisites: CM131 or CM103.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
(TECH)
Comm Points: 1

ES 436 **Global Climate Change: Science, Engineering & Policy**

The primary objective of the course is to provide the necessary background that will permit undergraduate students to understand and accurately describe the workings of the Earth's climate system, the interactions between the atmosphere, ocean, and climate, and human's involvement in altering these processes. The course is broken into four primary components: earth science, energy, policy, and programming. The highly quantitative course will use project-based experiences to allow each student an opportunity to complete a data acquisition/modeling project of their own design to show

correlations between human activities, current atmospheric concentrations and resulting ecosystem change. Students will use computational programming tools (Matlab) in combination with mapping tools (Google Maps API) to quantify, analyze, and display geographical variations of integrated and averaged values of quantities studied.

Prerequisites: Quantitative and modeling skills (Matlab, Excel) are required, statistics is recommended.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

UNIV/CGI/STS(TECH)

ES 438 **Alternate Energy Systems**

[Cross-listed with EE 438] The basic technology of emerging renewable or non-carbon based energy sources will be considered, and contrasted with traditional sources of energy. Topics will include photovoltaic, wind and others. The impacts of energy storage and electrified transportation will be discussed. The capability of these technologies will be assessed, and barriers to implementation will be explored. The role of the electric power grid in enabling alternate energy technologies will be covered. Prerequisite: ES250 or permission of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

ES 442 **Fundamentals of Research and Graduate Study**

Students learn basic research and technical communications skills, including literature reviews, technical writing (research proposals and papers), technical presentations, ethics, experimental methods and an introduction to research-related career paths. Each student prepares a portfolio of written materials and gives technical presentation(s). Students must concurrently register for a research course (approved list available in the office of the Dean of Engineering), or have prior research experience, or receive permission from instructor. Junior standing required. By permission of instructor only.

Credits: (1), Graded, Semester Calendar

Lecture, Fall Terms

ES 443 **Undergraduate Research I**

The student develops and conducts a self-contained independent research project under the guidance from a faculty research advisor. For 1-2 credits, student prepares a short paper or report. For 3-4 credits, student prepares a paper and gives an oral presentation. Junior standing required. By permission of research advisor only.

Credits: (1-4), Graded, Semester Calendar

Research, Every Term

ES 444 **Undergraduate Research II**

A Continuation of ES 443. Junior standing required. By permission of research advisor only.

Credits: (1-4), Graded, Semester Calendar

Research, Every Term

ES 445 **Undergraduate Research III**

A Continuation of ES 444. Junior standing required. By permission of research advisor only.

Credits: (1-4), Graded, Semester Calendar

Independent Study, Every Semester

ES 446 **Undergraduate Research IV**

A Continuation of ES 445. Junior standing required. By permission of research advisor only.

Credits: (1-4), Graded, Semester Calendar

Research, Every Term

ES 447 **Senior Research Experience**

The student conducts research under the guidance of a research advisor. Appropriate for paid or voluntary non-credit bearing research experiences. By permission of research advisor or academic advisor only. Pass/no credit only.

Credits: (0), P/NC, Semester Calendar

Research, Every Term

ES 452 **Biomaterials and Biomedical Engineering Applications**

This course will examine the biomaterials, biotransport phenomena, biomolecular engineering and tissue engineering aspects of biomedical engineering. Topics covered will include the interactions of biomolecules with synthetic materials tissue-biomaterial interactions, the tailoring of material chemistry toward rational design of biomaterials, application of the principles of transport phenomena to physiological systems, understanding the principles governing rates of drug transport in advanced drug delivery systems, the microarray technology, and biosensors. Prerequisites: BY160, and CM241 or ES260, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

ES 464 **Corrosion of Metals**

Mechanisms of environmental degradation of materials. Methods for eliminating or reducing environmental degradation. Prerequisite: CM132 (or CM104), and ES 260

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

ES 485 **Neural Engineering**

[Cross-listed with EE 485, BY 485] This course applies engineering principles to the study of neuroscience and to the design of devices or techniques intended to replace missing or augment existing functions such as seeing, hearing, speaking, and walking. The course provides a detailed overview of sensorimotor systems, neurophysiology, neuroanatomy, neuropathology and clinical neurology. The class sequences through the various sensory and movement systems, providing a quantitative basis for how the nervous systems works for these systems, for how it dysfunctions, for the disability produced, and finally for how function can be restored by neuroprostheses. Students will prepare and present a paper on a neural engineering topic. Prerequisites: MA132 and PH132 or PH142.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

ES 499 **Professional Experience for Engineering Majors**

This course number is used to matriculate the Professional Experience requirement of the Clarkson Common Experience curriculum. The student must participate in a project-based professional experience such as a co-op, internship, directed research, significant responsibility in an appropriate team project, or a community project clearly related to the student's professional goals. Enrollment is restricted to engineering majors.

Prerequisite: Pre-approval (using the PRE-APPROVAL WORKSHEET for the PROFESSIONAL EXPERIENCE Requirement in the Wallace H. Coulter School of Engineering.)

Credits: (0), P/NC, Semester Calendar

Independent Study, Every Term

Environmental Science & Policy

EV 1,3,5... **Environmental Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

EV 2,4,6... **Environmental Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Professional Elective requirement.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

EV 100 Introduction to Environmental Science & Policy Professions

The purpose of this course is to introduce students to environmental science and policy issues. The course is an overview of local and global issues relating to safety, health, environmental science and policy, and industrial hygiene concerns in the community and the work place. Students will review journal articles on selected topics and attend 1-2 field trips to local industries. The course will provide an open forum for discussion of curriculum choices and career options in environmental science and policy.

Credits: (1), Graded, Semester Calendar

Lecture, Fall Semesters

EV 280 **Environmental Science**

This course will investigate the key concepts and principles of environmental science, emphasizing human impacts to the earth. The themes will include, energy flows through nature, and biogeochemical systems and how they have been perturbed by human activities. Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. Quantitative analysis of air, soil, and water quality on local, regional, and global scales will be a significant component of the course. Emerging principles in environmental science, including sustainability, industrial ecology, risk assessment, and the precautionary principle will be introduced. The course will prepare students to qualitatively and quantitatively analyze fluid and contaminant flow in varied biological and geologic systems. Prerequisites: sophomore standing, CM131/CM132 or CM103/CM104, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture

EV 305 **Sustainability & the Environment**

This course is an introduction to sustainability and the environment. Students are expected to harness initial knowledge from science, engineering, and policy courses to collectively address environmental problems and issues on campus, or in the local community. Class time is split between lectures on sustainability and the environment, and a semester-long (real-world) project on a local or campus environmental problem. In addition, EV 305 allows for direct review and instructor on the quality of the written and oral communication by the students. Written and oral progress reports will be required

throughout the semester by each student/group. The final paper and presentations are intended to be professional format to motivate change on campus or in the local community. Prerequisite: At least Sophomore standing

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

Comm Points: 1

EV 310 **Environmental Science Laboratory**

This is a lab course that meets for three hours a week. The course consists of weekly labs. Students must prepare lab reports on a weekly basis. These lab reports are evaluated for consistency, accuracy, presentation and overall quality. The course ends with students individually presenting scenarios that encompass knowledge gained over the length of the course. Students are expected to communicate knowledge of both environmental health and public health. In addition, each student must prepare a final report to accompany their presentation. The written material will be critiqued by the instructor and feedback will be provided to each student. A portion of the labs will be dedicated to instruction on writing and presentation skills. Prerequisites: BY140, CM131, or CM103.

Co-requisites: EHS309

Credits: (1), Graded, Semester Calendar

Laboratory, Spring Semesters

EV 311 **Environmental Science Laboratory**

Students will study the theory and application of measurement techniques used for environmental sampling. Students will use a wide variety of monitoring equipment to assess water and soil quality. Both biological and chemical contamination of water and soil that may lead to environmental degradation will be examined. This lab course will meet for three hours a week. The course will consist of 8 laboratory experiments. Students will be asked to prepare lab reports for each experiment. These lab reports are evaluated for consistency, accuracy, presentation and overall quality. The course ends with students individually presenting scenarios that encompass knowledge gained over the length of the course. Prerequisites: BY140, CM131, or CM103.

Co-requisites: EV/BY/CE313

Credits: (1), Graded, Semester Calendar

Laboratory, Fall Semesters

EV 312 **Adirondack Ecology and Environmental Science**

[Cross-listed with BY 312] This course introduces ecological and environmental science concepts relevant for understanding the structure and function of terrestrial, aquatic, and human systems in the Adirondack Park. Students will learn to identify important plant and animal species representative of the Adirondack Mountains, and learn major features of ecological systems in the Park. The course will also provide the students an assessment of human impacts on the ecology of the Adirondack Park.

Enrollment is limited to those students participating in the Adirondack Semester Program.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Given When Needed (TECH)

EV 313 **Biogeochemical Earth Systems Science**

[Cross-listed with BY 313, CE 313] This course will investigate the key concepts and principles of environmental science emphasizing the

earth's biogeochemical cycles and how they have been perturbed by human activities. Quantitative analysis of air, soil and water quality on local, regional and global scales will be a significant component of the course. Emerging principles in environmental science, including sustainability, industrial ecology, risk assessment and the precautionary principle will be introduced. In addition to the quantitative aspects, the course will consider the historical, social, and political contexts in which the practice of environmental science takes place. Prerequisites: CM132 (or CM104), or consent of the instructor

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
(TECH)

EV 314 Adirondack Integrated Research Project

This problem-based learning course will task students to analyze and suggest solutions to complex problems relevant to the economic, social, and environmental welfare of the Adirondack Park. The course is intended to reinforce what students have learned in other Adirondack courses.

Enrollment is limited to students participating in the Adirondack Semester Program.
Credits: (3), Graded, Semester Calendar
Research, Given When Needed
UNIV/CGI/STS
Comm Points: 2

EV 315 Entrepreneurship and Economic Devel in the Adirondacks

[Cross-listed with EC 315] This course will explore the characteristics of the entrepreneurs of the park while also understanding the opportunities and challenges that these entrepreneurs face. It will also explore the theories of externalities and public goods applied to pollution and environmental policy. The students will analyze the options for encouraging entrepreneurship and achieving economic development goals within the Adirondack Park.

Enrollment is limited to students participating in the Adirondack Semester Program.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
EC

EV 316 Adirondack Environmental Science

A brief history of air, soil, and water pollution in the Adirondacks followed by an investigation into the major sources and concerns of pollution in the region. Through lectures and laboratory experiences the following areas will be studied: air, water and soil quality parameters and their measurements; material and energy balances; water, air and soil chemistry concepts; toxicology and risk assessment.

Credits: (1-3), Graded, Semester Calendar
Lecture, Given When Needed

EV 320 Social and Political Issues in the Adirondacks

[Cross-listed with SS 320] The historical, social, political, and environmental factors contributing to the fabric of the Adirondack Park is an evolving social experiment. The course readings will focus upon the New York State constitutional provisions that engendered the park, the policies that shaped the park, along with the political actions that influence the park today. The Adirondack State Park is extraordinary for its history and because it is a place where human

residents live and recreate in sustainable ways that conserve resources and 'forever wild' regions of the park.

Enrollment is limited to those students participating in the Adirondack Semester Program.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
CSO
Comm Points: 2

EV 322

Adirondack Park

To understand a place, one must often understand the views of nature and the environment as seen by writers and essayists. Students will explore the Adirondacks through literature while experiencing the lakes, rivers, streams, and mountains. The readings, discussions, and written assignments will explore the aesthetics, the social and political climate, and the prevailing attitudes toward the environment that helped create the Adirondack Park. In addition, the course will provide students will an opportunity to participate in seasonal outdoor activities to learn how recreational activities have impacted the social, cultural, economic, and physical aspects of the Park.

Enrollment is limited to those students participating in the Adirondack Semester Program.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CSO/IA
Comm Points: 1

EV 330

Great Lakes Water Protection

[Cross-listed with BY 330] The Laurentian Great Lakes contain 20% of the world's surface fresh water and serve both water supply and waste disposal services for over 30 million residents in the United States and Canada. Technological advances have controlled the outflow of the Great Lakes at the St. Lawrence River and this has brought with it social benefits and environmental costs. The United States and Canada share the management of this resource and have shared notable success controlling environmental consequences of development yet are faced with emerging issues. The LGL/SLR system will be examined from a multidisciplinary, multinational perspective to illustrate that a shared resource can be maintained. Students will be able to understand the forces (geomorphic, biological, chemical, social, economic, and political) that have shaped and impacted a globally significant resource. Prerequisite: At least Sophomore standing.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
UNIV/CGI/STS
Comm Points: 1

EV 390

Sustainability Project Experience

This course prepares students for and includes a two-week intensive work/study experience at a business with a stated sustainability focus. Students will study the nature of the business and their current sustainability practices through structured class time prior to traveling. Students successfully completing this course will gain a better perspective on the technology, business, cultural and regulatory constraints and opportunities that enable the enterprise to operate in a sustainable fashion. Interdisciplinary teams of students will identify additional possible projects to creatively overcome complex, real-world sustainability challenges for the business, and complete a preliminary feasibility study that includes

interdependent technical, economic and environmental considerations. Project ideas and progress will be communicated through oral presentations and progress reports throughout the semester, culminating in a presentation and report to the business staff. (3 Design Credits)

Prerequisites: At least sophomore standing & permission of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

STS(TECH)

Comm Points: 2

EV 400 Environmental Science Capstone

This course is part one of a two course sequence with EV 401 that acts as the cornerstone of the Environmental Science and Policy and Environmental Health Science Programs. Each student will conduct a research project as an individual or in a group that involves several components of the scientific process. Students will be given lectures on research methods and will be required to have weekly meetings with a capstone advisor. At these meetings, work that has been completed will be evaluated and subsequent goals will be planned and established. In addition, several drafts of a final Capstone report will be written throughout the semester. The final paper is meant to be similar to the process of writing a thesis, both in scope and quality. The final presentation of this course is designed to be the culmination of a student's experience in the Environmental Science & Policy and Environmental Health Science Program, and the projects will be presented at the SURE conference or a similar type of forum. Prerequisites: Senior status in EHS or ES&P or consent of the instructor

Credits: (1-3), Graded, Semester Calendar

Lecture, Every Semester

Comm Points: 1

EV 401 Capstone Project (continuation)

This senior level course is the conclusion of the Capstone Project. The course is for students who have taken EV400 and will be finishing their Capstone Project. The course will conclude with a final paper and presentation. Prerequisite: EV400 or consent of the instructor.

Credits: (1-3), Graded, Semester Calendar

Independent Study, Spring Semesters

EV 410 Where the Wild Things Are: Env

[Cross-listed with PHIL 410] This course takes Henry David Thoreau's claim 'In Wildness is the Preservation of the World' as the philosophical starting point of the American environmental movement and its attempts to conceptualize nature as a collection of ecosystems and as an ecosphere; along with the ontological, epistemological and ethical implications that result. Authors include Thoreau, Emerson, Muir, Leopold, Stan Rowe, Wes Jackson and Stuart Kauffman. Special emphasis will be given to applications to, and issues and challenges confronting, the Adirondack Park.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

STS

Comm Points: 1

EV 435 Groundwater Hydrology and Geochemistry

[Cross-listed with CE 435] This class provides fundamental understanding of the key physical and chemical processes impacting groundwater resources and quality. Emphasis is on groundwater

geology, physical characteristics of flow, and geochemical properties of groundwater. Groundwater contamination and contaminant transport and modeling will be introduced. The course will prepare students to qualitatively and quantitatively analyze fluid and contaminant flow in varied geologic systems. Prerequisites: CM132 (or CM104/106), and MA131, and (or EV/BY280)

Credits: (3), Graded, Semester Calendar

Lecture, Odd Fall Terms

EV 490 Internship/Co-op

Students who obtain a (summer) internship/co-op position may obtain credit for the work experience by registering for this course the semester following the position. Students will be required to keep a daily journal of work activities and submit the journal entries to the ES&P Program Director every two weeks. During the semester following the internship/co-op, a 10-page report on some aspect of their work experience and a 30 minute presentation will be required. Prerequisite: Open to EHS or ES&P major or minor only, or by consent of the program director

Credits: (0-3), Graded, Semester Calendar

Independent Study, Every Semester

EV 492 Internship/Co-op

Students who obtain a (summer) internship/co-op position may obtain credit for the work experience by registering for this course the semester following the position. Students will be required to keep a daily journal of work activities and submit the journal entries to the ES&P Program Director every two weeks. During the semester following the internship/co-op, a 10-page report on some aspect of their work experience and a 30 minute presentation will be required. Prerequisite: Open to EHS or ES&P major or minor only, or by consent of the program director

Credits: (0-3), Graded, Semester Calendar

Independent Study, Every Semester

EV 494 Directed Research for Undergraduates

A research project will be completed; research projects may include laboratory projects, literature research, or individual study of environmental science, environmental engineering, and/or environmental policy topics not available in other Clarkson courses. Prerequisite: Open to EHS or ES&P major or minor only, or by consent of the program director

Credits: (1-3), Graded, Semester Calendar

Research, Every Term

EV 495 Directed Research for Undergraduates

A research project will be completed; research projects may include laboratory projects, literature research, or individual study of environmental science, environmental engineering, and/or environmental policy topics not available in other Clarkson courses. Prerequisite: Open to EHS or ES&P major or minor only, or by consent of the program director

Credits: (1-3), Graded, Semester Calendar

Research, Every Term

EV 496 Directed Research for Undergraduates

A research project will be completed; research projects may include laboratory projects, literature research, or individual study of environmental science, environmental engineering, and/or environmental policy topics not available in other Clarkson courses.

Prerequisite: Open to EHS or ES&P major or minor only, or by consent of the program director

Credits: (1-3), Graded, Semester Calendar
Research, Every Term

EV 497 **Directed Study**

A directed study project will be completed; research projects may include laboratory projects, literature research, or individual studies of environmental science, environmental engineering, and/or environmental policy topics not available in other Clarkson courses. Prerequisite: Open to EHS or ES&P major or minor only, or by consent of the program director

Credits: (1-3), Graded, Semester Calendar
Research, Every Term

EV 498 **Directed Study**

A directed study project will be completed; research projects may include laboratory projects, literature research, or individual studies of environmental science, environmental engineering, and/or environmental policy topics not available in other Clarkson courses. Prerequisite: Open to EHS or ES&P major or minor only, or by consent of the program director

Credits: (1-3), Graded, Semester Calendar
Research, Every Term

Film Studies

FILM 1,3,5... **FILM Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

FILM 2,4,6... **FILM Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Humanities or Social Science Foundation Curriculum Requirement, depending on the specific designator.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

FILM 226 **Short Film Screenwriting**

[Cross-listed with COMM 226] In this course, you will learn the process of writing short screenplays for narrative fiction films of any genre. Short films can be anywhere from 30 seconds to 40 minutes long, though the majority of them fall between seven and fifteen minutes. Each student will complete two short scripts and then revise one of these from the ground up. Since this is a workshop, you are expected to comment thoughtfully on your classmates' work, as they will comment thoughtfully on yours. Though there is some reading in this course, your primary concern should be writing, writing, writing!

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
IA

Comm Points: 2

FILM 230 **Cinemas of Resistance**

This course means to explore major film-making movements that fall within a category of "cinema of resistance." We will discuss concepts in and approaches to film theory and film-making that resist a Western, hetero-normative, white, and/or patriarchal discourse and

will contextualize feminist and queer cinema, black cinema, postcolonial, imperfect, and third cinema, among others. We will furthermore emphasize how films are tied to the political reality of their time and pace, including major historical moments of resistance such as decolonization, the feminist movements, the Civil Rights Movement, LGBTQ rights movements, and others. While these will be our major points of discussion, we will also touch on issues like genre, spectatorship, and politics of marketing and distribution. We will watch and discuss films by filmmakers such as Vittorio De Sica, Ousmane Sembene, Julie Dash, Sally Potter, Spike Lee, Gillo Pontecorvo, and Stephen Frears, among others.

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Given When Needed

FILM 235 **Crossing Borders**

In this class, we want to take a close look at the representation of migration and border crossings in global cinema from the U.S., Canada, Germany, France, the U.K. Senegal, Nigeria, Algeria, Iran, Israel, Mexico, Argentina, and China. More often than not, conversations approach the issue of migration on a policy level, but in this class we want to take a look at how filmmakers from around the world imagine individual migrant stories and get a sense of the body of migration films that has emerged over the past three decades. Although we will certainly address policy issues, political debates, and legal frameworks, we want to focus on how cinema can create an individual humanity of migrant and refugee characters. What are the politics of representation in an unequal world order? How is the migrant humanized or de-humanized? Does a certain way of representing immigrants indicate specific national anxieties? We will discuss issues such as clandestine border crossings, migrant labor, global mobility, privilege of citizenship, gendered migration, asylum, deportation, and many more. In addition, we will learn how to effectively read and analyze films and contribute to an ever-developing field of transnational and diasporic cinema studies and its relationship with other cinema traditions.

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Given When Needed
CGI

Comm Points: 1

FILM 237 **The Horror Film**

In addition to being one of the most consistently profitable film genres, horror movies also provide a window into the culture anxieties captured at the time these films were made. This course examines horror films across a variety of sub-genres over the past several decades. In addition to watching these films, students will read commentary by critics and scholars that has shaped the way we think about horror films. Students will also have an opportunity to learn the basic tools of film studies while also honing their writing abilities.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
IA

Comm Points: 1

FILM 240 **Films From Fiction**

[Formerly LF270] Many film scripts start as adaptations of stories, plays and novels--or even of other films. This course will focus on the process through which stories originally presented in one medium are transformed in another, the process (for instance) through which Anthony Burgess's *A Clockwork Orange* becomes Stanley Kubrick's *A*

Clockwork Orange, or that through which Alice Walker's *The Color Purple* becomes a film by Steven Spielberg. Sometimes more than one film adaptation of a single work of fiction will be studied, and the class will also explore at least one instance of a film which has a previous film as its source. Students will be responsible for both reading the texts and seeing the films; no background in film criticism is necessary.

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Given When Needed

IA

Comm Points: 1

FILM 250 **Dystopian Visions in International Cinema**

In this course we want to explore the representations of various forms of dystopias in international cinema and our own fascination with these "bad" fictional places. How might dystopian films represent and recreate societal developments and anxieties? How do filmmakers and authors respond to different socio-political contexts and concerns, such as oppressive totalitarian regimes, environmental destruction, natural disasters, and/or medical catastrophes? Finally, we will investigate issues such as religion, gender, sexuality, race, and class as they relate to dystopian scenarios.

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Given When Needed

IA

Comm Points: 1

FILM 322 **The Hollywood Cinema**

[Formerly LF373] The Hollywood Cinema was launched in the early part of this century when a group of New Yorkers transferred their operations to the warmth and bright natural light of Los Angeles. Since then, the Hollywood style of filmmaking has grown to be a dominant influence in world cinema. In this course, students will study the history, economics, technology and theory of Hollywood filmmaking. The course will explore the different means through which movies communicate with views, focusing on technical components such as photography, frame compositions, movement, sound, and editing, as well as more literary components such as screenplay, acting, and directing. It will explore as well the cultural components of film viewing, since the ultimate goal of the course is to gain a better understanding of the movies that both reflect and affect the lives and times of those who make and see them.

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Given When Needed

UNIV/EC/IA

Comm Points: 1

FILM 326 **Feature Film Screenwriting**

In this course, you will learn the process of writing a feature-length screenplay. You will devise an original story idea, craft intermediate documents (i.e. logline, treatment, and beat sheet), and then write a first draft. Our goal is not to complete a polished draft (most screenplays go through at least a dozen revisions), but rather to execute a full draft in proper screenplay format that hits all the dramatic turning points, fleshes out characters and dialog, and leaves you with a document ready for substantive revision - now that you know what you're writing. Since this is a workshop, you are expected to comment thoughtfully on your classmates' work, as they will comment thoughtfully on yours. Along the way, you will read several professional scripts and complete a brief critique of each. We will also learn about the profession of screenwriting, including what to do with

finished scripts, how to seek representation, and what the Writers Guild of America is. Though there is a good amount of reading in this course, your primary concern should be writing, writing, writing!

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

IA

Comm Points: 2

FILM 340 **World in a Frame**

[Formerly LF370] Film is a complex medium that surrounds its participants, conveying ideas and emotions through the combination of words, images, sounds, and music. This course will explore the different means through which movies communicate with viewers, focusing on technical components such as photography, frame composition, movement, sound, and editing, as well as on more literary components such as screenplay, acting, directing, and producing. In the process of this exploration, class members will also learn about the major areas of film theory, since the ultimate goal of the course is to gain a better understanding of the movies that both reflect and affect the lives and times of those who make and see them.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Given When Needed

IA

Comm Points: 1

FILM 485 **Advanced Topics**

An advanced topics seminar open to students with at least 12 credit hours in the discipline or permission from the instructor. Limited to 12 students. Topics to be covered will be selected to conform to the mutual interests and needs of students and faculty. Additional prerequisites may be required depending on the topic. Graduate students will be required to perform additional work.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory,

FILM 490 **Independent Study**

Designed primarily for an advanced student who wishes to pursue special interests in film studies for one or more semesters, this series allows students to design and conduct independent study projects under faculty guidance.

Prerequisite: consent of the instructor.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Every Semester

Finance

FN 1,3,5... **Finance Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

FN 2,4,6... **Finance Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

FN 361 **Financial Management**

(May be used to satisfy a CUSB M.B.A. or M.S. foundation requirement.)

The basic goals of this introductory finance course are to familiarize students with the concepts and tools used in corporate financial management decisions. These include the analysis of financial statements for long-term financial planning, the notion of present value in addition to the relationship between risk and return. The concepts and techniques are, in turn, used to evaluate and make decisions regarding the firm's capital expenditures and capital structure as well as security valuation. Prerequisites: MA/STAT282, MA/STAT383 or MA330, EC150 or EC350, AC203 or AC/EM205 (or their equivalents) and sophomore standing, or the permission of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Every Term

FN 455 **Venture Capital and Private Equity**

Course is designed to address financial issues relating to high tech industries and the new economy. Topics covered will include venture capital, and in-depth study of the IPO process, valuation, capital structure, long run performance and other issues related to new industries. Prerequisite: FN361.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

FN 462 **Investments**

Beginning with the formulation of individual and institutional investment objectives and policies, this course examines the various assets, securities, and contracts provided in the private and public sector. Besides the characteristics of these investments vehicles, the course also looks at how trades occur in the respective markets and the general investment-decision making process. Prerequisite: FN361.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

FN 464 **Financial Management II**

This course introduces students to the complexities of financial management while providing a comprehensive overview of the major issues in Financial Management. Picking up where FN361 left off, FN464 will focus on financial strategy and the right-hand side of the balance sheet. Specific topics will include: an introduction to capital markets and the issuing of securities, capital structure issues, dividend policy, working capital considerations, mergers and acquisitions, and corporate governance. The course will integrate concepts from accounting, statistics, and economics. Prerequisite: A grade of C or better in FN361; Corequisite: AC 312

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

FN 467 **International Finance**

This course explores issues in international finance, especially as they pertain to financial management. Coverage includes an overview of the international financial environment, encompassing topics such as the international monetary system, balance-of-payments, trade agreements, and capital flows such as foreign direct investment. Specific attention is given to understanding exchange rate systems, purchasing-power parity (PPP), interest rate parity and international arbitrage. Techniques for measuring and managing exchange rate risk

are covered in detail. Prerequisites: FN361, EC/EM150 and EC151 or EC350.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

FN 468 **Financial Markets and Institutions**

[Cross-listed with EC 468] Emphasis is placed on understanding the basis of managing financial institutions, such as banks, the flow of funds, markets, and regulatory agencies that affect the institutions. The course addresses risk management, term structure of interest rates, international and domestic market operations and policy questions about financial markets and related topics. Prerequisite: FN361.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

FN 470 **Strategic Financial Management**

This case oriented capstone Finance course is designed to acquaint students with the fundamental issues in strategic financial management using financial markets. Using the underlying principle of shareholder wealth maximization, the key role of valuation in the strategic planning process will be highlighted by studying corporate decisions that interface with financial markets. Both theoretical valuation models and methods used in practice 'on the street' will be discussed, compared and implemented to measure the value created by investment, divestment, and restructuring decisions. The course examines the causes of value gaps in firms and develops methods to close the gaps and unlock hidden value. We will rely heavily on material from all previous Finance and Accounting courses. Prerequisite: FN464

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

FN 474 **Models for Financial Analysis**

The objective of the course is to understand how financial statement information affects the market value of securities. This course examines assessment of the firm through in-depth analysis of the financial statements. In addition to direct and ratio analysis of the financial statements, the course examines analysis of such topics as short and long-lived assets, tax strategy, leasing, pension plans & benefits, hedging, off-balance sheet considerations, business combinations, other forms of restructuring, multinational operations, credit and other risk analysis. The impacts of import FASB and international accounting and tax rules are examined. Coverage is done within a CFA (TM) framework. Prerequisites: FN361.

Credits: (3), Graded, Semester Calendar,

Lecture

FN 487 **Special Project in Finance**

An investigation of a problem or in-depth topic undertaken by the student under the guidance of a faculty member. Prerequisites:

Permission from the instructor.

Credits: (1-3), Graded, Semester Calendar

Research, Given When Needed

FN 490 **Internship**

An unpaid internship that is related to the student's professional goals. Consent of the instructor only.

Credits: (1-3), Graded, Semester Calendar

Independent Study, Given When Needed

First Year Studies

FY 100

First Year Seminar

[Cross-listed with PE 100] With a focus on group work and team dynamics, this adjustment course is required for all first-year students. It introduces the mission and expectations of the learning process at Clarkson; builds communication and teamwork skills; and provides some fundamental content relating to wellness and relationships during the college experience. Discussion, team activities, leadership opportunities, and interaction with upperclass peer educators form the foundation of the course. Restriction: Freshman standing

Credits: (1), P/NC, Semester Calendar
Seminar, Fall Terms

History

HIST 1,3,5...

History Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

HIST 2,4,6...

History Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Humanities or Social Science Foundation Curriculum Requirement, depending on the specific designator.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

HIST 100

European History Survey

Credit for this course is awarded only in the following cases: 1) receipt of a 4 or 5 on the AP European History Exam, 2) receipt of a score of 5 through 7 on the International Baccalaureate European History Higher-Level Examination, or 3) satisfactory completion of a college-level European History survey course.

Credits: (3), Graded, Semester Calendar
Independent Study, Transfer Credit Only
UNIV/CSO/IG

HIST 101

World History Survey

Credit for this course is awarded only in the following cases: 1) receipt of a 4 or 5 on the AP World History Exam, 2) receipt of a score of 5 through 7 on the International Baccalaureate History Higher-Level Examination, or 3) satisfactory completion of a college-level World History survey course.

Credits: (3), Graded, Semester Calendar
Independent Study, Transfer Credit Only
UNIV/CSO/IG

HIST 102

History of the Americas Survey

Credit for this course is awarded only in the following cases: 1) receipt of a score of 5 through 7 on the International Baccalaureate History of the Americas Higher-Level Examination or 2) satisfactory completion of a college-level History of the Americas survey course.

Credits: (3), Graded, Semester Calendar
Independent Study, Transfer Credit Only
UNIV/CSO/IG

HIST 103

Islamic History Survey

Credit for this course is awarded only in the following cases: 1) receipt of a score of 5 through 7 on the International Baccalaureate Islamic History Higher-Level Examination or 2) satisfactory completion of a college-level Islamic History survey course.

Credits: (3), Graded, Semester Calendar
Independent Study, Transfer Credit Only
UNIV/CSO/IG

HIST 210

The Ancient World

This course traces the birth and development of civilization in the ancient world from the 3rd millennium BC in Mesopotamia to the height of the Roman Empire in the 3rd century AD. Students will study the cultural values, economic organization and political systems of Mesopotamia, Egypt, Greece and Rome. Students will also consider the processes of social, cultural and geopolitical change in the ancient world and critically evaluate primary sources from each area in terms of their original function, and what types of information we can glean from them.

Credits: (3), Graded, Semester Calendar
Lecture
CSO

HIST 220

America: 1776 - 1877

[Formerly LC250] This course will survey developments in American history from the American Revolution to post-Civil War Reconstruction. Topics for special consideration will include: the American Revolution and its aftermath, the economic and political 'revolutions' of the first half of the 19th century, immigration and the opening of the West to settlement, the critical decade of the 1850's, and the Civil War and its aftermath. The focus of the course will be on the larger political and economic trends of this transformative period, but some attention will be paid to the social and intellectual developments as well. The course will alternate between lecture and discussion. A comprehensive text may be used but discussion will center on interpretive texts and primary documents. This is an entry-level course for people who want to prepare for more advanced work in American history at the upper division level.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CSO/IG

HIST 221

America: 1877 - Present

[Formerly LC251] A social, political, cultural and economic survey of the United States from Reconstruction through the present.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CSO/IG

HIST 230

Science and Society

This course will acquaint students with the multifaceted ways in which science and society interface in the modern world. It will discuss important developments in the history of modern science (17th century-present). But examining the conceptual development of scientific theories is only part of the story. The course will also explore the broader institutional, cultural and political contexts of the theories in questions. It will analyze how science influenced the societies which nurtured it as well as how societal values impact the nature and practice of science. Relationships between religion and science, science and political authority as well as the social and ethical responsibility of the scientist will be explored. Students will

understand science, not as a collection of disembodied ideas about the natural world, but as a historically and socially situated activity best understood in relation to the historical contexts in which it occurs.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

STS

Comm Points: 1

HIST 240 **War and Society**

[Formerly LP398] War is as old as society, and from earliest times, changes in warfare have reflected changes in society. Through primary source material (eyewitness accounts and descriptions) and selected historical writings, we will study the battle experience of soldiers and civilians, and the shifting relationship between the military and society. The course will concentrate on four stages of military/ cultural experience: 'the army of heroes' in which the warrior fights for personal honor; 'the professional army' in which training comes to the fore; 'the gentleman's war', in which the professional soldier follows a strict code of moral behavior; and 'the modern war', in which technology changes conventional warfare with dire consequences to the military and society.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CSO/IG

Comm Points: 1

HIST 241 **War Stories I**

[Formerly LF392] The oldest and most enduring stories describe war and its consequences. Reading these stories helps us see how different societies valued leadership, honor, loyalty, courage, and death on the battlefield. Not all war literature, however, glorifies heroic warriors and their exploits. Some war stories, even in the distant past, question martial codes imposed on men. Others examine what is worth dying or killing for, and still others lament the inevitable wastage and brutality of war, of the costs to individuals, civilizations, and the environment. Most of them are ambivalent. Text will range from the ancient world to the Renaissance and from Asia to Europe.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

IA

Comm Points: 1

HIST 250 **History of 20th Century Germany**

[Formerly LC375] Was Germany responsible for World War I? How and why did the Nazis rise to power? How was Auschwitz possible? Why were there two German states? What are the problems facing a reunified Germany? This course proposes to investigate these and other interesting questions by examining the social, political and cultural history of Germany from the end of the 19th century to the present. Through a combination of lectures, discussion and film, an attempt will be made to get a sense of the fabric of German society as it developed over the past hundred years.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CSO

HIST 255 **Introduction to Global History**

Introduction to Global History is a course that looks at global patterns through time, and attempts to see history as an integrated whole. Topics are studied in a general chronological order, but each is

examined through a thematic lens, showing how people and societies experience exchanges, integration and differences. The course consists of lectures that allow exploration of these issues at either introductory levels or at a more advanced level.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

UNIV/CSO/IG

HIST 260 **The Soviet Union at War**

The Soviet Union engaged in war throughout its 74-year history. This course will address the experience of World War One as a contributing factor to the Russian Revolution, the Russian Civil War (1918-1921), the Russo-Polish War (1919-21), intervention in the Spanish Civil War (1936-9), the Winter War (1939-40), the Great Patriotic War (1941-45), the Cold War including proxy wars and Soviet interventions during the period, the Soviet-Afghan War (1979-89) and the Gulf War (1990-91). Aspects to be considered include the conduct of and experience of war, development of Soviet defense capabilities, the diplomacy of war and peacemaking, the impact of war on Soviet society, and the international reactions to the Soviet Union.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CSO/IG

HIST 270 **Introduction to Society, Culture & Biology**

This course welcomes students into the interdisciplinary world of the human and biological sciences. In this class we will encounter the myriad ways in which the human and biological sciences were constituted, defined, and intertwined in the nineteenth and twentieth century. Students will learn to place ideas and controversies within a broad historical and cultural context. They will gain experience evaluating and interpreting historical texts. They will evaluate scientific theories, controversies, and ethical failures.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

UNIV/CSO/STS

HIST 280 **The Renaissance**

This course surveys the age of European Renaissance from the late fourteenth century to the age of Galileo, including the cultural exchange between Europe and the Near East. Studying the process of rapid religious and geopolitical change provides the historical context for analyzing the works of the master painters, sculptors, and architects of the Renaissance.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

UNIV/CSO/IA

Comm Points: 1

HIST 288 **Themes and Concepts in Chinese History**

[Cross Listed with HIST588] This course is an examination of themes and concepts related to the study of Chinese history. Topics include early China during the Shang, the dynastic cycle, philosophies, the Silk Road, urbanization, gender and society, revolution and change. Students will utilize a variety of source and literature to examine these topics. Note: this course will be jointly offered at the undergraduate and graduate level. Graduate students will do additional work; the syllabus will specifically delineate the course requirement at each level. Undergraduate students with a History major cannot apply HIST288 toward their required Major

Concentration in History.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
CSO

HIST 320 **Medicine and Society in America**

[Formerly LC353] This course is a history of American medicine from the eighteenth century to the present, with a focus on the social, cultural, and political dimensions of health care. Possible topics include: the development of the health care professions; midwives and obstetricians; the growth of the hospital; the transformation of medical education; medical and social reform; race, class, gender, and health care; changes in the organization of health care; sexually transmitted diseases; human experimentation; and medicine and the media.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CSO/STS
Comm Points: 1

HIST 321 **History of Public Health in America**

This course surveys the history of public health in the United States from the colonial period to the late twentieth century, with the aim of providing students with an understanding of how history may inform twenty-first century challenges regarding the health of populations. We will explore public health responses to diseases such as smallpox, tuberculosis, typhoid, syphilis, and HIV/AIDS and examine the ways in which those responses actually framed the conceptions of disease. Some of the questions we will address include: Who is responsible for the public's health? To what extent has the responsibility for the public's health changed over time? What rights should individuals have if they endanger the health of others? How have class, race, ethnicity, gender, and sexuality shaped public responses to and understandings of disease?

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CSO/STS, Comm Points: 1

HIST 323 **Modern War Literature**

Although war is one of the constants of human history, societies have always struggled to come to terms with it. Reading accounts of war helps us see how different societies value leadership, honor, loyalty, courage, and death on the battlefield, even as they question what is worth dying or killing for, and recognize the inevitable wastage and brutality of war, the costs to individuals, families, civilizations, and the land itself. Most war narratives are ambivalent, depicting both the heroism and the horror of war. This course examines both fiction and non-fiction accounts of war in the modern, industrialized world.

Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Terms
CSO
Comm Points: 1

HIST 326 **Modern Sex: Sexualities and Genders in Modern America**

This course covers the historical constructions of sexualities and genders in the modern era of American History. While it is a history course, students will review theories of sexualities and genders. The course will cover topics such as heterosexuality, homosexuality and their interrelation to gender. The course will focus on popular and prescriptive forms of sexuality and gender. Finally, the course explores the ways technology is intertwined with our constructions of

sexuality. Topics covered include licit and illicit sexuality, procreative and non-procreative models of sexuality and police power and sexual expression. This course covers explicit subject matter and is not recommended for individuals unwilling to explore these topics in intimate, scholarly detail.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
UNIV/CSO/STS

HIST 327 **History of Women and Gender in America**

This course focuses on the historical experiences of American women from the seventeenth-century era of colonization to the modern era (with an emphasis on the nineteenth and twentieth centuries), and it explores the role gender plays in shaping and defining American history. A separate investigation of women's experiences provides an understanding of 1) the distinct contributions of women to the American heritage, and 2) the ways in which gender intersects with race, ethnicity, class, sexuality, region, and religion in explaining social, cultural, and political developments in the United States.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters
UNIV/CSO/IG
Comm Points: 1

HIST 328 **Hist of Gender and Sexuality in the Transatlantic World**

This is a historical look at the constructions of gender and sexuality throughout the Transatlantic world. Chronologically, it will focus on the period of 1492-1999. Topics to be covered include the constructions of genders in Europe, the Americas and Africa. The course will progress chronologically, however it will cover certain topics in depth and other topics as part of a broad overview. Students will come to understand how cultures and societies shape and are shaped by gender constructions. In addition, students will come to appreciate the historical individual's negotiation of gender within a social grouping.

Credits: (3), Graded, Semester Calendar
Lecture
UNIV/CSO/IG

HIST 329 **History of the American Family**

What is a family? How have social, political, and economic forces shaped American families? How has the family changed throughout history? Did the end of the twentieth century see the demise of the American family, as some social critics have claimed? Focusing on the United States, this course will examine the history of marriage, divorce, childrearing, sexuality, families of different races, ethnicities, religions, classes, and regions, and the portrayal of the family in the media, as well as controversial issues concerning the American family today.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters
UNIV/CGI/CSO
Comm Points: 1

HIST 331 **Ancient Medicine and Magic**

[Formerly LC331] In a seemingly hostile world controlled by unseen forces, ancient man fought to gain the upperhand in a daily struggle against illness and death. Using magic and medicine (both thought to be equally valid) he sought to understand his body and maintain his health. Primary written sources and information gleaned from skeletal and mummified human remains allow us to trace the

development of medicine from its earliest appearance in Mesopotamia and Egypt to its more advanced form in Greece and Rome. Topics will include: disease, wounds, cures, surgery, the interplay between the supernatural and the mundane, physiology, life expectancy, nutrition, gynecology, and hygiene.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

STS

HIST 332 Documenting Social Activism

The course explores social movements in United States after World War II and allows students to describe and interpret the complex nature of cultures and societies in historical context. The movements will focus on issues of racial civil rights, workers' rights, the women's movement, the gay rights movement, the American Indian Movement and the Students' Movements. Ranging from 1945 until the present day the course illustrates the process of social, cultural, and geopolitical change over time. This is a team taught course in which students will be required to create a documentary film. Therefore students will split their time between history lectures, seminar style discussion and documentary film production. The course has 3 hours of class and 3 hours of lab per week, and students should expect to do extensive out-of-class work. Limit of 20 students. Permission of one of the instructors required.

Credits: (4), Graded, Semester Calendar

Lecture, Laboratory

UNIV/CSO/IA

Comm Points: 1

HIST 333 Science, Technology, and Society in the Renaissance

[Formerly LC395] Guns and printing were among the many revolutionary technological developments in Renaissance Europe. With the increased scale of war, feudal structures gradually dissolved and nationalism began to emerge. At the same time, religious reformation, with its theses disseminated through the printed page, helped shift the balance of power among states and individuals. Meanwhile, banking, commerce, and colonization, fueled by advances in navigation, promoted the beginning of capitalism. The theories of Copernicus, Kepler, and Galileo irreversibly changed ideas about man's place in the universe. Beginning with mathematical perspective and ending with the new scientific method, this courses will chart the extraordinary technological and scientific advances and profound economic and social changes that together mark the birth of the modern world.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CSO/STS

HIST 335 History of Medicine in Europe and North America

History of medicine is important even to those who think of themselves primarily as scientists or historians of science. Much of what we might initially see as biology, chemistry or physics was done within medicine, and even today a great deal of science either goes on in hospitals and the associated laboratories, or is at least nominally directed towards medical ends.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

UNIV/CGI/CSO/STS

HIST 337 Medicine in Europe and America

From a distance, the study of medical history might appear little more than an idle pursuit - perhaps only a study of great men and their discoveries. However, even slight reflection on the social, institutional, and cultural features of medicine will lead us to reconsider much about medicine that we might before have taken for granted. Enrollment is limited to students participating in the Trudeau Semester. Enrollment is limited to students participating in the Trudeau Semester.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CSO/STS

Comm Points: 1

HIST 338 Women, Gender and Science in American History

Why have science, medicine, and technology traditionally been the domains of men? What are the consequences of that? What has motivated women to become scientists, health care practitioners, and engineers? Has their growing participation changed the cultures of science, medicine, and technology? Focusing on the United States, this course examines (1) how preconceived notions about women, men, gender, and sexuality have shaped scientific ideas, and (2) the history of women as actual participants in science, medicine, and technology. We will use a historical perspective to shed light on current discussions about the gender dimensions of science.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CSO/STS

Comm Points: 1

HIST 340 Warfare in Ancient Greece

Study the major conflicts and conquests from the late Bronze Age to the founding of the Roman Empire. Topics include: weaponry and technological advances; reconstructions and battle-plans of specific engagements; combatants, non-combatants, and leaders; motivations, causes, and consequences; empire-building.

Credits: (3), Graded, Semester Calendar

Lecture,

CSO

HIST 341 War in Ancient Rome

The Romans developed the most successful military organization of the ancient world, but it took a great deal of painful experience, political maneuvering, and reform to move from volunteer citizen-soldiers to the highly trained professional legionaries of the Empire. This course traces the history of the Roman military from the inception of the Republic to the height of the Empire. Using primary and secondary sources, we will study the major wars of the Republic and early Empire: the Punic Wars, Caesar's Gallic Wars, the Civil Wars, and the wars of Imperial expansion. Specific topics will include weapons and armor, tactics, strategy, fortifications, artillery, leadership, and the campaign experience of legionaries. We will also consider the social, political, and economic consequences of warfare, and the impact of the Roman army on non-Roman cultures.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

UNIV/CSO/IG

Comm Points: 1

HIST 342 **War and Gender**

War and Gender will examine the historical category of gender as it pertains to war in the Modern Era. The course will span several cultures in Europe, the Americas and Africa as they relate to gender and war. The course breaks down into roughly four sections: introduction to the historical analysis of gender and war, conventional war, unconventional war and the imagined war. Each of these sections breaks down further into an analysis of masculinity and femininity. The course structure will alternate between lecture and source discussions seminar style. Students will be expected to analyze a variety of primary and secondary audio-visual source material for all sections. A significant portion of the class will focus on primary and secondary sources drawn from art, photography, literature and film in order to understand how gender shapes social values and worldviews regarding war.

Credits: (3), Graded, Semester Calendar

Lecture

UNIV/CSO/IA

Comm Points: 1

HIST 343 **War in the Middle Ages**

[Formerly LC392] One popular image from the Middle Ages is the brightly armored knight, charging into battle on his steed and performing brave deeds of arms. While war was a defining force in the medieval era, the picture is somewhat more complex. This course will consider European warfare from the Carolingian period to the dawn of the Renaissance, including the origins of feudalism, the Crusades, and the Hundred Years War. Using primary and secondary sources, we will look at developments in arms, armor, training, strategy, tactics, logistics, and battlefield experience. Our problem will be to determine the relationship between warfare and the economic, social, religious, and political culture of medieval Europe.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CSO

HIST 347 **World War I in History and Literature**

[Formerly LC359] This course will take an in-depth look at the war that both opened and shaped the 20th century. The course readings will be organized around three main topics. First, we will look at the events that provoked this global conflict. Second, we will look at the nature of the European battlefield in this first, totally 'modern' war. Finally, we will look at the human face of the war using first-hand accounts of the combatants as well as fictional works and poetry that came out of this experience. The course will be reading and writing intensive. There will be (at least) three required papers as well as an individual or group project, the subject of which will depend on the individual/s involved.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CSO/IA

Comm Points: 1

HIST 348 **WWII The European Theater**

This course will cover the central features of the World War II in European theater of operations from 1939-1945. The course will begin with an examination of the proximate causes of the war, namely the tensions in Europe arising from the conclusion of WWI and the various outcomes of the Versailles Peace treaties. The bulk of this course will focus on the period after America's entry into the

general war, i.e., from 1942 through 1945. Particular attention will be paid to issues that dominate in the scholarship: the role of the Eastern front in determining the war's trajectory and outcome as well as the role of strategic bombing in advancing the war's aims, which remains quite controversial. The course will incorporate several different kinds of texts: general histories, analytic studies, memoirs of German and American soldiers, a civilian memoir as well as some representative journalism of the day (and, perhaps, a novel). The course will conclude with a brief overview of the consequence of the war, in particular, its relationship to the rapid onset of the Cold War.

Credits: (3), Graded, Semester Calendar

Lecture

UNIV/CSO/IG

Comm Points: 1

HIST 349 **The Cold War Era: 1945-1991**

This course is intended to provide a general history of the Cold War, 1945-1991. We will discuss not only the evolution of the Soviet-American rivalry, but also the many smaller wars which emerged out of this larger conflict. Special attention will be paid throughout to the social, political, and cultural aspects of the Cold War. We will consider how the conflict was driven by social and political currents within the contending parties, and how the war shaped and transformed the societies that were a part of it.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

UNIV/CSO/IG

Comm Points: 1

HIST 351 **The Holocaust in Text and Film**

The Nazi mass murder of European Jewry during World War II occupies a special place in the annals of history. The attempted genocide of an entire people by a so-called 'advanced' nation gives rise to the historically and sociologically perplexing question 'how could it happen?' and undermines our faith in human reason and progress. The Holocaust also suggests that the nature of 'human nature' may be more complex than most care to admit. This course seeks to examine the experience of the Holocaust through a combination of literary and non-literary texts.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CSO/IG

Comm Points: 1

HIST 352 **European History: 1789-1914**

The period from 1789 to 1914 could be termed the long nineteenth century in the European context. Our course begins with an exploration of the French and Industrial Revolutions. It then examines the social and political transformation those twin revolutions wrought upon European society, and especially the social experiences of the rich and poor caught up in those upheavals. From this focus on the social and political context, our course turns to consider the economic thought that characterized the century, and specifically the increasing role that capitalism came to play in the wealth of European nations. Finally, the course examines the social and economic contexts that gave rise the World War I.

Credits: (3), Graded, Semester Calendar

Lecture

UNIV/CSO/IG

HIST 353 Medicine and Medical Ethics During the Third Reich

This seminar will attempt to explain how and why German medical professionals made the "Faustian bargain" with the Nazi regime. Although emphasis will be placed on the myriad ways in which an eugenic outlook and the aspirations of German physicians gave rise to Nazi medical practices, including the notorious medical experiments in hospitals and concentration camps, we will also examine the 1947 Doctors' Trial at Nuremberg and the Nuremberg Code of Medical Ethics that followed from it. Throughout the course, students will discuss the moral decisions made by medical professionals during the Third Reich as well as the ethical implications of Nazi medicine for our own twenty-first century age of genomic medicine. Prerequisites: BY214 or any of the following courses: HIST351, HIST354, HIST356 or consent of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

UNIV/CSO/IG/STS

Comm Points: 1

HIST 354 The Construction of Nazi Germany

This seminar will explore one of the most important topics in modern European history, and one of the most perplexing historical phenomena: the origins and establishment of the Nazi State. Emphasis will be placed upon the integration of social, economic, and cultural factors into the political history leading up to the Third Reich and the forces that accounted for the popularity and stability of Nazi Germany prior to WWII. We will also examine the continuities and discontinuities between earlier German history and Nazism.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

UNIV/CSO/IG

Comm Points: 1

HIST 380 Special Topic in History

Special topics courses are developed to cover emerging issues or specialized content not represented in the main curriculum. Not all courses are offered each semester. See the course schedule for a detailed topic description.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

CSO

HIST 390 Special Topic: History

Special topics courses are developed to cover emerging issues or specialized content not represented in the main curriculum. Not all courses are offered each semester. See the course schedule for a detailed topic description.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

HIST 393 Special Topic in History

Special topics courses are developed to cover emerging issues or specialized content not represented in the main curriculum. Not all courses are offered each semester. See the course schedule for a detailed topic description.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

HIST 394 Special Topic: History of Social Activism after WWII

The course explores social movements in United States after World War II. The movements will focus on issues of race and ethnicity,

poverty, civil rights, civil liberties and gender discrimination. The social movements explored will cover the main organizations and key individuals. Special attention will be paid to the religious liberal tradition and grass roots activism.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CSO

HIST 459 Neuroscience and Society

[Cross-listed with PY 459] The word 'neuroscience' is of recent origin. Yet we can trace neuroscientific ideas back to Rene Descartes. Since Descartes, social understanding of madness, the relationship between mind and brain, and the nature of sensation and perception has changed frequently. Beginning in the Age of Mechanical Man and ending in the Age of Prozac, our course focuses mainly on ways contemporary society has influenced neuroscientific thought and, in turn, the ways neuroscience has influenced society.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

STS

Comm Points: 1

HIST 490 Independent Study

Designed primarily for an advanced student who wishes to pursue special interests in history for one or more semesters, this series allows students to design and conduct independent study projects under faculty guidance.

Prerequisite: consent of the instructor.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Every Semester

HIST 498 Undergraduate TA

A student assists a faculty member in teaching a course. The student engages in substantial pedagogical work beyond mastery of the course material. Such activities may include mentoring students in course work, leading class discussions, designing and presenting course modules, etc. The primary objective is for the students to work with a faculty member to learn and practice pedagogical approaches in the discipline.

Credits: (1-3), Graded, Semester Calendar

Independent Study, Given When Needed

HIST 499 Minor Portfolio

In this course, students complete their Liberal Arts Minor Portfolios under the direction of their minor advisor. The course is graded on a Pass-No Credit Basis.

Credits: (0), P/NC, Semester Calendar

Independent Study, Every Semester

Honors Program**HP 100 The Social and Ethical Implications of Research I**

This course will provide an opportunity to assess and develop one's own skills in group work, information technology, original research, and project-based learning. As part of the Honors Program, students are expected eventually to pursue their own thesis research and explore cutting-edge issues in science, technology, and society. This course is designed to prepare them to investigate the social and ethical implications of emerging knowledge and its applications. Students will be required to hone their skills in investigation, critical thinking, written and oral communication of complex ideas, working as part of a team, and problem-solving. They will also be expected to

acquire computer competencies necessary for work at Clarkson and eventual research at the University. Prerequisite: Open to Honors Program Students only.

Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Fall Semesters

HP 101 The Social and Ethical Implications of Research II

This course will provide an opportunity to assess and develop one's own skills in group work, information technology, original research, and project-based learning. As part of the Honors Program, students are expected eventually to pursue their own thesis research and explore cutting-edge issues in science, technology, and society. This course is designed to prepare them to investigate the social and ethical implications of emerging knowledge and its applications. Students will be required to hone their skills in investigation, critical thinking, written and oral communication of complex ideas, working as part of a team, and problem-solving. They will also be expected to acquire computer competencies necessary for work at Clarkson and eventual research at the University. Prerequisite: Open to Honors Program Students only.

Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Spring Semesters

HP 102 Introduction to Programming I

This lab section will teach the computer competencies necessary for work at Clarkson and eventual research at the University. Prerequisite: Open to Honors Program Students only.

Credits: (1), Graded, Semester Calendar
Laboratory, Fall Semesters

HP 103 Introduction to Programming II

[Cross-listed with ES 100] This lab section will teach the computer competencies necessary for work at Clarkson and eventual research at the University. Prerequisite: Open to Honors Program Students only.

Credits: (1), Graded, Semester Calendar
Laboratory, Spring Semesters

HP 200 Honors Sophomore

Prerequisite: Open to Honors Program Students only.
Credits: (3), Graded, Semester Calendar
Seminar, Fall Semesters

HP 201 Honors Problem Seminar

Blending consideration of classic texts from the 17th c. to the present with an assessment of contemporary writings, this course examines two, crucial intellectual developments in the modern West. The first is the emergence of then triumph of a mechanistic conception of things. This conception is expressed not only in the West's understanding of the physical universe but also in its perception of social, political, and economic relationships. The second development involves the rise of new concerns with the treatment of both the natural world and human relationships. Triggered in part by a Romantic reaction, this development finds expression in both environmentalism and communitarian movements. Participants in this course should be prepared for substantial reading and writing, ongoing discussions, and some independent research. This satisfies the LS 195 (Great Ideas in Western Culture I) or LS 196 (Great Ideas in Western Culture II) requirement for Honors students. Prerequisite:

Open to Honors Program Students only.
Credits: (3), Graded, Semester Calendar
Seminar, Spring Semesters

HP 280 Honors Independent Study

Designed for Honors Program sophomores who wish to pursue special interests that are consistent with the goals of the Honors Program. This series allows students to design and conduct independent study projects under faculty guidance.

Prerequisites: Consent of the Honors Director is required.
Credits: (1-10), Graded, Semester Calendar
Independent Study, Every Semester

HP 300 Honors Junior Science Seminar

Credits: (3), Graded, Semester Calendar
Seminar, Fall Semesters
UNIV/CGI/CSO

HP 380 Honors Independent Study

Designed for Honors Program juniors who wish to pursue special interests that are consistent with the goals of the Honors Program. This series allows students to design and conduct independent study projects under faculty guidance. Permission of the Honors Director is required.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Every Semester

HP 390 Honors Undergraduate Thesis

Research project to be arranged with the consent of the Honors Research Committee and, typically, a staff member of the student's major department. The faculty director of the project assists the student in the choice of the research problem and the planning and execution of the project.

Credits: (3-10), Graded, Semester Calendar
Research, Every Term

HP 391 Honors Undergraduate Thesis

Credits: (1-9), Graded, Semester Calendar
Research, Every Term

HP 400 Honors Senior Seminar on Modernity

In the late fifteenth and early sixteenth centuries the Modern Age began with a technological revolution that paved the way for our modern vision of the world. These three areas printing, navigational science and cartography, and the military revolution have been credited with ushering in a new world of politics (the nation-state with large standing armies), a new world of knowledge (the Scientific Revolution), a new world of religion (the Reformation), a new social world (the middle class), a new economic world (Capitalism), and what was literally called the New World. These were irreversible changes with global implications. In this class we will explore and compare early technologies to the current state of digital, positioning, and military technology. Prerequisite: Open to Honors Program Students only.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
UNIV/CGI/CSO

HP 480 Honors Independent Study

Designed for Honors Program seniors who wish to pursue special interests that are consistent with the goals of the Honors Program.

This series allows students to design and conduct independent study projects under faculty guidance. Permission of the Honors Director is required.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Every Semester

HP 490 Honors Undergraduate Thesis

A continuation of HP 390. A written thesis is required at the end of the course.

Credits: (3-10), P/NC, Semester Calendar
Research, Every Term

HP 491 Honors Undergraduate Thesis

Credits: (1-9), P/NC, Semester Calendar
Research,

Health Sciences

HS 1,3,5... Health Science Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (1-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

HS 2,4,6... Health Science Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (1-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

HS 200 Health Coaches I: Introduction to Community Healthcare

In a new collaboration with Canton-Potsdam Hospital, HS 200 is the first in a 2-semester sequence that trains students to become Health Coaches in the Potsdam community. Students will attend a weekly 2-hour seminar class in which they learn about key issues in current healthcare policy, management, and delivery. Each week, different healthcare practitioners will discuss a variety of topics, including healthcare delivery challenges in the community, ethical concerns regarding insurance, and heart disease. The end of the course focuses on patient care and skill building. The course will culminate in a group presentation of a case study. By the conclusion of this course, students will be equipped to begin health coaching with continued guidance.

Application required. Contact the instructor for more information.

Credits: (2), Graded, Semester Calendar
Lecture, Fall Terms

HS 210 Health Coaches II: Community Healthcare Practicum

HS210 is the second in a 2-semester sequence that trains students to become Community Health Coaches in the Potsdam area. This course is offered in collaboration with the Canton Potsdam Hospital, part of the St. Lawrence Health System. During this practicum, each student will be assigned a patient to work with and will visit the patient in their home and maintain phone contact. The Health Coach will help the patient manage their health and navigate the healthcare system. The Health Coach will also meet regularly with a Canton-Potsdam Hospital healthcare team to discuss their coaching approach and gain knowledge on how to best manage the particular situation of their patient. All HS210 students must have access to personal transportation. Prerequisites: HS200 and approval of instructor(s).

Requirement: Access to transportation
Credits: (3), Graded, Semester Calendar
Practicum, Given When Needed

HS 220 Medicine & Healthcare Profession Seminar

Organized by the Career Center with assistance of the Pre-Health Advising Coordinator and in consultation with the Clarkson Health Professions Committee Chair, this course meets semi-weekly, and uses the seminar format to bring in human health professionals from a diversity of fields to discuss their professions, including what their professions encompass, the academic and experiential track they followed to become medical professionals, their perspective on the future directions of their fields, and opportunities for Clarkson students to pursue these fields. It will also bring representatives of different professional schools to discuss admission, expenses, and career opportunities.

Credits: (1), P/NC, Semester Calendar
Seminar

HS 405 Experiential Learning in Medicine & Healthcare

This is as an independent study course under the mentorship of a member of the Health Professions committee. The student is required to complete at least 50 hours of work in a health profession setting. The work must include some form of interaction with health professionals and with patients or analogous health-service recipients. Examples include healthcare internships or volunteer positions at a hospital or clinic, completions of HS 210 Health Coaches II, serving as an EMT or emergency first-responder, serving as an athletic trainer. Conducting research with medical applications that does not involve working with patients/ health-service recipients will not meet the requirements for this course. Upon completing the experience, the student will prepare a short (around 3 page) self-reflective essay on what the student did and learned during the experience, and how the experience has affected the student's professional goals and preparation.

Credits: (1), P/NC, Semester Calendar
Independent Study, Fall and Spring Terms

Humanities & Social Sciences

HSS 120 Introducing the Liberal Arts

This course welcomes new Liberal Arts majors to Clarkson with a combination of activities designed to orient them to the disciplines represented in the department (Literature, Philosophy, Film, History, Political Science, Anthropology, Sociology and American Studies), with a particular emphasis on their differing perspectives and ways of thinking critically and solving problems. Students will gain hands-on experience in research methods, and the course will also explore the wide variety of career options open to those who graduate with a Liberal Arts degree. Finally, students will have the opportunity to get to know Clarkson, the North Country, the Liberal Arts faculty and each other better during the course of the semester. Prerequisites: Freshman standing in a Humanities and Social Science major
Credits: (1), Graded, Semester Calendar
Lecture, Fall Semesters

HSS 310 Undergraduate Research

This is an opportunity to work one-on-one with a faculty member on an area of shared interest. It provides a chance to be involved in cutting-edge original research, practice research methods central to the relevant discipline, and become part of the research community in that field. The student will undertake research directed by the

faculty member and related to the faculty member's research agenda, and will document the research through a formal research paper. Undergraduate research may lead to a presentation at Clarkson's RAPS conference, other academic conferences, and/or joint publication.

Requirement: Permission of the instructor
Credits: (1-6), Graded, Semester Calendar
Research, Given When Needed

HSS 410 **Humanities/Social Science Internship**

Students gain experience in applying humanities and social science concepts and methods to issues, problems, or projects in professional contexts that are external to the Department of Humanities and Social Sciences. Internships typically occur during the fall or spring semester, but summer employment and co-op positions also can provide students with an internship experience depending on the type of work done. Students will work closely with a Faculty Supervisor to develop the academic component of the internship, which may take the form of outside readings, journal-writing as well as a major paper, project or exhibit related to or stemming from the work being done in the internship itself. Prerequisite: Consent of the Internship Director in the Department of Humanities and Social Sciences. Open to Humanities and Social Science majors only

Credits: (2-12), Graded, Semester Calendar
Independent Study, Every Semester

HSS 480 **Major Research Seminar**

This senior seminar is the capstone course for all students majoring in Humanities and Social Sciences. Taught every semester by a different member of the HSS faculty, the seminar focuses on broad-based interdisciplinary themes, including, for example, war and peace, poverty and social justice, cross-cultural issues, and the environment. Students will engage in readings and class discussions in preparation for writing their senior research papers. Significant portions of the seminar will be devoted to producing these research papers. Prerequisites: Must be in History, Humanities, Interdisciplinary Social Sciences, Political Science or Sociology, and Junior status.

Credits: (3), Graded, Semester Calendar
Seminar, Every Semester
Comm Points: 2

Humanities

IS 1,3,5... **Information Systems Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

IS 2,4,6... **Information System Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

HUM 490 **Independent Study**

Designed primarily for an advanced student who wishes to pursue special interests in Humanities for one or more semesters, this series allows students to design and conduct independent study projects under faculty guidance.

Prerequisite: consent of the instructor.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Every Semester

HUM 1,3,5... **Humanities Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

HUM 2,4,6... **Humanities Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Humanities Foundation Curriculum Requirement, depending on the specific designator.

Credits: (1-9), Graded, Semester Calendar
Lecture, Transfer Credit Only

Information Systems

IS 110 **Introduction to Business Intelligence and Data Analytics**

[Cross-listed with CS 110] This course is an introduction to the underlying technology components of modern information systems used in businesses. It is important for organizations to utilize technology to collect data and use modern analysis tools and techniques to transform that data into tactical and strategic information. Emphasis is on introducing students to the main building blocks of information systems in organizations, and how such systems can be used to support individual and organizational decision making. Students will gain hands on experience in using data gathering and analysis tools such as Microsoft Excel and Enterprise Resource Planning software. Offered Fall and Spring semesters. Prerequisites: Not open to students who have taken or are taking CS courses numbered 200 or higher or have taken or are taking IS courses numbered 300 or higher, without the permission of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
(TECH)

IS 200 **ERP Fundamentals**

The course serves as an introduction to enterprise resource planning (ERP) concepts and navigation using SAS R/3 software. This course is a co-requisite for non-CUSB or iE&M students taking MK320, OM331, or OS352 who have not taken IS211. Restriction: Students may not receive credit for IS200 as well as IS211.

Credits: (1), P/NC, Semester Calendar
Lecture, Every Semester

IS 211 **Intro to Enterprise Information Systems**

[Cross-listed with EM 211] This course will introduce students to enterprise information systems, their components, integration, and use as part of the business process. The distributed, accurate, real time flow of information is a critical success factor for most organizations. The ability of an organization to collect and analyze this information is crucial in today's data-driven economy. The focus of this course is on the functional and strategic use of enterprise resource planning (ERP) software, its application, input devices, implementation issues and use. Hands-on experience with SAP ERP is integral to this course. Offered fall and spring semesters. Restriction: students may not receive credit for IS200 as well as IS211.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
(TECH)

IS 237 Introduction to Application Development

This course will enable students to gain the knowledge and necessary skills required to develop standard software applications. Students will learn object oriented application development and programming principles and how they are applied through all the stages of software development, from requirements to testing and deployment. Students will learn programming syntax and best programming practices including documenting, testing, and error correction. Offered Spring semesters.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
(TECH)

IS 314 Database Design & Management

[Cross-listed with EM 314] This course provides the student with in-depth knowledge of database analysis, design, and implementation principles. Students who successfully complete this course will be able to use the entity-relationship data model to represent business data requirements, to translate that model into a relational schema, to normalize this schema and to build and use a relational database that implements the schema, using the Standard Query Language (SQL).

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

IS 400 Process and System Analysis and Modeling

Students are expected to master the fundamentals of business process analysis and application design using the traditional and agile analysis and modeling approaches. Students will learn methodologies and project management skills by completing an array of individual assignments that involve planning, design and prototyping of business application systems. A mock prototype software application based on the analysis will be developed throughout the course. Offered Fall semesters. Prerequisites: IS237 or CS141 or EE261

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

IS 415 Data Warehousing for Analytics

[Cross-listed with EM 415] This course covers the fundamental concepts, design, management and application of data warehouses and business/enterprise intelligence systems. Specific topics covered include the logical design of a data warehouse, the data staging area and extraction-transformation-loading process, the design, implementation and utilization of multi-dimensional data analysis systems, as well as key business/enterprise intelligence concepts, processes and techniques including knowledge discovery and exploratory analysis. Offered Fall semesters. Prerequisites: IS314 or CS460/EE468

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

IS 426 Big Data Architecture

This course will enable students to gain understanding of critical components and the processes of big data architecture. The course will take a hands-on approach, enabling students to develop skills for creating data processing pipelines and procedures to transform and integrate structured, semi-structured and unstructured data. The course will provide students with an understanding of web service based systems architecture and best practices for deployment of scalable applications for data analytics. Offered Fall semesters. Prerequisites: IS211, & IS314, & IS237, CS141 or EE261

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

IS 428 Information Systems for Supply Chain Management

This course will be focused on information systems that enable supply chain integration. Redesign of core intra and inter-enterprise business processes will be discussed in detail. Students will be introduced to and will get hands-on experience with latest technologies such as Extended Enterprise Systems. The trend of outsourcing of business and supply chain processes to distant geographical locations and its impact on business practices and strategies will be discussed in detail. Course material will be comprised of book chapters, cases, labs, and project work to apply concepts learned in the course, and to include hands-on experience with business process driven enterprise software (e.g. SAP Advanced Planner & Optimizer). Prerequisite: OM331.

Credits: (3), Graded, Semester Calendar
Lecture, Fall and Spring Terms

IS 437 Data Analytics Project: Planning, Devel, and Data Analysis

This course highlights the development of business intelligence applications which use remote data and web services for the purpose of presentation to organizational decision makers. As an experiential course, students will be required to engage in all stages of planning, analyzing and building a complete connected software application stack for data analytics. Students will use the stack to analyze a real-life data set, delivering insight and recommendations based on the analysis. Offered Spring semesters.

Prerequisites: IS314 and, IS237 or CS141 or EE261

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

IS 487 Special Project in Information Systems

An investigation of a problem or in-depth topic undertaken by the student under the guidance of a faculty member. Permission of the instructor required.

Credits: (1-3), Graded, Semester Calendar
Research, Given When Needed

IS 490 Internship

An unpaid internship that is related to the student's professional goals.

Prerequisite: consent of the instructor.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

IS 999 Special Graduate Topics

A graduate level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (1-10), Graded, Semester Calendar
Lecture, Transfer Credit Only

Information Technology**IT 2 Information Technology Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Technology Requirement.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only
(TECH)

Language

LANG 1,3,5... **Language Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

LANG 2,4,6... **Language Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Humanities Foundation Curriculum Requirement.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

LANG 100 **Introductory French Language**

Credit for this course is awarded only in the following cases: 1) receipt of a score of 5 through 7 on the International Baccalaureate French B Higher-Level Examination or 2) satisfactory completion of a college-level Introductory French course.

Credits: (3), Graded, Semester Calendar

Independent Study, Transfer Credit Only

LANG 101 **Introductory German Language**

Credit for this course is awarded only in the following cases: 1) receipt of a score of 5 through 7 on the International Baccalaureate German B Higher-Level Examination or 2) satisfactory completion of a college-level Introductory German course.

Credits: (3), Graded, Semester Calendar

Independent Study, Transfer Credit Only

LANG 102 **Introductory Italian Language**

Credit for this course is awarded only in the following cases: 1) receipt of a score of 5 through 7 on the International Baccalaureate Italian B Higher-Level Examination or 2) satisfactory completion of a college-level Introductory Italian course.

Credits: (3), Graded, Semester Calendar

Independent Study, Transfer Credit Only

LANG 103 **Introductory Spanish Language**

Credit for this course is awarded only in the following cases: 1) receipt of a score of 5 through 7 on the International Baccalaureate Spanish B Higher-Level Examination or 2) satisfactory completion of a college-level Introductory Spanish course.

Credits: (3), Graded, Semester Calendar

Independent Study, Transfer Credit Only

LANG 104 **Introductory English Language**

Credit for this course is awarded only in the following case: Receipt of a score of 5 through 7 on the International Baccalaureate English B Higher-Level Examination.

Credits: (3), Trans In, Semester Calendar

Lecture, Transfer Credit Only

LANG 110 **Chinese Language and Culture**

An Introductory Language course that covers both Chinese language and culture. No previous knowledge of Chinese language is required. Not open to native speakers of Chinese.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CSO

LANG 111 **Japanese Language and Culture**

Credit for this course is awarded only in the following cases: 1) receipt of a score of 5 or 6 on the AP Japanese Language & Culture Examination or 2) satisfactory completion of a comparable college-level course that covers both Japanese language and culture.

Credits: (3), Graded, Semester Calendar

Independent Study, Transfer Credit Only

CSO

LANG 112 **Spanish Language and Culture**

An Introductory Language course that covers both Spanish language and culture. No previous knowledge of Spanish language is required. Not open to native speakers of Spanish.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CSO

LANG 150 **Intermediate French Language**

Credit for this course is awarded only in the following cases: 1) receipt of a 4 or 5 on the AP French Language Exam, 2) receipt of a score of 5 through 7 on the International Baccalaureate French A1 or A2 Higher-Level Examination, or 3) satisfactory completion of a college-level Intermediate French course.

Credits: (3), Graded, Semester Calendar

Independent Study, Transfer Credit Only

CSO

LANG 151 **Intermediate German Language**

Credit for this course is awarded only in the following cases: 1) receipt of a 4 or 5 on the AP German Language Exam, 2) receipt of a score of 5 through 7 on the International Baccalaureate German A1 or A2 Higher-Level Examination, or 3) satisfactory completion of a college-level Intermediate German course.

Credits: (3), Graded, Semester Calendar

Independent Study, Transfer Credit Only

CSO

LANG 152 **Intermediate Italian Language**

Credit for this course is awarded only in the following cases: 1) receipt of a 4 or 5 on the AP Italian Language & Culture Exam, 2) receipt of a score of 5 through 7 on the International Baccalaureate Italian A1 or A2 Higher-Level Examination, or 3) satisfactory completion of a college-level Intermediate Italian course.

Credits: (3), Graded, Semester Calendar

Independent Study, Transfer Credit Only

CSO

LANG 153 **Intermediate Spanish Language**

Credit for this course is awarded only in the following cases: 1) receipt of a 4 or 5 on the AP Spanish Language Exam, 2) receipt of a score of 5 through 7 on the International Baccalaureate Spanish A1 or A2 Higher-Level Examination, or 3) satisfactory completion of a college-level Intermediate Spanish course.

Credits: (3), Graded, Semester Calendar

Independent Study, Transfer Credit Only

CSO

Literature

LIT 1,3,5... **LIT Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

LIT 2,4,6...**LIT Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Humanities or Social Science Foundation Curriculum Requirement, depending on the specific designator.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

LIT 101**Literature & Writing**

Credit for this course is awarded only in the following cases: 1) receipt of a score of 4 or 5 on the AP English Literature & Composition Exam; 2) receipt of a score of 5 through 7 on a designated International Baccalaureate Higher Level Examination; or 3) satisfactory completion of an approved college-level course. The University Registrar in Student Administrative Services maintains the current lists of the designated IB Exams and approved college-level courses.

Credits: (3), Graded, Semester Calendar
Lecture, Transfer Credit Only

IA

Comm Points: 1

LIT 102**French Literature**

Credit for this course is awarded only in the following cases: 1) receipt of a score of 4 or 5 on the AP French Literature Examination or 2) satisfactory completion of a third-year college French Literature course.

Credits: (3), Graded, Semester Calendar
Independent Study, Transfer Credit Only
UNIV/CSO/IA

LIT 103**The Works of Vergil**

Credit for this course is awarded only in the following cases: 1) receipt of a score of 4 or 5 on the AP Latin: Vergil Examination or 2) satisfactory completion of a third-year college Latin Literature course that focuses on the works of Vergil.

Credits: (3), Graded, Semester Calendar
Independent Study, Transfer Credit Only
UNIV/CSO/IA

LIT 104**Latin Literature**

Credit for this course is awarded only in the following cases: 1) receipt of a score of 4 or 5 on the AP Latin: Literature Examination or 2) satisfactory completion of a third-year college Latin Literature course.

Credits: (3), Graded, Semester Calendar
Independent Study, Transfer Credit Only
UNIV/CSO/IA

LIT 105**Spanish Literature**

Credit for this course is awarded only in the following cases: 1) receipt of a score of 4 or 5 on the AP Spanish Literature Examination or 2) satisfactory completion of a third-year college Spanish Literature course.

Credits: (3), Graded, Semester Calendar
Independent Study, Transfer Credit Only
UNIV/CSO/IA

LIT 106**Chinese Literature**

Credit for this course is awarded only in the following case -- Receipt of a score of 5 through 7 on the International Baccalaureate Chinese A: Literature Higher-Level Examination
Credits: (3), Trans In, Semester Calendar
Lecture, Transfer Credit Only

LIT 200**Introduction to Literature**

[Formerly LF200] This course introduces students to the three major literary genres: poetry, drama, and fiction. In addition, students explore various critical approaches to literature as they read, discuss and write about representative works.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

IA

Comm Points: 1

LIT 220**American Literature I**

[Formerly LF230] This course will survey American literature, from its roots in Colonial America through the nineteenth century. Early writers, such as America's first woman poet, Anne Bradstreet, and political writers, such as Thomas Paine and Benjamin Franklin, will be covered as well as nineteenth-century literary giants such as Edgar Allan Poe, Ralph Waldo Emerson, Henry David Thoreau, Nathaniel Hawthorne, Herman Melville, Emily Dickinson, and Walt Whitman. The focus of the course will be on the way these major writers helped shape the American literary tradition during America's formative years.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

IA

Comm Points: 1

LIT 221**American Literature II**

[Formerly LF231] This course will survey the poetry, drama, and fiction of twentieth-century American literature. Students will examine the revolution in modern literature reflected in the works of poets (such as Robert Frost, T.S. Eliot, and Wallace Stevens), fiction writers (such as Ernest Hemingway and William Faulkner), and dramatists (such as Eugene O'Neill and Tennessee Williams). The course will also introduce students to contemporary writers, such as Sylvia Plath, Philip Roth, Amy Tan, and Joyce Carol Oates.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

IA

Comm Points: 2

LIT 222**Philosophy for Life**

[Cross-Listed as PHIL 222] In this course, we will learn to think philosophically (which is to say: critically, rigorously, and reflectively) about complex and difficult questions. We will study practical life philosophies from both the Eastern and Western traditions, from the Tao Te Ching to Marcus Aurelius, and from Plato to the Dalai Lama. We will reflect on the ontological, epistemological, rhetorical, and ethical perspectives of each of these philosophers and schools of thought. We will note striking similarities and important distinctions between them. Ultimately, we will reflect on our own life philosophies as well—each of us refining our personal life philosophy through reading, reflection, and discussion of these classic texts from the wisdom literature tradition.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CGI/IG
Comm Points: 1

LIT 225 **American Short Story**

[Formerly LF351] Seeing short fiction as a distinct art form, this course will introduce students to selected masters of the short story. It will include works of short fiction by established authors as well as contemporary ones, and it will include stories by ethnic and racial minorities. It will introduce students to the key elements of fiction, such as character, theme, point of view, and symbolism, as a way to help students evaluate and interpret literature. Occasionally, filmed versions of short stories will be used for comparison.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
IA
Comm Points: 1

LIT 226 **Modern Fiction**

This course focuses on fiction of the 20th and 21st centuries. We will explore literary challenges to previous ways of writing and understanding the world. Typical topics include modernism and postmodernism, science fiction, magic realism, and the graphic novel.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
IA
Comm Points: 1

LIT 227 **Tales from the Tropics**

This course will examine short stories from Southeast Asian. Students will read and engage with texts by writers from Burma, Cambodia, Indonesia, Laos, Malaysia, Negara Brunei Darussalam, Singapore, Thailand, the Philippines, and Vietnam. We will explore topics such as race, family, tradition, modernity, marginality, displacement, intergenerational conflict, religion, and resistance. We will also pay close attention to the intended audience, implied author, and historical and cultural contexts of the texts.

Credits: (3), Graded, Semester Calendar
Lecture
UNIV/CSO/IA
Comm Points: 1

LIT 229 **American Weird Fiction**

This course will introduce students to that curious type of fiction known as "weird fiction" (also sometimes called slipstream fiction), which overlaps with a number of other genres such as science-fiction, fantasy, and horror. Weird stories often lack an explanation for the strange events they depict, and so the genre offers writers and readers a new perspective on the sometimes odd world in which we find ourselves. The course will introduce students to the most important American authors of weird fiction from the 20th and 21st Centuries, included H.P. Lovecraft, Joyce Carol Oates, Caitlin R. Kiernan, Thomas Ligotti, and Laird Barron.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
IA
Comm Points: 1

LIT 230 **Monsters in the House**

To label something monstrous may be to identify a primal source of fear or to construct a social barrier, deliberately marginalizing people who do not fit into the mainstream. This course explores portrayals of the monstrous across centuries, considering how they reflect and shape social norms. Texts may include, for example, fairy tales, Disney movies, horror films, and dystopian novels.

Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Semesters
IA
Comm Points: 1

LIT 235 **Science Fiction**

Introduction to the genre of science fiction and, more broadly, speculative fiction as well as a survey of representative literary texts, including readings from such writers as Philip K. Dick, Margaret Atwood, Octavia Butler, and Orson Scott Card. Works of speculative fiction often serve as an allegory for, or social commentary of, existing cultural views and social structures. The genre's focus on imagining other worlds and alternative realities make it particularly well-suited for viewing our own biases, prejudices, and social assumptions through the mirror of alien cultures.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
IA
Comm Points: 1

LIT 239 **Modern American Poetry**

[Formerly LF361] This course will examine the great revolution in the arts that initiated the great revolution in poetry around 1912, ushering in the period known as modernism. It will examine the poetry and impact of such modern masters as T.S. Eliot, Robert Frost, William Carlos Williams, Wallace Stevens, and Marianne Moore. In addition, it will examine the contributions made by a later generation of poets, including John Berryman, Elizabeth Bishop, and Richard Wilbur, as well as established and new voices writing today.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
IA
Comm Points: 1

LIT 240 **Gender and Popular Culture**

This interdisciplinary multi-media course explores the ways conceptions of gender are constructed and challenged by popular culture, including literature, film, TV, and advertising. It considers the complex ways in which social perceptions of gender intersect with constructions of race, class, and sexuality to affect relations of power. It looks at pop culture not simply as entertainment but as something that contributes to collective identities and influences our ways of seeing ourselves and others, often unconsciously. And it explores means of 'talking back,' challenging dominant portrayals of gender to open up more liberating possibilities for imagining selves.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CGI/IA
Comm Points: 1

LIT 250 **World Literature**

An introduction to representative works of world literature, other than British and American, including fiction, poetry, drama and film.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed
UNIV/CSO/IA
Comm Points: 1

LIT 251 **Understanding Vietnam**

Understanding Vietnam will examine Vietnamese history and culture (with particular attention to Vietnam's 20th century conflicts with France and the United States), primarily as those conflicts are manifested in literature, film, and autobiography. It will also provide a historical context for the conflicts as well as look at the social repercussions in the US and the West. Using an interdisciplinary approach, LIT 251 will provide a cultural and historical context for a divisive episode in American history, one which continues to affect both Vietnamese and American societies to the present day.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CSO/IA

LIT 253 **Greek Mythology**

This course will explore the beginnings of Greek culture through its myths, recorded primarily in Homer, Hesiod, the Greek dramatists of the 5th century BCE, and by later writers of the classical period, such as Apollonius of Rhodes, the Roman poet Ovid, and mythographers such as Apollodorus. As important as this rich textual record is the physical evidence of ancient Greek society. Since the late nineteenth century, archaeological excavations of sites associated with the ancient myths have steadily increased our understanding of their meaning and significance, as well as their relationship to ancient Greek religion and ritual. Finally, visual representations of the figures from myth and legend, found in vase paintings and sculptures, are essential to our full comprehension of the role of myth in the lived lives of Greeks.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CSO/IA
Comm Points: 2

LIT 255 **Close Encounters of the X Kind**

This course will examine Anglophone plays and other plays in English translation. The selected texts revolve around close encounters with the unknown or the foreign, and the impacts of such encounters on all parties involved. The course will expose students to different cultures and theatrical traditions, with playwrights hailing from, among others, Kenya, South Africa, Indonesia, India, the Caribbean, and Ireland. Possible readings might include Wole Soyinka's *Death and the King's Horseman*, Athol Fugard's *Boesman and Lena*, Arifin C. Noer's *Moths*, Girish Karnad's *Tughlaq*, Derek Walcott's *Dream on Monkey Mountain*, and Brian Friel's *Translations*.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CSO/IA
Comm Points: 1

LIT 260 **Introduction to Poetry**

[Formerly LF360] This course is designed to introduce students to the pleasures of poetry. It is intended not only for students who already appreciate poetry, but also for those students who fear or dislike it. The course will teach students how to read poetry for both enjoyment and understanding. It will introduce students to the nature and variety of poetry as well as provide them with a few primary concepts

on how to evaluate it. As an introduction to poetry, the course will help students to find 'the real toads' (reality) in 'imaginary gardens' (poems).

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
IA
Comm Points: 1

LIT 262 **Women Acting Out**

This course will examine dramatic texts by women playwrights. The selected texts revolve around issues pertinent to gender and women's issues such as family, love, employment, empowerment, and abuse/violence. Students will read and engage with plays from different cultures and theatrical traditions, and with playwrights hailing from Argentina, England, India, Indonesia, and the United States. Possible readings include Caryl Churchill's *Top Girls*, Griselda Gambaro's *Antigona Furiosa*, Maria Irene Fornes' *Conduct of Life*, Mahasweta Devi's *Bayen*, Ntozake Shange's *For colored girls*, Sarah Daniels's *The Gut Girls*, Susan Glaspell's *Trifles*, Spiderwoman Theater's *Sun, Moon, and Feather*, and Tsitsi Dangarembga's *She No Longer Weeps*.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CSO/IA
Comm Points: 1

LIT 265 **Creative Writing**

[Formerly LF365] This course is designed to introduce students to the main genres of imaginative writing and the basic techniques of those genres. Students will work primarily within the genres of fiction and poetry, though the course will also include brief sections on drama and memoir. Coursework will consist of reading examples and producing exercise in fiction, poetry, and (optionally), drama or memoir. The goal of the course is to make students familiar with the techniques of literary practice and to provide hands-on experience using those techniques.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Semesters
IA
Comm Points: 2

LIT 270 **Comics of Conscience**

Comics of Conscience will examine graphic novels or book-length comics which raise important social and political issues. It will explore how graphic novels are built and told—we will learn to use a conceptual vocabulary so we can discuss how the graphic novel achieves its objective of obtaining the reader's attention and engagement. We will learn how to read them, how to talk about how they get made and how they work, how to understand—and how to enjoy—some of the kinds of comics and graphic novels. Emphasis in our studies will examine the co-mixing of genres within telling a visual story: we will look at journalism comics, memoir comics, realistic fiction comics, and fantasy comics. The overall objective is to learn how to read graphic novels—e.g., how to understand the way the verbal and the non-verbal/graphic work together—and how to write about them.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CSO/IA
Comm Points: 1

LIT 310 **Imagining the Sacred**

Imagining the Sacred will examine the literature of East Asia and the Subcontinent that emerge directly from the religious and spiritual traditions of Hinduism, Buddhism, Taoism and related doctrines. In addition to understanding the origins and development of these literatures, the course will seek to make connections to their development and transformation in the context of modernism and globalization. To that end, the course will include a wide range of modern as well as ancient texts, including stories, poems, film, comics, and web-based media.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

IA

Comm Points: 1

LIT 323 **American War Fiction**

This course will examine fiction written about American wars. These works will enable us to investigate how imagination responds to the problem of war. As novelist and veteran Tim O'Brien represents this problem: In any war story, but especially a true one, it's difficult to separate what happened from what seemed to happen; In many cases, a true war story can't be believed. The truth of war is, of course, as myriad as the authors who write about it. We will investigate how novelists such as Joseph Heller and Kurt Vonnegut who served into wars transform their experience into fiction of remarkably different types. Similarly, we will examine how war, specifically the Civil War, furnishes a fictional subject to such contemporary writers as E. L. Doctorow and Michael Schaara. Such different accounts of war enable us to look more closely at war, truth, and the creative process.

Credits: (3), Graded, Semester Calendar

Lecture

IA

Comm Points: 1

LIT 324 **Literature of American Popular Music**

The course will examine the interactions between different forms of American popular music and American literature. Music and literature will be considered in historical and cultural context. Students will read works of fiction, poetry, and drama that deal with popular music, as well as sociological discussions of American popular music. A key part of the course will be listening to and seeking to understand key examples of several genres of American popular music, from folk ballads and parlour songs, through blues and jazz, to rock music and beyond.

Credits: (3), Graded, Semester Calendar

Lecture

UNIV/CSO/IA

Comm Points: 1

LIT 325 **Greek Drama**

Greek drama has given western society some of its most powerful and enduring ideas. The iconic figures of Oedipus, Antigone, and Prometheus are unforgettable examples of self-knowledge and of the interdependence of individual and community responsibilities. Dramatic performances in the west first appeared in the classical period in Athens – from around 500 CE. As the century progressed, the plays became more complex, both structurally and thematically, and more reflective of changes in Athenian society. In this course students will read several Greek tragedies and comedies and explore them from a literary, cultural, and continuing perspective.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CSOIA

Comm Points: 1

LIT 328 **African-American Literature**

[Formerly LF335] This course will survey African-American novelists, dramatists, and poets of the twentieth century in their social and political context and in their own sense of their literary tradition. It will begin, however, by looking back, (to the slave narrative of Frederick Douglass for instance), before moving into the four stages, broadly speaking, of African-American literature: The Harlem Renaissance: 1915-1935 (e.g., Zora Neale Hurston, Langston Hughes, Alain Locke); The Age of Protest: 1935-1955 (e.g., Richard Wright, James Baldwin, Gwendolyn Brooks); African-American Militant Literature: 1955-1970 (e.g., Amiri Baraka, Ishmael Reed, Nikki Giovanni); and Literature by African-American Women: 1970-1991 (e.g., Alice Walker, Toni Morrison, Toni Cade Bambara, Maya Angelou). Because in the 1950s and 1960s there is a 'rediscovery' of Africa, the survey will also include such influential African writers as Chinua Achebe. The course will be conducted as an exploration, mainly in class discussions, but also in formal written analysis, of some of the most powerful literature of this century.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Fall Semesters

UNIV/CSO/IA

Comm Points: 1

LIT 329 **Modern & Contemporary African American Fiction**

This course surveys the work of African American writers from the mid-twentieth century to the present. By close reading of representative texts, students explore the development of African American prose fiction from the naturalism of Richard Wright to the experimental work of Ishmael Reed to the post-modern work of Charles Johnson and Colson Whitehead. The course situates each work in its socio-historic context and explores the interaction of representational style and themes. In particular, the course focuses on how African American male writers negotiate identity and manhood in their fictional worlds. Readings may include texts by Wright, Himes, Baldwin, Reed, Gaines, Bambara, Butler, Morrison, Johnson, Wideman, Mosely, and Whitehead.

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Semesters

UNIV/CSO/IA

Comm Points: 1

LIT 335 **Violence and Reconciliation**

[Cross-listed with POL 335] While scholars have labeled the 20th century 'the century of genocide,' the past two decades have catalyzed global changes in the ways we think about peace-building and reconciliation. But reconciliation after mass conflict remains a difficult process. Can you forgive someone who has done irreparable harm to you or your loved ones? Can you reconcile -literally, return to a previous state of harmony- with someone if you never shared a harmonious relationship with that person? Is reconciling with a whole community the same as reconciling with an individual? This course examines the challenges to reconciliation after political trauma and assesses the strengths and weaknesses of major reconciliation mechanisms. Through the lens of two case studies, South Africa and Northern Ireland, and the disciplines of film, fiction, and political theory, students will compare the consequences of criminal trials,

truth commissions, and informal efforts at communal healing. As a final project, the class will participate in a simulation of negotiations for reconciliation in the aftermath of a nationwide conflict.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

UNIV/CGI/IA

Comm Points: 1

LIT 353 **African Literature**

A study of African literary works from the 19th century, to the present. In this course, students will read memoirs, songs, stories, novels, poems, and plays written by authors from the continent of Africa, considering thematic and stylistic trends and transformations over time.

Credits: (3), Graded, Semester Calendar

Lecture

UNIV/CSO/IA

Comm Points: 1

LIT 355 Power, Exploitation, and Freedom: Postcolonial Literature

Colonialism is the process of one country taking political, economic, and cultural control of another country. From the 15th-20th centuries, European countries colonized swathes of Asia, Africa, and South and Central America. They exploited the economic resources of those countries, subjugated their populations, and labeled indigenous cultures "inferior." In the mid-20th century, independence movements led to the decolonization of many countries and gave rise to an important body of literature. Postcolonial literature explores the effects of colonialism and challenges the misrepresentation of colonized countries by colonizing powers. It helps readers understand the cultures of colonized countries, their fight for independence, and their evolution after decolonization. This course examines postcolonial literature from a wide range of countries and cultures, including India, Nigeria, South Africa, and the Caribbean.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

IA

Comm Points: 1

LIT 365 **Advanced Creative Writing**

This course is designed to further develop students knowledge of and interest in imaginative writing. This course will focus on building deep understanding of literary devices, forms, and techniques used in creative writing. Students will spend time doing close readings and analysis of works of literature and crafting their own original work. The course will be focused primarily on the genres of poetry and creative non fiction. Prerequisite: 1 other LIT course or permission of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

IA

Comm Points: 2

LIT 380 **Shakespeare's Game of Thrones: Blood, Lust, and Power**

[Formerly LF480] While Shakespeare's plays are unquestionably part of our literary heritage, there were also written by a practical man of the theater who was fully engaged in the changing culture of late Elizabethan and early Jacobean England. During the semester, students will read Shakespeare's plays for their literary values and

their theatrical values, while placing them specifically in their historical context. Class discussion will involve literary analysis, questions or effective staging and stage history, and the most pressing social and political issues of Renaissance England. Students will read, see, and hear a representative selection of plays.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

IA

Comm Points: 2

LIT 490 **Independent Study**

[Formerly LF490] Designed primarily for an advanced student who wishes to pursue special interests in literature for one or more semesters, this series allows students to design and conduct independent study projects under faculty guidance.

Prerequisite: consent of the instructor.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Every Semester

LIT 499 **Minor Portfolio**

[Formerly LF499] In this course, students complete their Liberal Arts Minor Portfolios under the direction of their minor advisor. The course is graded on a Pass-No Credit basis.

Credits: (0), P/NC, Semester Calendar

Independent Study, Every Semester

Law

LW 1,3,5... **Law Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Discussion, Transfer Credit Only

LW 2,4,6... **Law Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Business Foundation Curriculum Requirement.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

LW 270 **Law and Society I**

A course designed to provide a basic understanding of (1) the nature, functions and limitations of law and legal systems; (2) the basic relationship among justice, ethics, legal systems and social structure; and (3) the relationship among society, law and business activity. Further, it is designed to enlighten with respect to rules, principles, standards and doctrines of law fundamental to a free enterprise system. The course covers the substantive areas of constitutional law, torts, contracts, and property and estate law. Prerequisite: at least sophomore standing.

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

LW 352 **Reading for the Law: Legal Issues Through Non-Fic Lit**

Understanding "black letter law" is but one window in to legal understanding. In order to contextualize the law, we must understand the social and political issues which have given rise to, and are affected by, the statutes and judicial decisions that shape our legal

system. Prerequisites: LW270
 Credits: (3), Graded, Semester Calendar
 Lecture, Even Spring Terms
 CGI
 Comm Points: 1

LW 466 **The Law of the Workplace**

This course is designed to review areas of law affecting the workplace both from the perspective of the employer as well as the employee. The students will study the environment of the workplace from a legal perspective. Topics will include the National Labor Relations Act and the jurisdiction of the National Labor Relations Board, the rights and obligations of management and labor under the Act. The course will also review the law which governs the public employer in the form of federal, state and local governments. Finally, the course will review other areas of law which affect the workplace such as the doctrine of 'employment at will,' Worker's Compensation and Disability Law, Social Security Law, the law governing discriminatory practices, the Americans with Disabilities Act, the law of the Occupational Safety and Health Agency and developing topics such as drug testing in the workplace and pay equity issues. Prerequisites: LW270 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
 Lecture, Fall Semesters

LW 471 **Law and Society II**

A continuation of LW 270, including the substantive areas of agency law, business organizations (including the law of partnerships, corporations and the limited liability company), negotiable instruments, sales and secured transactions. Prerequisite: LW270.

Credits: (3), Graded, Semester Calendar
 Lecture, Spring Semesters

LW 487 **Special Project in Law**

An investigation of a problem or in-depth topic undertaken by the student under the guidance of a faculty member.

Prerequisites: Permission from the instructor.

Credits: (1-3), Graded, Semester Calendar
 Independent Study, Given When Needed

LW 490 **Internship**

An unpaid internship that is related to the student's professional goals.

Prerequisite: consent of the instructor.

Credits: (1-3), Graded, Semester Calendar
 Independent Study, Given When Needed

LW 499 **Law Studies Minor Portfolio**

A student completing the Law Studies Minor will compile a portfolio that manifests his or her learning experience in the minor. In this course, students complete their Law Studies Minor portfolio under the direction of their minor advisor. The course is graded on a Pass-No Credit basis.

Credits: (0), P/NC, Semester Calendar
 Independent Study, Given When Needed

Mathematics

MA 1,3,5... **Mathematics Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may not be used to

satisfy the requirements of the Mathematics or Applied Mathematics and Statistics major. Check with major department to determine whether credits count toward graduation.

Credits: (2-4), Graded, Semester Calendar
 Independent Study, Transfer Credit Only

MA 2,4,6... **Mathematics Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy the requirements of the Mathematics or Applied Mathematics and Statistics major.

Credits: (2-4), Graded, Semester Calendar
 Independent Study, Transfer Credit Only

MA 30 **Introductory Mathematics Summer Program**

This course is intended primarily as a preparation for students who will be starting their Clarkson careers in MA 180, Introduction to College Mathematics. Course topics include: a brief review of elementary algebra, linear, quadratic, exponential, logarithmic, and trigonometric functions. The course emphasizes an applied approach to all topics through real-life examples. You should check with your major department to determine whether this course can be used to satisfy your degree requirements in specific majors.

Credits: (3), Graded, Semester Calendar
 Lecture, Summer Semesters

MA 31 **Pre-Calculus Mathematics**

This course is a comprehensive review of the high school level mathematics whose mastery is necessary for success in calculus. Topics include: Elementary algebra, geometry and trigonometry; coordinate geometry; linear, quadratic, trigonometric, exponential and logarithmic functions. Check with major department to determine whether credits count toward graduation.

Credits: (3), Graded, Semester Calendar
 Lecture, Fall and Summer Semesters

MA 41 **Co-Calculus Mathematics**

This course provides support for students in Calculus I by reviewing topics from algebra, functions, geometry and trigonometry as they are being used in calculus. Enrollment is by invitation of the Mathematics Department. Check with major department to determine whether credits count toward graduation. Corequisite: MA 131

Credits: (2), Graded, Semester Calendar
 Lecture, Fall Semesters

MA 42 **Co-Calculus II**

This course provides help sessions for students in Calculus II by reviewing carefully selected examples as the corresponding topics are being studied in calculus. Review of background topics from Calculus I will also be included as needed. Enrollment is by invitation of the Mathematics Department. Given Pass/No Credit only.

Credits: (0), P/NC, Semester Calendar
 Discussion, Spring Semesters

MA 120 **Introduction to STEM Mathematics**

Prepares students for Calculus and higher mathematics in the science, technology, and engineering majors. Topics include algebraic concepts, lines and quadratic equations; functions; exponential and logarithmic functions and equations, trigonometry and trigonometric functions, identities and equations; systems of equations and

inequalities. This course will focus on illustrating these mathematical topics from pre-calculus within the context of applications taken from the sciences and engineering. Restriction: This course is not available for students who already have credit for any one of the following: MA 131, MA 132, or MA 181. Students may not receive credit for both MA 120 and MA 180.

Credits: (4), Graded, Semester Calendar
Lecture, Discussion, Fall Semesters

MA 131 **Calculus I**

Functions and graphs; derivative concept and formulas, including chain rule and implicit differentiation; integral concept; the Fundamental Theorem of Calculus; properties and applications of the derivative, including max-min problems and graph sketching; exponential, logarithmic, and inverse trigonometric functions.

Prerequisites: high school algebra and trigonometry. Corequisite: MA 41

Credits: (3), Graded, Semester Calendar
Lecture/Discussion, Every Semester

MA 132 **Calculus II**

A continuation of MA 131. Properties and applications of the integral, including areas, volumes, arc length and differential equations; integration techniques, including parts, partial fractions, trigonometric substitution, and numerical integration; indeterminate forms; improper integrals; infinite series and Taylor series; introduction to polar coordinates, complex numbers, and parametric equations. Prerequisite: MA131

Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Every Semester

MA 180 **Introductory College Mathematics**

Review of basic algebra and functions, differences, an introduction to discrete calculus, rates of growth, introduction to the derivative. This course is not available for students who already have credit for any one of MA131, MA132, or MA181. Restriction: Not open to students who have taken, or are taking MA120, MA181, MA131, or MA132

Credits: (4), Graded, Semester Calendar
Lecture, Discussion, Fall Terms

MA 181 **Basic Calculus**

The fundamentals of differential calculus with applications to business, life and social sciences, optimization, the fundamental theorem of calculus, introduction to the concept of the integral. Prerequisites: MA180 or MA120

Credits: (3), Graded, Semester Calendar
Lecture/Discussion, Spring Terms

MA 200 **Introduction to Mathematical Modeling and Software**

Introduction to the use of mathematics in solving real-life problems. Basics of using mathematical software (such as MATLAB and Maple) to apply calculus and other methods. Group projects. Communication skills including ethical considerations, presentation and mathematical exposition. Introduction to mathematical professions.

Prerequisite: MA131.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

MA 211 **Discrete Mathematics and Proof**

A transitional course between the technique-oriented lower-level courses and the concept-oriented upper-level courses in both

mathematics and computer science. Topics include logic, quantifiers, proof techniques (including mathematical induction), integers, sets, functions, equivalence relations, and basic combinatorics. A major emphasis of the course is learning to write mathematical proofs. This course is intended for students majoring in Mathematics, Computer Science, and related fields. Prerequisites: MA132

Credits: (3), Graded, Semester Calendar
Lecture, Every Term
Comm Points: 2

MA 230 **3-D Space and Projective Geometry**

An introduction to the mathematics of 3 dimensional space, including vector functions, elementary vector calculus and partial derivatives, introductory projective geometry especially as applied to projections of 3-D images on two dimensional media, translations, rotations and an introduction to their matrix representations. A student may not receive credit for both MA230 and MA231. MA231 satisfies any requirement for MA230. Prerequisite: MA131

Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Spring Terms

MA 231 **Calculus III**

Vectors and vector-valued functions; functions of several variables; partial differentiation, including the chain rule, gradients, and maxima and minima; multiple integration, including polar, cylindrical, and spherical coordinates; vector calculus, including Green's, Divergence, and Stokes's Theorems. A student may not receive credit for both MA230 and MA231. MA231 satisfies any requirement for MA230. Prerequisites: MA132

Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Every Semester

MA 232 **Elementary Differential Equations**

Solutions and applications of first-order differential equations and linear differential equations with constant coefficients. Laplace transform methods. Introduction to matrix algebra, systems of algebraic equations, eigenvalues and eigenvectors, with application to systems of differential equations. Other topics may include modeling, engineering applications or numerical methods. Prerequisites: MA132

Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Every Semester

MA 239 **Elementary Linear Algebra**

Introduction to matrices and matrix operations, Linear systems of equations, Elementary treatment of eigenvalues, parameter estimation by least squares, Introduction to linear programming, MATLAB will be used throughout (Instruction in MATLAB is included.) Prerequisites: MA 131 or MA181

Not open to Mathematics or Applied Math and Stats majors; not open to students who have taken or are taking MA 232 or MA 339

Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Terms

MA 277 **Elementary Numerical Methods**

An introductory course on numerical methods as applied in scientific computing. Topics include application of Taylor polynomials and representations of functions, numerical calculus, solving linear systems, and interpolation. Optional topics may include numerical solution of differential and difference equations and solutions to nonlinear equations. This course is intended for students outside of

engineering/math/physics that seek to expand their skill set in applying computational tools. Students may not receive credit for both MA277 and MA377. Prerequisites: MA239, and MA230 or permission of the instructor

Not open to students who have credit for MA377

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Terms

MA 300 Seminar in Actuarial Mathematics

Seminar for students with interest in an actuarial career. Especially recommended for those preparing for the actuarial exams.

Requisite: Permission of the Instructor

Credits: (1), Graded, Semester Calendar

Seminar, Given When Needed

MA 301 Mathematics Elective

An upper-division mathematics course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy the requirements of the Mathematics or Applied Mathematics and Statistics major or the Mathematics minor.

Credits: (3-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

MA 311 Abstract Algebra

A study of mathematical systems, including an introduction to the theory of groups, rings, ideals and fields. Polynomials over a field; matrix polynomials. Prerequisites: MA211

Credits: (3), Graded, Semester Calendar

Lecture, Odd Fall Semesters

Comm Points: 1

MA 313 Abstract Linear Algebra

A proof-oriented introduction to linear algebra. Vector spaces, linear transformations, determinants, eigenvalues, canonical forms and inner-product spaces. Prerequisites: MA211 and MA339.

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Semesters

Comm Points: 1

MA 314 Number Theory and Its Applications

Divisibility; the fundamental theorem of arithmetic; linear diophantine equations; fundamentals of congruences; prime numbers and factoring; the theorems of Fermat and Wilson; quadratic residues. Additional topics may include arithmetic functions, the Mobius inversion formula; geometric number theory; partitions; continued fractions; primality testing and factoring; applications to crystallography and cryptography. Prerequisites: MA211

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

Comm Points: 1

MA 321 Advanced Calculus I

A rigorous course in analysis on the real line and calculus of functions of one variable. Prerequisites: MA231 and MA211

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

Comm Points: 1

MA 322 Advanced Calculus II

Continuation of MA321 and extension to functions of several variables. Prerequisites: MA321

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

Comm Points: 1

MA 330 Advanced Engineering Mathematics

Introduction to linear algebra. Review of ordinary differential equations and Laplace transforms; ordinary boundary value problems. Fourier analysis; overview of partial differential equations. Introduction to probability and statistics. Modeling and applications to engineering problems will be emphasized throughout. This course is intended principally for Mechanical and Aeronautical Engineering majors; not open to Mathematics majors. Prerequisites: MA231 and MA232

Credits: (3), Graded, Semester Calendar

Lecture, Discussion, Fall and Spring Terms

MA 331 Fourier Series and Boundary Value Problems

Review of ordinary boundary value problems. Fourier series and integral. Derivation of heat, wave and potential equations with boundary and initial conditions. Solution by separation of variables. Additional topics may include multidimensional problems, Bessel functions, Laplace transforms, numerical methods. Prerequisites: MA231 and MA232

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

MA 332 Intermediate Differential Equations

Theory of linear differential equations; oscillation and boundedness. Nonlinear differential equations: stability, phase-plane analysis, exact solutions. Additional topics may include control theory, theory of first-order equations, singularities. Prerequisites: MA231 and MA232

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

MA 339 Applied Linear Algebra

This course is an introduction to matrices and linear algebra with applications in engineering and science. Algebra of matrices and systems of linear algebraic equations. Rank, inverse, eigenvalues, eigenvectors, vector spaces, subspaces, basis, independence, orthogonal projection, determinant. Other topics may include: systems of differential equations, numerical methods, linear programming. Prerequisites: MA132;

MA230/231 recommended but not required

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

MA 345 Automata Theory and Formal Languages

[Cross-listed with CS 345] This course gives an introduction to formal languages and their relation to automata. Topics include deterministic and non-deterministic finite automata, regular expressions and languages, closure properties and decision procedures for context-free languages, recursive and recursively enumerable sets, Turing machines, and decidability. Some aspects of computational complexity may also be explored. Prerequisites: CS 142, EE262, or EE361, and MA211

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

MA 362 **Complex Analysis with Applications**

Complex numbers and functions, conformal mapping and applications, derivative, Cauchy-Riemann equations, real and complex line integrals, Fundamental Theorem, Cauchy and Poisson formulas, Taylor series, analytic continuation, special functions, Laurent series, residues. Applications to partial differential equations. Prerequisites: MA231

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

MA 363 **Mathematical Modeling**

Introduction to the use of mathematics in solving real-life problems. Topics include: formulation and refinement of models, different types of models, application of results to prediction and design. Mathematical methods beyond the prerequisite courses will be presented as needed. Prerequisites: MA231, MA232 and PH132

Corequisites: MA330, or MA381, or STAT383
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
Comm Points: 2

MA 368 **Mathematical Biology Seminar**

[Cross-listed with BY 368] The objective of this course is to present recent advances in research that combines biological and mathematical analysis, and to describe opportunities for interdisciplinary summer research in biology and mathematics. Students will receive one credit for attending seminars (6 per semester), reading a journal article prior to each presentation, writing a short review of each seminar, and participating in discussions. This course can be taken for credit more than once. Prerequisites: BY140 and BY160; MA181 or MA131 (or equivalent), or consent of the instructor

Credits: (1), Graded, Semester Calendar
Seminar, Fall Semesters

MA 377 **Numerical Methods**

Floating-point numbers and sources of error, direct solution of linear systems, nonlinear equations, interpolation, numerical integration and numerical solution of initial value problems in ordinary differential equations. Prerequisites: MA230 or MA231

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Fall Semesters
Comm Points: 2

MA 381 **Probability**

[Cross-listed with STAT 381] Sample spaces; axioms of probability; basic theorems; random variables (discrete and continuous); combinatorial methods; Bayes' Theorem and conditional probability; expected values and variances; distribution functions, including: binomial and multinomial, Poisson, normal and bivariate normal distributions, and others such as geometric, hypergeometric, negative binomial, exponential, gamma and beta; joint distributions; covariance and correlation; central limit theorem; geometric probability; method of transformations; introduction to stochastic processes. Prerequisite: MA231 or MA230 (MA211 Recommended)

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

MA 382 **Mathematical Statistics**

[Cross-listed with STAT 382] A rigorous course in statistics. Topics include random variables and their distributions, data reduction,

estimation, sampling distributions, testing, optimal tests, analysis of variance and nonparametric statistics. Prerequisites: MA/STAT381
Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

MA 400 **Undergraduate Seminar**

This seminar will emphasize recreational mathematics and problem solving on the advanced undergraduate level. It is particularly recommended for those who are interested in preparing for the Putnam Undergraduate Mathematics Competition or the Mathematical Contest in Modeling.

Credits: (1-6), Graded, Semester Calendar
Seminar, Given When Needed

MA 401 **Directed Study in Mathematics**

Prerequisite: consent of the instructor.
Credits: (1-10), Graded, Semester Calendar
Research, Given When Needed

MA 405 **Directed Study in Applied Mathematics**

Prerequisite: consent of the instructor.
Credits: (1-10), Graded, Semester Calendar
Research, Given When Needed

MA 407 **Directed Study in Numerical Analysis**

A directed study in Numerical Analysis, intended to give a student the opportunity to further explore an area of interest to them under the supervision of a faculty member.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Given When Needed

MA 409 **Directed Study in Probability and Statistics**

[Cross-listed with STAT 409] A directed study in Probability and Statistics, intended to give a student the opportunity to further explore an area of interest to them under the supervision of a faculty member.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Given When Needed

MA 431 **Mathematics Course Assistance**

Assisting a faculty member in a mathematics course or project. Credit can be used as free electives to meet baccalaureate degree requirements, up to a maximum of 6 hours for MA431. This course is offered on a Pass/No-Credit basis only. (May be taken more than once for credit.)

Credits: (1-3), P/NC, Semester Calendar
Independent Study, Fall Semesters

MA 442 **Computational Complexity**

The complexity of a computational problem is the amount of computer resources it requires. Computational complexity theory studies the complexity of computational problems as well as relationships between different types of resources. This course will cover both classical and research-related topics in computational complexity, such as: complexity measures and complexity classes for sequential machines and Boolean circuits, reductions and completeness, hierarchy theorems, relativization, circuit complexity, and proof complexity. Prerequisites: CS345 or equivalent MA345.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

MA 447 Computer Algorithms

[Cross-listed with CS 447] This course will study and contrast a variety of computational algorithms and develop tools for algorithm analysis. Methods and topics such as dynamic programming, greedy algorithms, graph algorithms, circuits, parallel algorithms, matrix and polynomial algorithms, string matching, and geometrical algorithms will be explored. The theory of NP-completeness and methods of managing NP-complete problems will also be covered. Prerequisites: CS344 and MA211

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

MA 449 Computational Learning

[Cross-listed as CS 449] Computational learning studies algorithmic problems for inferring patterns and relations from data. This course describes the mathematical foundations of learning and explores the important connections and applications to areas such as artificial intelligence, cryptography, statistics, and bioinformatics. A list of relevant topics may include perceptron and online learning, graphical models and probabilistic inference, decision tree induction and boosting, analysis of Boolean functions, sample complexity bounds, cryptographic and complexity hardness, and reinforcement learning. Basic ideas from computer science and mathematics are employed to describe the main ideas and major developments in computational learning. Prerequisites: CS344 and CS345, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

MA 451 Introduction to Mathematical Research

Introduction to the methods and tools needed to prepare mathematical research papers and presentations. Course instruction includes an introduction to research journals, including databases and search tools; mathematical writing; mathematical authoring and presentation software; professionalism, diversity, and ethics in the mathematical professions. Elements of the student grade will be drawn from performance in this class, from peer-evaluations and from self-assessment through surveys. Restriction: Only open to Math or Applied Math and Statistics majors with at least junior standing, or by permission of the instructor.

Credits: (2), Graded, Semester Calendar

Lecture, Spring Terms

MA 453 Introduction to Mathematical Instruction

Introduction to mathematical pedagogy. Students majoring in Math or Applied Math and Statistics register for 2 credits, consisting of: classroom presentation techniques; preparation of handouts; evaluation techniques; mathematical authoring and presentation software; professionalism, diversity, and ethics in the mathematical professions. Elements of the student grade will be drawn from performance in this class, from peer-evaluations and from self-assessment. Students are required to complete a semester-long non-paid teaching experience in conjunction with this course (for example, serving as a teaching assistant or a group tutor). Students enrolled in the pre-teaching minor register for one additional credit and complete additional assignments covering a broader range of topics in education; this additional credit may be taken in the same semester or in a later semester. Prerequisite: Only open to Math or Applied Math and Statistics majors with at least junior standing or permission

of the instructor.

Credits: (1-3), Graded, Semester Calendar

Lecture, Spring Terms

MA 456 Cryptography

[Cross-listed with CS 456] Cryptography is the discipline which studies the making of 'secret' codes. This course will examine some of the methods of cryptography together with many surprising applications. The language of modern cryptography is primarily number theory, and various tools of number theory will be developed as needed. No background in number theory or cryptography will be necessary, but some mathematical sophistication and familiarity with proofs will be assumed. Topics will include: one-way functions, public-key cryptosystems, digital signatures, probabilistic encryption, primality testing, interactive proof systems, and methods of secret sharing. Prerequisites: CS142, EE262, or EE361, and MA211. (CS344 Recommended)

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

MA 469 Quantum Information and Computation

This course studies information and computation based on quantum mechanical laws. The first part of the course will cover the relevant background in quantum information theory. A brief overview discussion of several universal quantum computational models will be given. The second part will cover algorithmic techniques important for developing quantum algorithms. Topics to be covered include amplitude amplification, quantum walks, phase estimation, hidden subgroup problems, and quantum protocols. Background in physics would be helpful but is not required. Prerequisites: CS344 and MA232 or MA339

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

MA 497 Undergraduate Research

Students engage in mathematical research with a faculty member. The topic will be determined by student interest and faculty research programs. This course may be repeated for credit.

Credits: (1-3), Graded, Semester Calendar

Research, Given When Needed

MA 499 Professional Experience

This course records success in completing the requirements other than conventional course work for all mathematics majors. The student must present evidence demonstrating skill in communications and understanding the profession. The requirement can be satisfied in a number of ways including internships or co-ops with appropriate professional content, participation in REU programs, a mathematical honors thesis, teaching assistance in mathematics, active participation in professional societies including attendance at regional or national conferences and presentation of work at such. Directed study or research courses that lead to such presentations would also satisfy the requirement. Check with the Math department for specific requirements.

Credits: (0), P/NC, Semester Calendar

Independent Study, Every Semester

Mechanical Engineering**ME 1,3,5... Mechanical & Aeronautical Engineering Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

ME 2,4,6... **Mechanical & Aeronautical Engineering Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used as a Professional Elective.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

ME 201 **Intro to Exp Methods in Mechanical & Aeronautical Eng**

[Cross-listed with AE 201] This course provides an introduction to experimental methods including the structure of experiments, measurement error types, statics, frequency distributions, error propagation, plot types, introductory design of experiments and use of computer for data processing. Experiments are used to demonstrate principles of material science, statics, strength of materials, rigid body dynamics and electrical science. Experiments are documented using written memoranda and worksheets.

Corequisites: ES220, ES222, ES223

Credits: (1), Graded, Semester Calendar

Lecture, Spring Terms

Comm Points: 2

ME 212 **Introduction to Engineering Design**

This course lays the foundation for the design curriculum of the MAE Department. Students are introduced to how to solve complex, open-ended engineering problems. Core topics covered are: the design process; engineering ethics and professional responsibilities; design for safety; mathematical and computer modeling; and written, oral and graphical communication. These topics are presented within the framework of at least one design project which students must complete, including documentation, construction, and demonstration. Prerequisites: ES100 or equivalent, PH131, or permission of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

ME 301 **Exp Methods in Mechanical and Aeronautical Eng**

[Cross-listed with AE 301] This course covers experimental methods including sampling statistics, uncertainty analysis, error propagation, variable transformations, multi-variable regression, design of experiments and use of computers for data acquisition and processing. Experiments demonstrate principles from fluid mechanics, thermodynamics and introductory vibrations. Experiments are documented using written memoranda.

Corequisites: ES330 and ES340 (or CH271)

Credits: (1), Graded, Semester Calendar

Lecture, Fall Semesters

Comm Points: 2

ME 310 **Thermodynamic System Engineering**

The preliminary design of thermodynamic systems made up of components such as turbines, pumps, compressors, boilers, evaporators, and condensers will be investigated. The major emphasis will be on the design of systems operating at steady-state, but start-up and transient operation will also be studied. Design work will consider actual, rather than ideal, thermodynamic systems, and account for the applicable combustion and psychrometric aspects of the system. Both individual and team work may be required. Open-ended problems on topics discussed will be assigned. Oral and

written reports will be required. Some laboratory work may be required. Prerequisites: ES340 or CH260

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

ME 324 **Dynamical Systems**

[Cross-listed with AE 324] Dynamic systems classification, mathematical modeling of mechanical, electrical and mixed dynamic systems, state space representation, equilibrium points and linearization, solution of linear input/output and state equations, Laplace transforms, transfer functions and block diagrams, first and second order systems, stability, frequency response and simulation techniques. Prerequisites: MA232.

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

ME 326 **Intermediate Fluid Mechanics**

A continuation of ES 330. Topics include: deformation and stress in fluids; basic conservation laws; kinematics of fluid flow; theory of potential flow; introduction to compressible flows; isentropic flows and shock waves; compressible flows with friction and heat transfer; Navier-Stokes equation and theory of viscous flow; low Reynolds number flows with applications to hydrodynamic lubrication; laminar boundary layer theory and von Karman momentum integral method; introduction to computational fluid dynamics; applications of fluid mechanics to engineering problems including turbomachinery. Introduction to design concepts. Prerequisites: ES330, ES340 or CH271, MA232

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Every Semester

ME 341 **Mechanics of Machine Elements**

The course reviews and extends the study of strength of materials and engineering materials behavior concepts with applications to mechanical design/behavior of classical machine elements. Additional coverage of multi-axial static failure theories, fatigue of materials and components and fracture mechanics is also provided. A self-directed study of a machine component is undertaken. Prerequisites: ES222.

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

ME 342 **Introduction to Numerical Methods with Application**

The goal of this course is to introduce the techniques needed for the numerical solution of ordinary and partial differential equations. These techniques will include the formulation of physical problems for numerical simulations, discretization and solution methods, and use of commercial software for solving engineering problems governed by differential equations. Specific topics covered are numerical differentiation, integration, interpolation, and associated errors, the solution of systems of non-linear algebraic equations, and the solution of initial and boundary value problems using finite difference and finite element methods. Prerequisites: ES 100, or HP102 and HP103, or EM120 and EM121, or CS141, and MA 232

Corequisites: ES 222, MA 231

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Every Term

ME 365 **Independent Projects I**

[Cross-listed with AE 365] An opportunity for the student to become involved singly, or with a group, working on a special project under

the guidance of a faculty member. Topics are often suggested by the faculty but suggestions from the students are encouraged. By permission of advisor only.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

ME 366 **Independent Projects II**

[Cross-listed with AE 366] Continuation of ME 365.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

ME 380 **Special Topic: Biomechanics**

[Cross-listed with ES 380] This course will examine the application of engineering principles to biologic systems. The structure and function of biologic tissue will be examined in the context of engineering mechanics. Emphasis will be placed on the biomechanics of human movement, including the basic principles of orthopedic biomechanics. Students will develop the skills necessary to explore biomechanics in the contemporary scientific literature and will write a term paper on a biomechanics topic of their choice. Prerequisites: PH131 and MA132

Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Fall Semesters

ME 385 **Design of Electromechanical Systems**

This course will cover analog electronic design for purposes of controlling electromechanical systems, including electromechanical sensors and actuators, analog electronic design of filters, state space and classical controllers, and transistor-based servoamplifiers and high voltage amplifiers. The course has a significant laboratory component in which students are expected to design and fabricate circuits to control electromechanical systems. Implementation of digital controllers is also covered. Text Description: The Art of Electronics, Horowitz and Hill, Cambridge University Press, Second Edition, Mechatronics; An Integrated Approach, Clarence de Silva, CRC Press. Prerequisites: ES250, EE/ME324.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

ME 390 **Additive Manufacturing**

Brief introduction to the traditional manufacturing processes such as bulk deformation, extrusion, forging/forming, cold & hot working, and joining/welding. Emphasis will be on advanced near net shape forming/processes of engineering materials known as Additive Manufacturing/3D Materials Processing, including 3D processing for Polymers as well as metals. Prerequisites: ES260 and ME341

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

ME 401 **Adv Exp Methods in Mechanical and Aeronautical Eng**

[Cross-listed with AE 401] This course covers advanced experimental methods including Fourier analysis filtering, computer data acquisition. Experiments demonstrate principles of heat transfer, fluid mechanics, gas dynamics and aerodynamics. Experiments are documented using written memoranda and worksheets. Prerequisites: ME/AE 201 or ME/AE301

Corequisites: ME411 or ME326
Credits: (1), Graded, Semester Calendar
Lecture, Spring Semesters

ME 411 **Introduction to Heat Transfer**

Introductory treatment of steady and transient conduction, natural and forced convection and radiation heat transfer with applications to basic heat exchanger design and other multimode problems. Students will complete at least one design project. Laboratory work may be required. Prerequisites: ES330 or CH301, ES340 or CH271, and MA232 or equivalent.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

ME 443 **Optimal Engineering**

[Cross-listed with AE 443] An introduction to the optimal design of mechanical systems. This course involves the application of mathematical optimization techniques, including linear and nonlinear methods, to the design of devices and systems of interest to mechanical engineers. Emphasis is placed on the formulation of problems which can be solved by these techniques. Use is made of currently available optimal design computer programs. Prerequisites: AE/ME350 or ME341.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

ME 444 **Computer Aided Engineering**

An introduction to computer-aided design of mechanical and structural systems. The course deals with the use of commercially available computer-aided design software and hardware for the design of mechanical and structural assemblies. The production of engineering drawings using a CAD system will also be discussed. Hands-on experience is emphasized. Students entering the course are assumed to have a basic understanding of general computer usage and computer graphics in particular. Prerequisites: ES100 or EM121 and MA231

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

ME 445 **Integrated Design I**

This course provides a review and extension of the basic methodology and decisions surrounding design leading to the conceptual and preliminary design of mechanical systems. Topics covered included preliminary sizing, mathematical modeling, experimental evaluation, requirements and constraints, layout, fluid mechanics and thermal sciences issues, structural issues, economics, trade studies, and ethical implications of the design and decision process. Prerequisites: AE/CE/ME212, ES330, and ES340 or CH271

Corequisites: ME341
Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters
(TECH)

ME 446 **Integrated Design II**

Continuation of concepts introduced in the Integrated Design I on the basic methodology and decisions surrounding mechanical systems design including what is necessary for final detail design. The course is supplemented by lectures on various topics including conceptual design issues, detailed system considerations, trade studies, integration, structural issues, computational mechanics, testing considerations, cost, and manufacturing. Prerequisites: ME445

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
(TECH)
Comm Points: 1

ME 450 **Control Systems**

[Cross-listed with EE 450] Introduction to the analysis and design of continuous-time feedback control systems. Topics include: mathematical representation of physical systems with linear differential equations, Laplace transforms, transfer functions, block diagrams and signal flow graphs, feedback, sensitivity, transient specifications, steady-state tracking errors, stability, root locus plots, compensator design, simulation. Prerequisites: AE/EE/ME324 or Corequisite: EE321.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

ME 455 **Mechanical Vibrations and Control**

[Cross-listed with AE 455] Fundamentals, free vibration, harmonically excited vibration, transient vibration, multi-degree freedom systems, vibration measurements, introduction to control theory, linear feedback control, vibration control, adaptive and optimal control, numerical methods. Prerequisites: ES223

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

ME 457 **Composite Mechanics and Design**

[Cross-listed with AE 457, ME 457] Nature of composite materials. Classification and characteristics of composite materials, mechanical behavior of composite materials. Macromechanical and micromechanical elastic behavior of unidirectional lamina. Constitutive and transformation relations. Strength of unidirectional lamina. Composite failure theory. Mechanics of multidirectional structural laminates. Lamination theory. Strength and failure analysis of multidirectional laminates. Effect of temperature and moisture. Prerequisites: ES222 and ES260

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

ME 465 **Advanced Independent Projects I**

[Cross-listed with AE 465] An opportunity for the advanced student to undertake an independent investigation in a mechanical engineering field of his or her own choice. Assistance will be given only when the student requests it. The project may be a comprehensive literature investigation, involve laboratory experiments, or involve analytical work by permission of adviser only.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

ME 492 **Welding Metallurgy**

Introduction to conventional and non-conventional welding processes. Weldability problems in ferrous, non-ferrous and metal-matrix composite materials will be discussed. Solidification modes and their effects on the mechanical properties of weldments will be examined. Students will perform arc welding and friction welding of alloys, and ultrasonic welding of plastics. Prerequisites: ES260

Corequisites: ME411
Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Fall Terms

Marketing**MK 1,3,5...** **Marketing Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

MK 2,4,6... **Marketing Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

MK 306 **Professional Sales**

This course focuses on understanding the sales process mainly at the business-to-business level. Students will learn both theoretical and applied models of sales, with a focus on practical application in the types of companies that Clarkson graduates work at. Topics covered include identification of customer needs, customer relationship management, identification of differentiating factors across products and services, fundamentals of relationship management, managing customer expectations, working with international customers (managing cultural and legal differences), working across internal functional boundaries to sell and support products and services, pricing, negotiation basics, closing a contract, customer satisfaction, and after-sales support and services. Prerequisite: At least Sophomore standing.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

MK 320 **Principles of Marketing**

(May be used to satisfy a CUSB MBA or MS foundation requirement). Familiarizes students with various marketing terms, concepts, principles, institutions and practices. Topics covered include: buyer behavior, market research, product planning, pricing, distribution, personal selling and advertising. The changing nature of marketing and the trends in domestic and international marketing are also examined. Experiential exercises are an intrinsic and important part of this course. Corequisite: IS/EM211 for CUSB majors, and IS200 for non-CUSB majors

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

MK 321 **Consumer Behavior**

[Cross-listed with PY 321] Extensive coverage of selected consumer behavior theories and models. Special emphasis given to the most recent research along with marketing mix applications. Topics include classic and operant conditioning, motivation and attribution theories and the elaboration likelihood model. Students are required to complete a term project. Prerequisite: MK320.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

MK 332 **Marketing Research**

Introductory coverage of various concepts and tools relevant to market information acquisition, analysis, and interpretation. Primary focus is on decision making in marketing research. Students are required to complete a term project. Prerequisites: MK320 and MA/STAT282 or MA/STAT383.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

MK 419 **New Product Development and Marketing Portfolio**

This New Product Development and Marketing Portfolio is the mechanism by which students enrolled in the New Product

Development and Marketing Minor maintain a repository of their work within the minor and in related areas of study and work during their time at Clarkson. This portfolio should include at least evidence from four (4) new product development and/or marketing projects that were completed by the student during their Clarkson experience. The portfolio can be multimedia and include both coursework and work from extracurricular activities, entrepreneurial initiatives, or Internship/co-op work experiences. Prerequisites: Senior Standing
Credits: (0), Pass/Fail, Semester Calendar
Independent Study, Fall and Spring Terms

MK 431 **Supply Chain Distribution Channels**

Few firms can survive in today's competitive marketplace without constant attention to improved product and service offerings while simultaneously minimizing transaction costs associated with their supply chains. To effectively manage supply chains, however, managers need to understand the nature of the network of channel intermediaries that constitute an important part of these supply chains and the functions they perform. This course will examine the latest channel design models and identify the core decision areas and the critical contemporary issues associated with the management of such channel networks. Primary topics to be covered will include understanding the sociopolitical nature of channel networks and channel governance principles, developing and sustaining synergistic, partnerships and strategic alliances with distributive intermediaries, role of trust in conflict management and channel coordination, and the impact of technology and internet on contemporary supply chains channels. Prerequisite: MK320.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

MK 436 **Creativity, Innovation & New Product Development**

This course provides an introduction and broad overview of the strategic decision making process for managing three critical components for firm growth: creativity, innovation and new product development. The fostering of creativity, the stimulation and management of innovation and the strategic new product development process are discussed within the context of interdisciplinary management. This course concentrates on the front end of new product development focusing on understanding, fostering and managing the creative processes, grasping the importance of innovation in satisfying market needs, and the development of new products up to and including the design stage of new product development. The course provides students with the ability to understand, appreciate and manage new products and the new product development process. Marketing research methods, current topics and critical examination of traditional management strategies applicable to creativity, innovation and new product development and management will be explored through lecture, case analysis, and discussion. Prerequisite: MK320.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

MK 487 **Special Project in Marketing**

An investigation of a problem or in-depth topic undertaken by the student under the guidance of a faculty member.

Prerequisites: Permission of the instructor
Credits: (1-3), Graded, Semester Calendar
Research, Given When Needed

MK 490 **Internship**

An unpaid internship that is related to the student's professional goals.

Prerequisite: consent of the instructor.
Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

Multidisciplinary

MP 151 **Multidisciplinary Course (Open Source Software Projects)**

Student teams will engage in projects in the following areas: administer, create, modify, test, or document Open Source Software (OSS); analyze business and policy issues involving OSS; and create and run outreach/tutorial programs that introduce interested persons to OSS or enhance the skill of persons already using OSS. Project status will be reported during regularly scheduled weekly meetings. Students will document projects on the Clarkson Open Source Institute (COSI) web site and will construct individual, web-based portfolios of their work. Students are expected to have some experience or course preparation in their project areas. Given Pass/No Credit.

Credits: (0-3), P/NC, Semester Calendar
Research, Given When Needed

MP 152 **Internet Teaching Laboratory Projects Course**

In conjunction with Clarkson's Internet Teaching Laboratory, students will participate in projects related to computer networking such as implementing network software, configuring networking hardware, simulating large-scale networks, evaluating and testing computer security, administering the Internet Teaching Laboratory, deploying networked solutions for community members or developing network tutorials for other students. Students will construct web-based portfolios and give oral presentations of their work. Given Pass/No Credit. By permission of instructor.

Credits: (0-3), P/NC, Semester Calendar
Research, Every Term

MP 251 **Open Source Software Projects**

A continuation of MP 151

Credits: (0-3), P/NC, Semester Calendar
Research, Given When Needed

MP 252 **Internet Teaching Laboratory Projects Course**

In conjunction with Clarkson's Internet Teaching Laboratory, students will participate in projects related to computer networking such as implementing network software, configuring networking hardware, simulating large-scale networks, evaluating and testing computer security, administering the Internet Teaching Laboratory, deploying networked solutions for community members or developing network tutorials for other students. Students will construct web-based portfolios and give oral presentations of their work. Given Pass/No Credit. By permission of instructor.

Credits: (0-3), P/NC, Semester Calendar
Research, Every Term

MP 351 **Open Source Software Projects**

A continuation of MP 251.

Credits: (0-3), P/NC, Semester Calendar
Research, Given When Needed

MP 352 Internet Teaching Laboratory Projects Course

In conjunction with Clarkson's Internet Teaching Laboratory, students will participate in projects related to computer networking such as implementing network software, configuring networking hardware, simulating large-scale networks, evaluating and testing computer security, administering the Internet Teaching Laboratory, deploying networked solutions for community members or developing network tutorials for other students. Students will construct web-based portfolios and give oral presentations of their work. Given Pass/No Credit. By permission of instructor.

Credits: (0-3), P/NC, Semester Calendar
Research, Every Term

MP 401 Multidisc Course (Environmental Remediation Design)

Science and engineering concepts are synthesized to generate safe, economics and effective solutions to real-world environmental restoration projects. Emphasis is placed on multidisciplinary teamwork and communication.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
(TECH)

MP 414 Multidisciplinary Course (Applied Robotics)

Clarkson students work together with local high school students to participate in a nation-wide robotics competition and get a hands-on, inside look at the engineering profession. During the fall semester, students plan for the upcoming spring competition by participating in a series of seminars that focus on various aspects of mobile robot design and construction. Competition rules are announced at the start of the spring semester, and during an intense six-week period, students work to brainstorm, design, construct, and test their robot entry. With only six weeks of build time, all jobs are critical path. Teams from across the nation then compete in a tournament complete with referees, cheerleaders and time clocks. The competition changes each year, so returning team members always have a new challenge.

Credits: (1-3), P/NC, Semester Calendar
Project Team, Every Term

MP 418 Project-Based Learning Program

Clarkson students will work with students from two local school districts to increase their understanding of science, math, engineering and technology. Clarkson students in this project will develop and then teach a holistic, project-based learning approach to problem solving. Both the Clarkson and K-12 students will gain an appreciation for the relevance and usefulness of science and engineering within a larger social, political and economic context. Year long projects will be oriented towards understanding and solving environmentally related problems that affect their school or community.

Prerequisite: consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

MP 425 Multidisciplinary Course - Sustainable Housing Solution

[Cross-listed with MP525] A team of Clarkson students from multiple majors will collaborate to design, optimize, and build a prototype of a housing solution. Principles of sustainable design, alternatives assessment, resource management, multidisciplinary teamwork, and communication will be emphasized.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms
Comm Points: 1

MP 451 Open Source Software Projects

A continuation of MP 441

Credits: (0-3), P/NC, Semester Calendar
Research, Given When Needed

MP 452 Internet Teaching Laboratory Projects Course

In conjunction with Clarkson's Internet Teaching Laboratory, students will participate in projects related to computer networking such as implementing network software, configuring networking hardware, simulating large-scale networks, evaluating and testing computer security, administering the Internet Teaching Laboratory, deploying networked solutions for community members or developing network tutorials for other students. Students will construct web-based portfolios and give oral presentations of their work. Given Pass/No Credit. By permission of instructor.

Credits: (0-3), P/NC, Semester Calendar
Research, Every Term

MP 456 Special Topics in E&M: Lean Six Sigma for Healthcare

Students will have a first-hand experience in solving a real-world problem by applying lean six sigma tools. To this aim, students will be assigned to a process improvement research project and will closely collaborate with stakeholders of a Healthcare organization in the North Country. Students will gather and analyze data, and provide process insights and recommendations for redesigning a process. To this aim, students will have to commute on a regular basis to the Healthcare organization facilities that can be located in Canton, Potsdam, or in the Adirondacks. The goal is to bring a tangible improvement that ultimately results in an effective and efficient operational process that consistently satisfies customers/patients.

Requirement: Instructor permission
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

Military Science**MS 111 Leadership and Personal Development**

Introduces cadets to the personal challenges and competencies that are critical for effective leadership. Cadets learn how the personal development of life skills such as critical thinking, goal setting, time management, physical fitness, and stress management relate to leadership, officership, and the Army profession. The focus is on developing basic knowledge and comprehension of Army leadership dimensions while gaining a big picture understanding of the ROTC program, its purpose in the Army, and its advantages for the student. Class meets weekly for one hour with a co-requisite laboratory and one weekend field training exercise. Physical fitness training is also required.

Credits: (1), Graded, Semester Calendar
Lecture, Laboratory, Fall Semesters

MS 112 Introduction to Tactical Leadership

Overviews leadership fundamentals such as setting direction, problem-solving, listening, presenting briefs, providing feedback, and using effective writing skills. Cadets explore dimensions of leadership values, attributes, skills, and actions in the context of practical, hands-on, and interactive exercises.

Continued emphasis is placed on recruitment and retention of cadets. Cadre role models and the building of stronger relationships among the cadets through comment experience and practical interaction are critical aspects of the MS112 experience. Class meets weekly for one hour with a co-requisite laboratory and one weekend field training exercise. MS111 recommended but not required as prerequisite; Physical fitness training is also required. No military obligation for non-contracted students.

Credits: (1), Graded, Semester Calendar

Lecture, Laboratory, Spring Semesters

MS 221 **Innovative Team Leadership**

Explores the dimensions of creative and innovative tactical leadership strategies and styles by examining team dynamics and two historical leadership theories that form the basis of the Army leadership framework (trait and behavior theories). Cadets practice aspects of personal motivation and team building in the context of planning, executing, and assessing team exercises and participating in leadership labs.

Focus is on continued development of the knowledge of leadership values and attributes through an understanding of Army rank, structure, and duties and basic aspects of land navigation and squad tactics. Case studies provide tangible context for learning the Soldier's Creed and Warrior Ethos as they apply in the contemporary operating environment (COE). Class meets weekly for two hours with co-requisite laboratory and one weekend field training exercise. Physical fitness training is also required. MS111 and MS112 recommended but not required as prerequisites. No military obligation for non-contracted students.

Credits: (2), Graded, Semester Calendar

Lecture, Laboratory, Fall Semesters

MS 222 **Foundations of Tactical Leadership**

Examines the challenges of leading tactical teams in the complex contemporary operating environment (COE). The course highlights dimensions of terrain analysis, patrolling, and operations orders. Further study of the theoretical basis of the Army leadership framework explores the dynamics of adaptive leadership in the context of military operations. MS222 provides a smooth transition into MS331. Cadets develop greater self awareness as they assess their own leadership styles and practice communication and team building skills. COE case studies give insight into the importance and practice of teamwork and tactics in real-world scenarios. Class meets weekly for two hours with co-requisite laboratory and one weekend field training exercise. Physical training is also required. MS111, MS112, MS221 recommended but not required as prerequisites. No military obligation for non-contracted students.

Credits: (2), Graded, Semester Calendar

Lecture, Laboratory, Spring Semesters

MS 331 **Adaptive Tactical Leadership**

Challenges cadets to study, practice, and evaluate adaptive leadership skills as they are presented with challenging scenarios related to squad tactical operations. Cadets receive systematic and specific feedback on their leadership attributes and actions. Based on such feedback, as well as their own self-evaluations, cadets continue to develop their leadership and critical thinking abilities. The focus is developing cadets' tactical leadership abilities to enable them to succeed at ROTC's summer Leadership Development and Assessment

Course (LDAC). Class meets weekly for three hours with co-requisite laboratory and one weekend field training exercise. Physical fitness is also required.

Prerequisite: MS Basic Course or equivalent.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Fall Semesters

Comm Points: 1

MS 332 **Leadership in Changing Environments**

Uses increasingly intense situational leadership challenges to build cadet awareness and skills in leading tactical operations up to platoon level. Cadets review aspects of combat, stability, and support operations. They also conduct military briefings and develop proficiency in garrison operation orders. The focus is on exploring, evaluating, and developing skills in decision-making, persuading, and motivating team members in the contemporary operating environment (COE). MS332 cadets are evaluated on what they know and do as leaders as they prepare to attend the ROTC summer Leader Development Assessment Course (LDAC). Class meets weekly three hours with co-requisite laboratory and one weekend field training exercise. Physical fitness training is also required.

Prerequisite: MS Basic Course or equivalent.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Spring Semesters

Comm Points: 1

MS 441 **Developing Adaptive Leaders**

Develops cadet proficiency in planning, executing, and assessing complex operations, functioning as a member of a staff, and providing performance feedback to subordinates. Cadets assess risk, make ethical decisions, and lead fellow ROTC cadets. Lessons on military justice and personnel processes prepare cadets to make the transition to Army officers. MS IV cadets analyze, evaluate, and instruct cadets for their first unit of assignment. They identify responsibilities of key staff, coordinate staff roles, and use situational opportunities to teach, train, and develop subordinates. Class meets weekly for three hours with co-requisite laboratory and one weekend field training exercise. Physical fitness training also required.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Fall Semesters

Comm Points: 1

MS 442 **Leadership in a Complex World**

Explores the dynamics of leading in the complex situations of current military operations in the contemporary operating environment (COE). Cadets examine differences in customs and courtesies, military law, principles of war, and rules of engagement in the face of international terrorism. They also explore aspects of interacting with non-government organizations, civilians on the battlefield, and host nation support. The course places significant emphasis on preparing cadets for their first unit of assignment. It uses case studies, scenarios, and What Now, Lieutenant? exercises to prepare cadets to face the complex ethical and practical demands of leading as commissioned officers in the United States Army. Class meets weekly for three hours with co-requisite laboratory and one weekend field training exercise. Physical fitness training also required.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Spring Semesters

Comm Points: 1

MS 444 **Independent Study**

MS 444 is an independent study that prepares students to become Army Officers. Cadets explore military history, customs, and courtesies, military law, principles of war, and rules of engagement in the face of international terrorism. This course places significant emphasis on preparing cadets for their first unit of assignment. It uses scenarios, 'What Now, Lieutenant?' exercises, and practical work to prepare cadets to face the complex ethical and practical demands of leading as commissioned officers in the United States Army.

Credits: (3), Graded, Semester Calendar
Independent Study,

MS 1,3,5... **Military Science Elective**

A college level course for which there is no comparable Clarkson course.

Credits: (1-9), Graded, Semester Calendar
Lecture, Transfer Credit Only

Materials Science & Engineering**MSE 451** **Advanced Characterization of Materials**

[Cross-listed with MSE551] Advanced methods for characterizing materials, such as scattering methods, including laser light scattering and x-ray diffraction (powder patterns & Laue patterns); microscopy, including optical microscopy; scanning electron microscopy (including EDX), transmission electron microscopy, and atomic force microscopy; and spectroscopy, including nuclear magnetic resonance, surface plasmon resonance, and scanning confocal Raman microscopy.

The following undergraduate courses should be completed prior to taking this course: CM371 (Physical Chemistry I); PH132 (Physics II); and ES260 (Materials Science and Engineering I). Prerequisites: CM371, CH210, PH132, and ES260

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

Multidisciplinary Project Team**MT 51** **Introduction to Basic Shop Skills**

This course covers simple shop procedures including measurement and layout, drills and drill presses, use of hand taps, proper use of the various band saws, and use of the shear and brake; involves use of the composite lab and wood working equipment. MT 51 consists of three hours of lecture, and three hours of hands-on lab experience.

Credits: (0), P/NC, Semester Calendar
Lecture, Laboratory, Every Term

MT 52 **Basic Lathe Operations**

This course covers the basic theory and operation of the metal lathe; topics include tool grinding, turning, facing, boring, fits, tapers, etc. this course consists of three lectures of 1.5 hours each and four labs of 2 hours each. Offered Pass/No Credit. Prerequisite: MT 51

Credits: (0), P/NC, Semester Calendar
Lecture, Laboratory, Every Term

MT 53 **Basic Milling Procedures**

Basic Milling will cover the theory and operation of the Bridgeport type mill; topics covered include set-up of the mill, fixturing, zeroing parts, cutters, and milling techniques for various materials. This course would consist of three lectures of 1.5 hours each and four labs of 2 hours each. Offered Pass/No Credit.

Prerequisite: MT52. Prerequisite: MT 51

Credits: (0), P/NC, Semester Calendar
Lecture, Laboratory, Every Term

MT 54 **CNC Mill Procedures**

Basics of CNC Machine programming and operation of the Haas Bed Mill; topics covered include machine start up and homing, conversational programming, drill patterns, profiles, and pockets. The course would consist of three lectures of 1.5 hours and four labs of 2 hours each. Prerequisite: MT53

Credits: (0), P/NC, Semester Calendar
Lecture, Laboratory, Given When Needed

MT 55 **Basic Welding Procedures**

Basic welding addresses the operation and use of welding equipment in a safe and effective manner; topics include general welding safety, oxygen-acetylene techniques, basic arc welding, MIG welding, TIG welding, and use of the plasma cutting torch. The course would consist of three lectures of 1.5 hours each and four labs of 2 hours each. Offered Pass/No Credit.

Prerequisite: MT51. Prerequisite: MT 51
Credits: (0), P/NC, Semester Calendar
Lecture, Laboratory, Given When Needed

MT 56 **Introduction to MasterCam**

This course is an overview of the CAD software MasterCam. Students will draw, choose tool paths, create machine code, and run programs on CNC mills using CAD. Prerequisite: MT 54

Credits: (0), P/NC, Semester Calendar
Lecture, Laboratory,

MT 57 **Advanced Lathes**

This course will cover the use of the precision lathes in the student shop. Students will set up and machine on several different lathes using advanced techniques and tooling. Prerequisite: MT52. Prerequisite: MT 52

Credits: (0), P/NC, Semester Calendar
Lecture, Laboratory,

MT 58 **CNC Lathe Operation**

CNC Lathe Operations and Programming. Topics covered include machine programming and operation; using g-code programs generated by CAD/CAM software, tool path creation utilizing conversational HAAS lathe programming and basic g-code. Students will learn how to turn complex profiles and mill a variety of 3D contours. This course will consist of four lectures of 1.25 hours each and four labs of 2 hours each. Prerequisites: MT56, and MT 57

Credits: (0), P/NC, Semester Calendar
Lecture, Laboratory, Given When Needed

MT 109 **Mini Baja Car Project**

Active participation in Mini Baja Car project. Pass/No Credit only. Must have permission of instructor.

Credits: (0), P/NC, Semester Calendar
Project Team, Every Semester

MT 110 **Multidisciplinary Course (CPS OM-DINI)**

Active participation in Creative Problem Solving -- Odyssey of the Mind/Destination Imagination project. Pass/No Credit only. Must have permission of instructor.

Prerequisite: consent of the instructor.

Credits: (0-3), P/NC, Semester Calendar
Project Team, Every Semester

MT 209 **Mini Baja Car Project**

Active participation in Mini Baja Car project. Pass/No Credit only. Must have permission of instructor.

Credits: (0), P/NC, Semester Calendar
Project Team, Every Semester

MT 210 **Multidisciplinary Course (CPS OM-DINI)**

See MT 110 for course description.

Credits: (0-3), P/NC, Semester Calendar
Project Team, Every Semester

MT 214 **Multidisciplinary Course (FIRST Robotics Competition)**

Clarkson students work together with local high school students to participate in a nation-wide robotics competition and get a hands-on, inside look at the engineering profession. During the fall semester, students plan for the upcoming spring competition by participating in a series of seminars that focus on various aspects of mobile robot design and construction. Competition rules are announced at the start of the spring semester, and during an intense six-week period, students work to brainstorm, design, construct, and test their robot entry. With only six weeks of build time, all jobs are critical path. Teams from across the nation then compete in a tournament complete with referees, cheerleaders and time clocks. The competition changes each year, so returning team members always have a new challenge.

Credits: (0), P/NC, Semester Calendar
Project Team, Every Semester

MT 309 **Mini Baja Car Project**

Active participation in Mini Baja Car project. Pass/No Credit only. Must have permission of instructor.

Credits: (0), P/NC, Semester Calendar
Project Team, Every Semester

MT 310 **Multidisciplinary Course (CPS OM-DINI)**

See MT 110 for course description.

Credits: (0-3), P/NC, Semester Calendar
Project Team, Every Semester

MT 409 **Mini Baja Car Project**

Active participation in Mini Baja Car project. Pass/No Credit only. Must have permission of instructor.

Credits: (0), P/NC, Semester Calendar
Project Team, Every Semester

Operations Management

OM 1,3,5... **Operations Management Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

OM 2,4,6... **Operations Management Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Business Foundation Curriculum Requirement.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

OM 331 **Operations & Supply Chain Management**

[Cross-listed with EM 331] (May be used to satisfy a CUSB MBA and MS foundation requirement.) An introduction to the planning, analysis and control of production systems. Topics include product and service design, manufacturing processes, aggregate production planning, inventory models and MRP, just-in-time systems, facility layout, forecasting/demand planning, project management, and quality management. Students acquire problem solving experience using ERP software. Prerequisites: STAT 282 or STAT 383 or MA 330, and at least sophomore standing

Corequisite: IS 211 (CUSB majors) or IS 200 (non-CUSB majors)

Credits: (3), Graded, Semester Calendar
Lecture, Every Term

OM 341 **Supply Chain Design & Management**

[Cross-listed with EM 341] Fierce competition in today's global markets has forced business enterprises to focus on reducing costs while meeting rising customer expectations by designing and managing effective and sustainable supply chains. This course focuses on a systems approach to review state-of-the-art models and practical tools for inventory and materials management, design for supply chain, as well as supply chain integration. Topics covered include managing inventories in the supply chain, the bullwhip effect, risk pooling, delayed differentiation, measuring the financial performance of supply chains, the value of information and the role of information technology in the supply chain, coordination and collaboration with channel partners, supply chain related strategic alliances, and outsourcing/off-shoring/reshoring trends. Several team projects and hand-on experiences are utilized to demonstrate real world issues and applications. Prerequisite: OM331 and at least junior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

OM 371 **Strategic Sourcing**

This course provides an in-depth analysis of the procurement process and supplier management, with strong emphasis on managing a supplier base for both products and services. Topics covered include the strategic role of sourcing in supply chains, the identification and evaluation of requirements, the strategic make versus buy decision, supplier selection, development and evaluation processes, the supplier coordination and control mechanisms, the relationship between product design and the supplier base and the impact of information technology on strategic sourcing. Both theoretical and quantitative perspectives will be offered. In addition, the topics will be addressed from strategic, financial, sustainability and global perspectives. Students will also develop practical skills in using quantitative tools to select and evaluate suppliers. Prerequisites: OM/EM331 and at least junior standing

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

OM 380 **Project Management**

[Cross-listed with EM 380] This course will introduce students to all phases of project management from project initiation to termination. Topics covered include project selection, organization, contracts, planning and scheduling (PERT and CPM), estimating, budgeting and cost control, procurement, resource allocation, variance analysis,

auditing and termination procedures. Project management software, case studies, and student team projects will be an integral part of the course. Requisites: Enrollment is limited to students in E&M, CUSB, Software Engineering, Project Management Minors, Construction Engineering Concentration or consent of instructor.

Corequisites: STAT 383

Credits: (3), Graded, Semester Calendar

Lecture, Every Term

EC

OM 451 Quality Management & Lean Enterprise

[Cross-listed with EM 451] This course will introduce the students to both the managerial and technical aspects of quality improvement. The course emphasizes statistical applications to quality related topics such as process/product design, process capability, quality control, design of experiment, and inspections/sampling. Other topics of interest include: Juran quality trilogy, six-sigma project methodology, and cost of quality. The course consists of a series of lecture and problems solved in class. Prerequisites: MA/STAT282 or MA/STAT383 or MA330 or permission of instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Every Term

OM 476 Management of Technology

[Cross-listed with EM 476] Management of technology links together the engineering, science, and management disciplines to plan, develop, and implement technological capabilities to be competitive in the global arena. Students taking the course will gain an understanding of the following topics: innovation, product life cycles, product development process, concurrent engineering, management of technology strategy, selecting technical projects, management of the R&D process, initiating new ventures, international technology transfer, and the management of complex projects. Lectures, readings, and case studies focus on firms operating in an international context. Prerequisite: OM331.

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

STS

OM 484 Advanced Project Management

[Cross listed with EM484] This course builds on the foundation of EM/OM380 (Project Management) by introducing advanced topics in decision making, risk, and cost control as well as providing comprehensive knowledge of project scheduling and other PM tools. This course also provides an opportunity for students to further extend their PM skills in managing and controlling projects by applying the PM methods in a project management simulation using typical project management software. Students are exposed to advanced research topics in the emerging PM areas. Prerequisite: EM/OM380

Credits: (3), Graded, Semester Calendar

Lecture, Every Term

OM 487 Special Project in Operations Management

An investigation of a problem or in-depth topic undertaken by the student under the guidance of a faculty member.

Prerequisites: Permission of the instructor

Credits: (1-3), Graded, Semester Calendar

Research, Given When Needed

OM 490 Internship

An unpaid internship that is related to the student's professional goals.

Prerequisites: enrollment is limited to available positions. Consent of the instructor only.

Credits: (1-3), Graded, Semester Calendar

Lecture, Given When Needed

Organizational Studies

OS 1,3,5... Organizational Studies Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Lecture, Transfer Credit Only

OS 2,4,6... Organizational Studies Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Business Foundation Curriculum Requirement.

Credits: (2-4), Graded, Semester Calendar

Lecture, Transfer Credit Only

OS 286 Organizational Behavior I

[Cross-listed with EM 286, PY 286] (May be used to satisfy a CUSB MBA or MS foundation requirement.) An introduction to the processes required to manage contemporary organizations with a focus on individual behaviors as they relate to the functions of planning, organizing, controlling, and leading. The most recent concepts of behavioral science in the practice of management are presented to assist the student in gaining understanding of the pervasiveness of the discipline in all types of organizations and processes. Topics include motivation, leadership, perceptions, personality theory, learning theory, personnel issues, stress management, organizational culture, and decision making. Prerequisites: sophomore standing or the permission of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

IG

OS 352 Strategic Human Resource Management

This course provides an introduction to the strategic management of human resources in organizations. Topics include human resource planning, recruitment and selection of employees, training and development, performance appraisal, employee motivation, compensation and benefits, and employee and labor/management relations. These topics should be understood in the context of business strategy, pressures external to organizations, and relevant theories of human and organizational behavior. Prerequisites: OS 286 (or equivalent)

Credits: (3), Graded, Semester Calendar

Lecture, Every Semester

OS 432 Organizational Policy and Strategy

[Cross-listed with EM 432] A capstone course designed to integrate the functional areas and tools of management studied in previous courses within a strategic planning framework giving due attention to ethical and social responsibility concerns and international business issues. Emphasis is placed on the business environment in a global economy, industry analysis, tactical planning, overall strategic

planning, policy establishment and implementation. Case analysis, in the small group setting, is utilized, enabling students to share their expertise and explore their value structure. Students present results via written and oral reports. Prerequisites: FN361, OM331, OS286, MK320 and Senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
Comm Points: 2

OS 452 **Advanced Human Resource Management**

This course provides advanced instruction in the strategic management of human resources in organizations. The focus is on the development and critical evaluation of sound HR policies and systems in key HR areas such as selection, training and development, performance management, and compensation. The course will also address the use of HR metrics, employee surveys, and the relationship between strategic HR practices and organizational performance. Knowledge and skills will be developed through qualitative and quantitative data analysis, evaluating best practices, and linking current HR research to practice. Prerequisites: OS352.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

OS 466 **Negotiations and Relationship Management**

This course introduces students to the complex problems associated with the management of stakeholder relationships. The course emphasis is on the establishing, negotiating, building, sustaining, and repairing of both workplace and external relationships, including relationships with employees, management, customers, suppliers, manufacturers, shareholders, society, and other key stakeholders. This course introduces theories of negotiation, conflict, complaint handling, and norms and ethics of fairness. The course introduces labor relations, collective bargaining, and U.S. labor and employment laws, and considers corresponding implications for union and nonunion workplaces. Prerequisites: OS286 and Junior Standing.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

OS 487 **Special Project in Organizational Studies**

An investigation of a problem or in-depth topic undertaken by the student under the guidance of a faculty member.

Prerequisite: Permission of the instructor
Credits: (1-3), Graded, Semester Calendar
Research, Given When Needed

OS 490 **Internship**

An unpaid internship that is related to the student's professional goals.

Prerequisite: Permission of the instructor
Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

Physical Education

PE 1,3,5... **Physical Education**

Credits: (0), Graded, Semester Calendar
Lecture, Transfer Credit Only

PE 2,4,6... **Physical Education**

Credits: (0), Graded, Semester Calendar
Lecture, Transfer Credit Only

PE 7 **Varsity Sports**

Credits: (0), No Grade, Semester Calendar
Physical Education, Every Semester

PE 8 **Varsity Sports - Mens Hockey**

Credits: (0), No Grade, Semester Calendar
Physical Education, Every Semester

PE 9 **Varsity Sports - Women's Hockey**

Credits: (0), No Grade, Semester Calendar
Physical Education, Every Semester

PE 100 **First Year Seminar**

[Cross-listed with FY 100] See FY 100 First Year Seminar for description. Prerequisite: for Clarkson School students only.

Credits: (1), P/NC, Semester Calendar
Lecture, Fall Semesters

PE 101 **Introduction to Lifetime Activities**

This will be a 14 week course combining seven lifetime activities (racquetball, weight training/physical fitness, badminton, volleyball, golf, indoor soccer, and tennis) Each activity will go for two week and will cover rules, strategies, and skills.

Credits: (0), P/NC, Semester Calendar
Physical Education, Spring Semesters

Physics

PH 1,3,5... **PH Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

PH 2,4,6... **PH Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Science Foundation Curriculum Requirement.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

PH 31 **Elementary Physics I**

Introduction to Newtonian Mechanics. Given as a Pass or No-Credit (P/NC) only. Credit does not count toward graduation.

Credits: (2), P/NC, Semester Calendar
Lecture, Given When Needed

PH 121 **Physics Freshman Seminar**

Activities and facilities in the Physics Department, curriculum choices, and career options in Physics will be introduced to incoming freshmen through group discussions and faculty seminars. Challenge problem solving and team projects will cover selected topics beyond the material in general freshman Science courses.

Credits: (1), P/NC, Semester Calendar
Seminar, Fall Semesters

PH 131 **Physics I**

Calculus-based general physics course covering elements of Newtonian mechanics and thermal physics. Laboratory experiments keyed to the lectures to illustrate and demonstrate some of the physical principles and concepts. Corequisite: MA 131

Credits: (4), Graded, Semester Calendar
Laboratory, Lecture, Every Semester

PH 132 **Physics II**

Calculus-based general physics course covering elements of electricity and magnetism, waves and optics. Laboratory experiments keyed to the lectures to illustrate and demonstrate some of the physical principles and concepts. Prerequisite: PH131

Corequisite: MA132

Credits: (4), Graded, Semester Calendar
Laboratory, Lecture, Every Semester

PH 141 **Physics for Life Sciences I**

General physics course covering elements of mechanics, thermal physics, and physics of fluids, with emphasis on topics and applications relevant for biological sciences, physical therapy, and pre-med (MCAT). Laboratory experiments keyed to the lectures to illustrate and demonstrate some of the physical principles and concepts.

Corequisite: MA180.

Credits: (4), Graded, Semester Calendar
Laboratory, Lecture, Fall and Summer Semesters

PH 142 **Physics for Life Sciences II**

General physics course covering elements of electricity and magnetism, waves, optics, and modern physics, with emphasis on topics and application relevant for biological sciences, physical therapy, and pre-med (MCAT). Laboratory experiments keyed to the lectures to illustrate and demonstrate some of the physical principles and concepts. Prerequisite: PH141 or equivalent

Credits: (4), Graded, Semester Calendar
Laboratory, Lecture, Spring and Summer Semesters

PH 157 **Elementary Astronomy**

This course will cover basic concepts in astronomy. The course will cover the planets and planet formation, life cycle of stars, clusters, galaxies, and the scientific principles used in astronomy and astrophysics.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

PH 221 **Theoretical Mechanics I**

Kinematics and dynamics of a single particle and systems of particles, conservation laws, central force problem, oscillatory and rotational motion. Introduction to Lagrangian and Hamiltonian formulations of classical mechanics. Prerequisites: PH132

Corequisites: MA232

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

PH 230 **Physics III**

This course introduces certain fundamental concepts of waves, optics and thermal physics, including the basic mathematical framework necessary to describe the associated physical phenomena. Specific topics of waves phenomena include: Transverse and longitudinal waves, wave equation, superposition principle, interference of waves, phasors; electromagnetic waves, Maxwell's equations; Poynting vector, radiation pressure; polarization, reflection and refraction; Young's interference experiment; coherence; Michelson's interferometer; wave theory of light, diffraction grating, X-Ray

diffraction; photoelectric effect, and matter waves. Topics of thermal physics include: Temperature, thermal expansion; absorption of heat; heat transfer mechanisms; first and second laws of thermodynamics; entropy. With an emphasis on problem solving, this course serves to bridge the concepts developed in Physics II (PH 132) and Modern Physics (PH 231), and is strongly recommended as a PH elective to physics majors. Prerequisites: PH132 and MA132

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

PH 231 **Fundamentals of Modern Physics**

Introduction to the most important developments of 20th century physics, including applications to technology. Foundations and implications of special relativity, introduction to waves and quantum theory. Survey of applications in solid state, atomic, nuclear and particle physics. Prerequisites: PH132

Corequisites: MA232

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

PH 232 **Modern Physics Laboratory**

Laboratory course to supplement PH 231. Experiments keyed to the lectures to illustrate and demonstrate some of the physical principles and concepts. Corequisites: PH231

Credits: (1), Graded, Semester Calendar
Laboratory, Fall Semesters
Comm Points: 1

PH 301 **Teaching Methodology in Physics I**

Assisting a faculty member in a physics course, in order to prepare the student for teaching physics with emphasis on skills needed for work as a teaching assistant (TA) in a graduate school.

Prerequisite: consent of the instructor.

Credits: (1-2), Graded, Semester Calendar
Independent Study, Fall Semesters

PH 302 **Teaching Methodology in Physics II**

Assisting a faculty member in a physics course, in order to prepare the student for teaching physics with emphasis on skills needed for work as a teaching assistant (TA) in a graduate school.

Prerequisite: consent of the instructor.

Credits: (1-2), Graded, Semester Calendar
Independent Study, Spring Semesters

PH 320 **Physical Models of Living Systems**

This course focuses on modeling essential processes in living systems using the tools and techniques of physics, including computer modeling. Using case studies in virus dynamics, bacterial genetics and naturally evolved cellular circuits, the course will explore how living organisms use physical mechanisms to gain information about their surroundings, process information and make decisions. It will also examine some of the cutting edge techniques used by scientists at the forefront of biophysical and life sciences research to study living organisms and understand their behavior. This course is broadly aimed at students studying in physics, chemistry, mathematics, computer science, chemical engineering, and biomedical engineering, in addition to biology majors with advanced math classes. Prerequisites: PH132 and MA132

Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Terms

PH 323 **Optics**

Geometrical optics: reflection and refraction at plane and spherical surfaces, lenses, lens aberrations. Physical optics: interference, diffraction, polarization, photons, absorption, scattering, electrooptics. Prerequisite: PH132 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Semesters

PH 325 **Thermal Physics**

Temperature, heat, thermodynamics and applications. Introduction to kinetic theory and classical and quantum statistical mechanics. Prerequisites: PH231 and MA231 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

PH 327 **Experimental Physics I**

Experiments selected from the fields of atomic physics, electricity and magnetism, thermal physics, condensed matter physics and optics. A major component of the course involves statistical analyses of experimental data and random uncertainties. The topics of data analysis include: Standard deviation and standard deviation of the mean; variance, co-variance and Schwarz inequality; weighted averages, histograms and distribution functions; confidence limit; least-squares fitting, uncertainties in slopes and intercepts, error-bars, coefficients of correlation and determination, chi squared test; general formula of error propagation and its applications. Computer based graphing and data analyses are routinely used throughout the course. Elements of writing technical research papers are practiced in the laboratory reports. Prerequisites: PH 132 and MA 132, or consent of the instructor

Credits: (1-3), Graded, Semester Calendar

Lecture, Every Semester

Comm Points: 2

PH 328 **Experimental Physics II**

Continuation of PH 327. Prerequisite: PH327 or consent of the instructor.

Credits: (1-3), Graded, Semester Calendar

Lecture, Every Semester

PH 331 **Quantum Physics I**

Basic principles of quantum mechanics, Schrödinger equation for simple potentials including harmonic oscillator and hydrogen atom. Selected application to atomic, molecular and nuclear structure.

Prerequisites: PH 231 and MA 232

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

PH 341 **Solid State Physics I**

This course focuses on the fundamental physical processes that occur in solid state materials. Topics include crystal structure of solids, point defects and dislocations, crystal bonding, X-ray diffraction, lattice vibrations, thermal properties, specific heat, thermal conductivity, free electron gas theory of metals, energy bands, theory of semiconductors, band gaps, doping, and a brief introduction to device physics. Graduate students will do additional coursework.

Prerequisites: PH231, or ES260, or consent of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

PH 371 **Physical Chemistry I**

[Cross-listed with CM 371] This course covers the gaseous state, kinetic theory and chemical thermodynamics, with applications to chemical and phase equilibria. The emphasis is on mathematics and problem solving. Prerequisites: CM104 or CM132, MA132, PH131

Corequisites: PH132

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

PH 372 **Physical Chemistry II**

[Cross-listed with CM 372] A continuation of PH 371. Topics may include quantum mechanics, atomic structure, chemical bonds, intermolecular forces, spectroscopy, molecular symmetry, optical activity, photochemistry and photobiology. Prerequisites: CM371 or BY371 or PH371.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

PH 380 **Electromagnetic Theory I**

Fundamental properties of electric and magnetic fields. Gauss law, Poisson equation, dielectrics, boundary value problems, vector potential, inductance, Maxwell equations, electromagnetic waves. Prerequisites: PH132 and MA231 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

PH 381 **Electromagnetic Theory II**

Continuation of PH 380. Detailed discussion of electromagnetic waves and their applications: filters, transmission lines, waveguides. Atomic theory of diamagnetism, paramagnetism, ferro- and anti-ferromagnetism. Theory of conduction in solids, magnetic resonance. Prerequisites: PH380 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

PH 401 **Teaching Methodology in Physics III**

Assisting a faculty member in a physics course, in order to prepare the student for teaching physics with emphasis on skills needed for work as a teaching assistant (TA) in a graduate school.

Prerequisite: consent of the instructor.

Credits: (1-2), Graded, Semester Calendar

Independent Study, Fall Semesters

PH 402 **Teaching Methodology in Physics IV**

Assisting a faculty member in a physics course, in order to prepare the student for teaching physics with emphasis on skills needed for work as a teaching assistant (TA) in a graduate school.

Prerequisite: consent of the instructor.

Credits: (1-2), Graded, Semester Calendar

Independent Study, Spring Semesters

PH 426 **Introduction to Biophysics**

[Cross-listed by BY 426] This course concentrates on the fundamental physical processes that occur within living organisms, particularly the cell. Topics include the structure and physics of macromolecules, biological membranes, the thermodynamics of living systems, muscle contraction and the propagation of signals in nerve cells.

Prerequisites: BY160 or BY312 or consent of instructor

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Semesters

PH 432 **Quantum Physics II**

Continuation of PH 331. Transformation theory and matrix formulation of quantum mechanics; angular momentum, spin, perturbation theory, variational methods, scattering theory. Prerequisite: PH331 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

PH 435 **Physics Senior Seminar**

Forum for discussion of current research in physics. Exploration of employment and career opportunities for physics majors. Preparation for GRE in Physics.

Prerequisite: consent of the instructor.
Credits: (1), P/NC, Semester Calendar
Lecture, Fall Semesters

PH 442 **Solid State Physics II**

Continuation of PH 341. Band structure of solids, electrical and thermal transport properties, magnetism, optical properties, superconductivity, semiconductors, magnetic resonance. Prerequisite: PH341 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Semesters

PH 445 **Undergraduate Thesis I**

Investigation of a topic selected by the student in consultation with a thesis adviser. A written thesis is required.

Prerequisite: consent of the instructor.
Credits: (1-3), Graded, Semester Calendar
Lecture, Given When Needed
Comm Points: 2

PH 447 **Nuclear Physics**

An introduction to nuclear structure, nuclear radiation and elementary particle physics. Topics include properties of nuclei, the two-nucleon forces, complex nuclei, interaction of radiation with matter, accelerators, nuclear reactions, elementary particles and their classification. Prerequisites: PH331 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

PH 451 **Statistical Mechanics I**

Review of thermodynamics and classical ensembles. Modern theories of phase transitions, critical phenomena, liquid structure. Introduction to Monte Carlo methods, nonequilibrium phenomena. Prerequisites: PH325 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

PH 453 **Relativity**

Review of the special and general theories of relativity. Topics include: tensor analysis, Riemann geometries, Minkowski geometries, unified field theories. Prerequisites: PH231 and PH380 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Semesters

PH 455 **Mathematical Methods in Physics**

Mathematics methods used in theoretical physics. Topics covered include complex variables, Fourier transforms, special functions,

eigenfunction expansions, Green's functions, differential equations, linear algebra and linear spaces, with physical applications.

Prerequisite: consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

PH 457 **Introduction to Astrophysics**

Radiation from astrophysical sources and measurement of position, mass, temperature, velocity, density, composition and age. Emphasis will be on recent discoveries and interpretations. Prerequisites: PH231 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

PH 460 **Physics of Fluids**

Discussion of the mechanics of fluids based on the Navier-Stokes equation. Laminar and turbulent flows, dimensional analysis. Special topics with applications. Prerequisites: PH221 and PH325 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

PH 470 **Directed Study Experimental**

A course of study of subjects not otherwise available in formal courses may be undertaken under the supervision of a faculty member.

Prerequisite: consent of the instructor.
Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

PH 471 **Directed Study Experimental**

A course of study of subjects not otherwise available in formal courses may be undertaken under the supervision of a faculty member.

Prerequisite: consent of the instructor.
Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

PH 472 **Directed Study Experimental**

A course of study of subjects not otherwise available in formal courses may be undertaken under the supervision of a faculty member.

Prerequisite: consent of the instructor.
Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

PH 473 **Directed Study Experimental**

A course of study of subjects not otherwise available in formal courses may be undertaken under the supervision of a faculty member.

Prerequisite: consent of the instructor.
Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

PH 474 **Directed Study Theoretical**

A course of study of subjects not otherwise available in formal courses may be undertaken under the supervision of a faculty member.

Prerequisite: consent of the instructor.
Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

PH 475 **Directed Study Theoretical**

Prerequisite: consent of the instructor.
Credits: (1-3), Graded, Semester Calendar
Independent Study

PH 476 Directed Study Theoretical

Prerequisite: consent of the instructor.
Credits: (1-3), Graded, Semester Calendar
Independent Study

PH 477 Directed Study Theoretical

Prerequisite: consent of the instructor.
Credits: (1-3), Graded, Semester Calendar
Independent Study

PH 478 Directed Research in Experimental Physics

Students will carry out research in experimental physics under the supervision of a faculty member. Topics will be determined by faculty research programs. A formal report is required at the conclusion of the course.
Credits: (1-3), Graded, Semester Calendar
Research

PH 479 Directed Research in Theoretical Physics

Students will carry out research in theoretical physics under the supervision of a faculty member. Topics will be determined by faculty research programs. A formal report is required at the conclusion of the course.
Credits: (1-3), Graded, Semester Calendar
Research

PH 480 Internship/Co-op in Physics

Students will gain practical work experience in Physics under the direction and supervision of professionals outside their department. Students must submit a formal report describing work performed as well as the Internship/Co-op learning opportunities. Report approval is required for the award of credit. Feedback will be provided by their Internship/Co-op field supervisor. This course will be graded on a pass/no-credit basis.
Credits: (1), P/NC, Semester Calendar
Independent Study

PH 487 Applications of Synchrotron and Electron Based Techniques

The purpose of the course is to familiarize all students with the x-ray and electron based experimental techniques available at Brookhaven National Lab and other similar facilities. Students will be cognizant of the applications of these cutting edge facilities, and well positioned to use them in their own research. This course is suitable for graduate students, postdocs, and advanced undergrads in physical sciences and engineering, as well as students in biological, environmental, and chemical sciences who may have the interest to learn more about the techniques they may use for their research. Prerequisites: PH132 or consent of the instructor; ES260 and/or PH231 are recommended prerequisites
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

PH 489 Physics of Semiconductor Devices

Principles of quantum mechanics, elements of statistical physics, the energy band theory of solids, semiconductor physics, recombination mechanisms, current transport, contact phenomena, surface phenomena in semiconductors, advanced concepts in quantum and spintronic device technology. Prerequisites: PH231 or ES260.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

Philosophy**PHIL 1,3,5... Philosophy Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.
Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

PHIL 2,4,6... Philosophy Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Humanities or Social Science Foundation Curriculum Requirement, depending on the specific designator.
Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

PHIL 200 Philosophy and Contemporary Issues

This course introduces students to philosophy and philosophizing by using philosophical concepts and methods to examine contemporary issues. For example, a society's practices regarding crime and punishment rest on its beliefs about human freedom and responsibility, and philosophical discussions of determinism provide a vantage point from which to critically evaluate these beliefs. Other issues -- such as the possibility and implications of artificial intelligence, the legitimacy of religious beliefs, the morality of torture, and the paradoxes of democracy (for example, people who are rational managers of their time may not spend the time necessary to be informed citizens) -- can be evaluated on the basis of philosophical accounts about knowledge, religion, the basis of morality, and the nature of the state.
Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters
UNIV/CGI/IG
Comm Points: 1

PHIL 201 History of Western Philosophy

This course examines representative authors from three periods of philosophical history: ancient, modern and contemporary. We will consider the writings of Plato, Aristotle, Epictetus, Augustine, Aquinas, Descartes, Locke, Hume, Mill, Nietzsche, James, and Sartre. We will read these authors both in their historical context and in terms of the relevance of their view to our lives today.
Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Semesters
IG
Comm Points: 1

PHIL 220 Philosophy and Shakespeare

This course is an introduction to ethics through a study of Shakespeare. The course pairs different moral theories with specific plays to examine their strengths and weakness and it attempts to understand Shakespeare's views on ethics. Along the way, the course examines the relationship between philosophy and art.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/IA/IG

PHIL 222 Philosophy for Life

[Cross-Listed as LIT 222] In this course, we will learn to think philosophically (which is to say: critically, rigorously, and reflectively) about complex and difficult questions. We will study practical life

philosophies from both the Eastern and Western traditions, from the Tao Te Ching to Marcus Aurelius, and from Plato to the Dalai Lama. We will reflect on the ontological, epistemological, rhetorical, and ethical perspectives of each of these philosophers and schools of thought. We will note striking similarities and important distinctions between them. Ultimately, we will reflect on our own life philosophies as well—each of us refining our personal life philosophy through reading, reflection, and discussion of these classic texts from the wisdom literature tradition.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CGI/IG

Comm Points: 1

PHIL 241 **Medical Ethics**

[Formerly LP241] The practice of modern medicine has created a number of moral dilemmas for health-care providers, their patients, and society as a whole. This course will explore the roots and nature of these various dilemmas and examine the moral theories and principles used to resolve them.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

UNIV/CGI/IG

Comm Points: 1

PHIL 243 **Business Ethics**

[Formerly LP243] This is an introductory business ethics course that is primarily for sophomores in the School of Business. Topics will include ethical theory and case studies.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

CGI

Comm Points: 1

PHIL 310 **World Religions & Contemporary Issues**

We will also consider a number of contemporary moral issues from the standpoint of these religion traditions including environmental and economic justice, war and capital punishment, abortion and euthanasia, gender and sexual orientation, and science and technology. We will have the opportunity to debate these issues from the perspectives of these religious traditions.

Credits: (3), Graded, Semester Calendar

Lecture

UNIV/CGI/IG

Comm Points: 1

PHIL 330 **Logic for Critical Thinking**

This course helps students develop practical reasoning ability, i.e., the ability to analyze the arguments that they encounter every day (for example, editorials, political speeches, memos and reports at work, and their roommate's, friends', and parents' infuriating, but apparently irrefutable, arguments) and decide whether or not these arguments really support the conclusions, as well as to construct sound arguments of their own. Prerequisites: UNIV 190 and one additional course within the humanities and social sciences.

Credits: (3), Graded, Semester Calendar

Lecture

IG

PHIL 370 **Environmental Ethics**

[Formerly LP342] Environmental issues and concerns are of primary importance as we enter the 21st Century. This course examines the ethical and social approaches to preserving the planet's ecosystems and to developing an environmentally aware culture.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

STS

Comm Points: 1

PHIL 405 **Sustainability Theory and Practice: A Critical Assessment**

This course will offer an overview and critical assessment of some of the founders, fundamental assumptions and contributions of the environmental sustainability movement in an effort to evaluate its effectiveness as an inside the paradigm response to the most critical challenges of our time. Prerequisites: UNIV 190 and at least 2 courses in environmental sciences, and junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture

STS

Comm Points: 1

PHIL 410 **Where the Wild Things Are: Env**

[Cross-listed with EV 410] This course takes Henry David Thoreau's claim 'In Wildness is the Preservation of the World' as the philosophical starting point of the American environmental movement and its attempts to conceptualize nature as a collection of ecosystems and as an ecosphere; along with the ontological, epistemological and ethical implications that result. Authors include Thoreau, Emerson, Muir, Leopold, Stan Rowe, Wes Jackson and Stuart Kauffman. Special emphasis will be given to applications to, and issues and challenges confronting, the Adirondack Park.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

STS

Comm Points: 1

PHIL 485 **Advanced Topics**

An advanced topics seminar open to students with at least 12 credit hours in the discipline or permission from the instructor. Limited to 12 students. Topics to be covered will be selected to conform to the mutual interests and needs of students and faculty. Additional prerequisites may be required depending on the topic. Graduate students will be required to perform additional work.

Credits: (3), Graded, Semester Calendar

Lecture

PHIL 490 **Independent Study**

[Formerly LP490] Designed primarily for an advanced student who wishes to pursue special interests in philosophy for one or more semesters, this series allows students to design and conduct independent study projects under faculty guidance.

Prerequisite: consent of the instructor.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Every Semester

PHIL 491 **Independent Study**

[Formerly LP491] Designed primarily for an advanced student who wishes to pursue special interests in philosophy for one or more semesters, this series allows students to design and conduct independent study projects under faculty guidance.

Prerequisite: consent of the instructor.
Credits: (1-10), Graded, Semester Calendar
Independent Study, Every Semester

PHIL 499**Minor Portfolio**

In this course, students complete their Liberal Arts Minor Portfolios under the direction of their minor advisor. The course is graded on a Pass-No Credit basis.

Credits: (0), P/NC, Semester Calendar
Independent Study, Every Semester

Political Science**POL 1,3,5...****POL Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

POL 2,4,6...**POL Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Humanities or Social Science Foundation Curriculum Requirement, depending on the specific designator.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

POL 220**American Politics**

[Formerly LP250] An introduction to the approaches to political inquiry, and the use of these to acquire an understanding of: the social and economic environment and purposes of the American political system; the political behavior of Americans; the patterns of decision-making within the American political system, and the consequences of public policy.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
IG
Comm Points: 1

POL 230**Introduction to Global Politics**

This course introduces students to key concepts, theories, and patterns for understanding politics in the international arena and within states. It aims to expose students to a broad spectrum of ideas and theories in international relations and comparative politics, and it does so by examining some enduring questions in the study of politics. Topics include the structure of the international system, causes of war and peace, economic globalization, international organizations, democratic processes and democratization, economic and political development, political institutions, civil society, and other issues and processes within and across national borders. Cases from different parts of the world are examined to provide grounding in comparative analysis. In addition to simply learning more about world politics, the course will equip students with key political science concepts, theories and explanations, through which they can improve their capacity to critically interpret current events. By the end of the course, students should have a strong analytic lens by which to interpret the most pressing contemporary issues. This course should appeal to students interested in understanding a multifaceted world, changing societies, and institutions.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
CGI

POL 240**Causes of War**

The main objective of this course is to inquire into the causes of war. Following critical engagement with traditional theoretical approaches to the question of conflict and cooperation in international politics, students will be introduced to systemic, group, and individual-level explanations of war, as well as to case study discussions regarding the influence of these factors. The course provides students with a set of tools for the analysis of classic and contemporary civil and international conflicts and strives to show how evidence and theory can be effectively used in understanding peace and conflict. The course draws on a wide range of disciplines, including international relations, political theory, social psychology, economics, and environmental studies. By the end of the term, students should be able to understand the main factors that drive war, as well as to outline solutions for preventing them.

Credits: (3), Graded, Semester Calendar
Lecture
UNIV/CGI/IG

POL 249**Zombie Politics**

The zombie has spread throughout American popular culture since 2002, appearing in numerous films, television shows, video games and comic books. Why are American audiences fascinated by a reanimated corpse that feasts upon the living and brings about the apocalypse? What is the underlying meaning and significance of the zombie and its apocalyptic story? Our investigation will proceed down two pathways. First, we will examine how the zombie is similar to the monsters that appear in the work of political thinkers since Plato. Second, we will study the political and philosophical significance of zombie culture, including the film Dawn of the Dead, the television show The Walking Dead, and the numerous "zombie walks" that have occurred throughout the world. Throughout the course we will consider how the imaginary world of the zombie apocalypse shows us the dark side of American society, including mindless behavior and uncontrolled consumption.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms
CGI
Comm Points: 1

POL 250**Politics in Cross-National Perspective**

[Formerly LP260] This course introduces students to the study of political development and constitutionalism. By studying at least four countries, course participants will learn to develop and test explanations intended to account both for common patterns of modernization and for the unique features of social and political evolution in each nation-state. Countries to be studied represent developed Western democracies (France and Germany), post-communist regimes (Russia), and 'third world' political systems (Mexico).

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
CGI

POL 251**Introduction to International Politics**

This course introduces students to the prevailing explanations of international relations, and how they are used and misused in the analysis of contemporary policy issues. The main topics to be discussed include the definition and distribution of power in the international system, the role of individual leadership, the influence of international institutions, the impact of globalization and the

future of international governance. Policy issues will include: national security strategy, the rise of China, democracy promotion, the role of the United Nations, terrorism and energy security.

Credits: (3), Graded, Semester Calendar

Lecture

UNIV/CGI/IG

POL 255 **Intro to African Politics**

This course is designed to look at contemporary African Politics from the perspective of cultural pluralism. In the process we situate the evolution of the African State and state-society relations in a historical and yet dynamic context. We assume that the history of the modern state in African greatly influences the character of contemporary politics and greatly influences how African states and their people interact with the forces of globalization.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

UNIV/CGI/IG

Comm Points: 1

POL 260 **Introduction to Public Policy**

This is an introductory course to policy analysis. Policy analysts are responsible for defining and framing public problems, identifying and evaluating possible strategies for addressing problems, and recommending solutions that make the most sense. The goals of this course are to provide students with an understanding of the role that analysis plays in the policymaking process, and to make students critical consumers of policy analysis

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

UNIV/CGI/IG

Comm Points: 1

POL 268 **Social Movements in the United States**

When and why do social movements occur? What motivates some individuals to participate in organized collective action? What role do strategies, values, decision-making structures, and leaders play? How have recent technological developments transformed recruitment efforts? Which tactics are most effective in pressuring legislators to respond to movement demands? What impacts have oppositional movements had on politics and society in the United States? In considering these (and other) questions, we will explore a range of movements which have both animated previous cycles of protest such as civil rights, women's liberation, and antiwar mobilization along with several cases which characterize our own time including climate change advocacy, Occupy Wall Street demonstrations, and the Black Lives Matter campaign. When examining the issue grievances and proposed remedies of both historical and contemporary political struggles, we will also focus close attention on media coverage of social movements, intra-movement disputes and inter-movement coalitions, the rise of counter-movements, and movement relations with political parties and presidential administrations.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CGI/IG

Comm Points: 1

POL 301 **Political Theory**

[Formerly LP301] An historical and topical consideration of some prominent yet divergent conceptions of 'justice' and 'community'

within the Western political tradition. Theorists to be considered include: Plato, Aristotle, Hobbes, Locke, Rousseau, Mill and Marx.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

IG

Comm Points: 1

POL 302 **Contemporary Political Theory**

[Formerly LP302] This course will begin by examining contemporary versions of liberalism, the still-dominant paradigm of political thought in the United States. Students will then read and discuss various critical perspectives on liberalism, such as communitarianism, 'civil society' theory, postmodernism, multiculturalism, and 'green' political thought. We shall try to decide whether liberalism has outlived its usefulness as a model of justice and/or political organization, or whether it can renew itself by responding to the countercurrents noted above.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

IG

Comm Points: 1

POL 320 **The American Political Tradition**

[Formerly LP390] The American Political Tradition: surveys shifting interpretations of American politics and society from colonial times to the present. Some themes to be addressed include: alleged American uniqueness and 'mission,' American democracy, the debate over liberalism versus republicanism, 'Hamiltonian means' and 'Jeffersonian ends,' the pervasiveness of Locke in American thought, the weakness or absence of socialist and conservative alternatives, and environmentalist interpretations of America. Prerequisites: POL220 or a course in American History or permission of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CSO

POL 330 **Politics in the Americas**

This class is an introduction to the politics and governments of the countries that comprise the American continents and the Caribbean. It will focus predominantly on the Spanish & Portuguese-speaking countries in Mexico, Central & South America, and the Caribbean. It also may address relationships between or among Latin American countries and the United States and Canada. The course will address the region's political history, including periods of authoritarian rule, revolution and democratization. It also will examine the causes and consequences of these countries' institutional design, as well as the challenges to economic and political development they face, such as crime and corruption. Additionally the course will evaluate policy failures and successes from agrarian and land reform to economic development and wealth redistribution.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Terms

UNIV/CGI/CSO

POL 333 **Latin American politics & Society through Cinema**

This class is a course about Latin American politics and society through the use of film and literature. It is neither a critical film course, nor a course about the use of film in politics. This course does not offer a broad overview of the politics of Latin America, but rather explores in greater depth particular political and social issues that

popular films from around the world have brought to light. As many of these films have made their way to the United States (several have been entrants or winners in the Best Foreign Language Film category of the Academy Awards), they have raised global awareness of these issues. However, films that achieve success, particularly at an international level, often focus on very dramatic issues. As such, please be conscious that this course does not offer a comprehensive portrayal of Latin America. Nevertheless, we deal with very important and influential issues in Latin American political history, including colonialism, insurgencies, military dictatorships, human rights abuses, corruption, drug trafficking, violence and issues related to the politics stemming from socioeconomic class structures, and racial, ethnic, gender and sexuality-based identities.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

UNIV/CGI/CSO

Comm Points: 1

POL 335 **Violence and Reconciliation**

[Cross-listed with LIT 335] While scholars have labeled the 20th century 'the century of genocide,' the past two decades have catalyzed global changes in the ways we think about peace-building and reconciliation. But reconciliation after mass conflict remains a difficult process. Can you forgive someone who has done irreparable harm to you or your loved ones? Can you reconcile -literally, return to a previous state of harmony- with someone if you never shared a harmonious relationship with that person? Is reconciling with a whole community the same as reconciling with an individual? This course examines the challenges to reconciliation after political trauma and assesses the strengths and weaknesses of major reconciliation mechanisms. Through the lens of two case studies, South Africa and Northern Ireland, and the disciplines of film, fiction, and political theory, students will compare the consequences of criminal trials, truth commissions, and informal efforts at communal healing. As a final project, the class will participate in a simulation of negotiations for reconciliation in the aftermath of a nationwide conflict.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

UNIV/CGI/IA

Comm Points: 1

POL 350 **Political Economy of Development**

[Cross-listed with SOC 350] [Formerly LP370] Explanations of social change and development in an international context are covered. The course moves from a starting point of the presentation of theories and explanations of how nations have historically attempted to modernize themselves and develop their economies, and concludes with a brief introduction to current discussions of the global economy and globalization. Students are introduced to competing explanations of the modernization process and the movement of nations from less industrialized to industrialized status. Other topics covered are the causes and consequences of poverty and famine and hunger, and policies to alleviate these social ills. This course is recommended for students interested in taking POL351: Globalization.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

EC

POL 355 **Sex, Gender and Power**

This course addresses the political, social, and economic circumstances of women in global perspective. Topics include:

theories of gender and politics; intersectionality; the public / private divide; the construction and maintenance of gendered political interests; friction between feminism and multiculturalism in both the developed and developing worlds; issues surrounding the promotion of women's rights; women as political candidates; and women as office-holders.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CGI

Comm Points: 1

POL 362 **Human Rights Law and Politics**

The politics and law framed around various conceptions of Human Rights are primarily responses to perceived crimes against people based on their ethnicity, religion, gender and/or age. This course is a historical, institutional, and political inquiry, therefore, on how we go about protecting and improving the lot of the most vulnerable populations throughout the world. The first half of the semester will examine the institutional responses to Human Rights (the formation of the Declaration of Human Rights, various international aid agencies, and war crimes tribunals). The second half of the semester will involve investigation into legal and political responses to torture, political repression, war crimes and genocide, the status of refugees, women's rights, children's rights, and humanitarian intervention.

Credits: (3), Graded, Semester Calendar

Lecture

CGI

Comm Points: 1

POL 370 **Close and Contested Elections**

Course material includes the study of electoral rules worldwide, including social and political consequences of these rules. The first section of this course examines the role of elections in both democratic and non-democratic systems. What are elections intended to accomplish? How do they work? The second, longer, section of the course turns to a series of case studies of contemporary close and contested elections in a number of different contexts, including cases ranging from the United States (2000) to Iran (2009). This latter portion of the course addresses such questions as (1) the tools and procedures that various kinds of states/regimes have for dealing with such contestation, (2) the extent to which such contested elections may de-legitimize the entire political system, and (3) the role of the media. The final week addresses international election monitoring bodies.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CGI

Comm Points: 1

POL 374 **Environmental Political Theory**

This course is designed for students with interests in environmental science and policy, and political theory, or both. We will examine the relationship between nature, politics, and the political economy. We will also examine a wide spectrum of ideas on political, economic, social and scientific matters expressed by contemporary environmental thinkers, though we will also discuss thinkers from the past (Thoreau, Muir, Leopold, Carson). In particular, we will focus our discussions on the relationship between environmental concerns and dominant ideas in liberal capitalism and democracy. We will also study feminist, socialist, communitarian, authoritarian, and anarchist perspectives.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters
UNIV/CGI/STS
Comm Points: 1

POL 375 **Environmental Law**

In this course we will be examining the relationship between the Courts and various policies, laws, and regulations pertaining to the restoration and management of the environment. The central issues in the cases we will be examining emerge from the tension between property rights and what has been conceived as a constitutional right to a clean, healthy environment. Areas where this tension plays out include: the Clean Air Act, the Clean Water Act, The Superfund Law, and the National Environmental Policy Act. In general, the course is designed to help students assess whether environmental laws provide us with a route for attaining ecological goals, and to think critically about the role of the Courts as a defender of the environment.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
CGI

POL 380 **The Law and Bioethics**

This course explores the relation between law, ethics, and new technologies. In particular, we will be exploring issues of the right to privacy, abortion, state sterilization programs, cloning, rights of surrogate parents, doctor/patient confidentiality, the right to die, new definitions of death, the human genome project and intellectual property rights, and organ transplantation. This inquiry will be guided by the question: 'Who Owns Life?' There is no definitive answer to this question offered by the American court system. Through readings and discussions students will gain political and ethical perspective on how legal standards are formed in response to new demands by the public and government, and how new ethical questions are inspired by innovations in germline bioengineering, medical and rehabilitative technology, robotics, virtual reality, and nanotechnology. The material for the course will be case law and articles by leading scientists, physicians, ethicists, and legal scholars in this young field.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
UNIV/CGI/STS
Comm Points: 1

POL 388 **Terror and Terrorism**

This course will focus on terrorism as political violence carried out by non-state actors, although we will also explore the topic of state sponsorship of terrorist groups. The purpose of the course is to familiarize students with the theoretical approaches to and contemporary challenges in the study of terror and terrorism. Topics will include the nuances involved in defining terrorism; the political context in which terrorist groups emerge; the ideologies, motivations, organizational structure, and decision-making processes of important terrorist groups; the effectiveness of various counter-terrorism tools; and the role of technology in the evolution of terror and terrorism. The course will provide a basis for discussing and analyzing contemporary terror/terrorist events and related security issues.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
CGI
Comm Points: 1

POL 391 **Special Topic: American Politics in Comparative Persp**

In what ways is the United States an outlier among western democracies, and in what ways does the United States resemble other democratic nations? To the extent that the United States is distinctive, what explains the differences between the United States and other advanced industrial societies? What do the structural differences of the American political system mean for democratic performance? Is the American way more or less effective than comparably developed states in Asia, Latin America, North America, or Europe? In order to explore these questions, this class examines major features of American democracy – political culture and public opinion, electoral institutions and behavior, interest groups, political parties, and social movements, the division of power between state and federal governments – from a comparative perspective. Understanding American politics in the twenty-first century requires moving beyond national boundaries and situating the United States and its interventions in the world.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CGI/IG
Comm Points: 1

POL 400 **Constitutional Law**

[Formerly LP400] An introduction to American Constitutional law and jurisprudence. Using a case study approach that focuses upon Supreme Court decision making, the course will pay particular attention to the evolution of discourse on 'rights' in the United States. Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
CGI

POL 450 **Development and Public-Private Partnerships**

This course introduces students to the challenges and opportunities of economic liberalization and public-private partnerships in the delivery of public goods and services. We will study public procurement, or the mechanisms through which governments buy goods and services from private vendors to fulfill their public mission. We frame procurement politics within the literature on development economics and political accountability. We study the interactions between four actors: government, law, private vendors, and civil society. We survey the linkages and tensions between economic, social, and political goals.

Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Semesters
UNIV/CGI/STS
Comm Points: 1

POL 470 **Environmental Policy**

[Cross-listed with SOC 470] [Formerly LP360] Public policy is developed in response to problems or issues in society that are presumed, for whatever reasons, not to be resolvable by the private sector. In theory, public policy as it relates to environmental issues is used to intervene to alleviate problems, such as industrial pollution, that threaten the integrity of the natural resource base and the natural and built environments on which our lives and livelihoods depend. However, public policy development and implementation in general, and environmental policy in particular, are not immune to political forces and influences. Even scientific institutions that often provide the empirical basis for environmental policy are potentially influenced and shaped by the political process and political and economic interests. This course introduces students to the distinctive

features or characteristics of environmental policy development and implementation. The course primarily focuses on the United States but includes international environmental issues and policies. The course will help students understand how environmental policy fits within the large-scale social and economic changes in the U.S. and elsewhere that have resulted in greater environmental awareness. We will also consider how scientific evidence is created and marshaled in support of competing interpretations of environmental problems, and the appropriate policies to address such problems. Case studies of particular environmental policies, such as regulation of transgenic crop development and commercialization, will be used to help students grasp the complexities of, and driving forces behind, environmental policy.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

STS

Comm Points: 1

POL 471

Energy Policy

Energy policy is a critical component of state and national public policy. Issues surrounding the reliability and security of energy supplies directly affect national domestic and foreign policy, as well as state level environmental, economic development, and land use concerns. Via emphasis on specific issues unique to North American energy policy (US and Canada), the class will introduce students to the major theoretical frameworks used by political scientists, sociologists, economists, and other intellectual disciplines to understand how societies design and implement public policies related to energy, and how the energy industry responds. Topics covered will include theories of the state, monopoly and regulation, public choice, organizational behavior, international agreements, and innovation. The class will apply these theories to major current and historical issues in energy policy, such as ethanol, climate change, and renewable energy systems, nuclear power, energy efficiency, energy security, the world oil market, and OPEC, electricity production and markets and the California electricity crisis.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

UNIV/EC/STS

Comm Points: 1

POL 490

Independent Study

Designed primarily for an advanced student who wishes to pursue special interests in political science for one or more semesters, this series allows students to design and conduct independent study projects under faculty guidance.

Prerequisite: consent of the instructor.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Every Semester

POL 491

Independent Study

Designed primarily for an advanced student who wishes to pursue special interests in political science for one or more semesters, this series allows students to design and conduct independent study projects under faculty guidance.

Prerequisite: consent of the instructor.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Every Semester

POL 499

Minor Portfolio

In this course, students complete their Liberal Arts Minor Portfolios under the direction of their minor advisor. The course is graded on a Pass-No Entry basis.

Credits: (0), P/NC, Semester Calendar

Independent Study, Every Semester

Physical Therapy

PT 1,3,5...

PT Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (1-4), Graded, Semester Calendar

Lecture, Transfer Credit Only

PT 2,4,6...

PT Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Science Foundation Curriculum Requirement.

Credits: (1-4), Graded, Semester Calendar

Lecture, Transfer Credit Only

PT 105

Introduction to Physical Therapy I

Introduction to the profession of physical therapy, the pre-physical therapy and DPT programs at Clarkson, the problem-based learning (PBL) mode of curriculum, and the concept of the medical model and team in the U.S.

Credits: (1), P/NC, Semester Calendar

Lecture, Spring Semesters

PT 210

Introduction to Sports Medicine

This course is a 15 week lecture and lab based course. Day 1 of the week will be a lecture on a sports medicine related topic and day two of the week will be practice, in a lab type setting. The course will help to provide students with a basic understanding of the principles of sports medicine and a background in the care and prevention of injuries to athletes.

Credits: (2), Graded, Semester Calendar

Lecture, Laboratory, Spring Semesters

PT 300

Independent Study

An opportunity for Pre-PT students to undertake a research project or clinical observation with approval by a PT faculty member. A portfolio or written report must be handed in at the end of the semester.

Prerequisite: consent of the instructor.

Credits: (1-3), Graded, Semester Calendar

Independent Study, Every Semester

PT 305

Introduction to Physical Therapy II

Introduction to the requirements and process of graduate physical therapy education, participation in the (PBL) mode of curriculum, and issues of professionalism in physical therapy practice. Prerequisites: PT105 or Permission of Instructor.

Credits: (1), P/NC, Semester Calendar

Lecture, Fall Semesters

Psychology

PY 1,3,5...

Psychology Elective

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

PY 2,4,6... **Psychology Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Social Science Foundation Curriculum Requirement.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

PY 151 **Introduction to Psychology**

Emphasizes the scientific study of the human mind. Appropriate research methods and philosophical questions will be considered. Topics include the brain, memory, perception, development, personality, social behavior, emotion, motivation, psychological disorders, stress, and states of consciousness.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
IG

PY 246 **Educational Psychology**

This course will examine the ways in which theories of child development and learning inform classroom teaching methods, assessment, behavioral interventions, and student motivation. Prerequisites: PY151 or permission of the instructor

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

PY 253 **Social Psychology**

Emphasis on the relative influences of society and other people on the individual. Topics include persuasion, attitude formation and change, group decision making, prejudice, social influence, altruism and aggression. Fundamental to the discussion of each topic is the scientific research that underlies it. A focus of the course is the means by which the individual can influence and be influenced by the organizations that play a major role in our lives. Prerequisite: PY151.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

PY 255 **Cognitive Psychology**

Cognitive psychology is the study of how the mind perceives, attends to, remembers, and interacts with the world. The mental processes that will be examined include perception, attention, memory, language, decision-making, and problem solving. During this course, each topic will be explored by investigating theories and results from laboratory experiments, computer simulations and work in artificial intelligence. Prerequisite: PY151.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

PY 286 **Organizational Behavior I**

[Cross-listed with EM 286, OS 286] (May be used to satisfy a CUSB MBA or MS foundation requirement.) An introduction to the processes required to manage contemporary organizations with a focus on individual behaviors as they relate to the functions of planning, organizing, controlling, and leading. The most recent concepts of behavioral science in the practice of management are presented to assist the student in gaining understanding of the pervasiveness of the discipline in all types of organizations and processes. Topics include motivation, leadership, perceptions, personality theory, learning theory, personnel issues, stress

management, organizational culture, and decision making. Prerequisites: sophomore standing or the permission of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester
IG

PY 310 **Human Sexuality**

The course objective is to provide an informed perspective on human sexual behavior. Topics include anatomy and physiology, contraception, sexually transmitted diseases, sexual development and identity, varieties of sexual behavior across cultures and species, disorders and difficulties of sexual expression, therapeutic issues on the treatment of sexual disorders and the role of sex in interpersonal relationships.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
UNIV/CGI/IG

PY 311 **Cyberpsychology**

Cyberpsychology is the branch of psychology that examines human behavior in the context of interaction with modern technologies. The research in this field is primarily focused on the use of Internet, particularly social media sites, but other technologies, such as gaming, mobile device applications, artificial intelligence and virtual reality are also within the scope of this area of psychological research and practice. The goal of this course is to provide students with an in-depth understanding of the psychological factors associated with using technologies and interacting in on-line environment. Prerequisite: PY151

Credits: (3), Graded, Semester Calendar
Lecture

PY 315 **Personal Relationships**

According to some statistics humans spend as much as 60% of their lives in the company of others. This course will focus on research and theory in the psychology of personal relationships. Characteristics of romantic, marital, family and other social relationships will be considered. Topics will include attraction, relationship development and maintenance, communication, social support, and relationship conflict. Prerequisites: PY151 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
Comm Points: 1

PY 317 **Psyc of Psychoactive Drugs**

The Psychology of Psychoactive Drugs will examine a number of medicinal and so-called recreational drugs that affect consciousness, including cocaine, morphine, LSD, marijuana, alcohol, nicotine and caffeine. The course will include a description of the drugs, their pharmacological action, and side-effects. Psychological, physiological, and pharmacological theories of tolerance and addiction, and addiction treatment programs will also be covered.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters
UNIV/CGI/IG

PY 319 **Current Readings in Animal Behavior**

[Cross-listed with BY 319] The field of animal behavior is a rapidly advancing one, especially at the interface of neurobiology and cognition, and the interface of cognition and functional analysis of

behavior (behavioral ecology and sociobiology). This one credit hour course is designed as a 'journal club' with a focus on the latest developments in theory and empirical research on animal behavior. The course is intended for any student who has a sincere interest in integrative animal behavior. Prerequisites: BY222 or PY151

Credits: (1), Graded, Semester Calendar
Lecture, Fall Semesters

PY 321 Consumer Behavior

[Cross-listed with MK 321] Extensive coverage of selected consumer behavior theories and models. Special emphasis given to the most recent research along with marketing mix applications. Topics include classic and operant conditioning, motivation and attribution theories and the elaboration likelihood model. Students are required to complete a term project. Prerequisite: MK320.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

PY 335 Personality

Examines research evidence that treats various features of personality. Includes introversion-extroversion, authoritarian personality, the psychoanalysis, aggression, sexuality, dream interpretation, self-monitoring, locus of control, defense mechanisms, and unconscious motivation. Prerequisites: PY151 or junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

PY 340 Behavioral Ecology and Sociobiology

[Cross-listed with BY 340] This course is concerned with the adaptive functions of animal behavior, emphasizing ecological and evolutionary perspectives. Topics covered include foraging behavior, sexual selection, social systems, parental care, and cooperation and conflict. One major focus will be on evaluating the arguments of proponents and critics of sociobiology on whether the field is useful at explaining human behavior. Prerequisites: BY140 or PY151 or consent of instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters
IG

PY 357 Human Cognitive Evolution

[Cross-listed with BY 357] Evolutionary psychology is concerned with the adaptive problems and selective pressures our ancestors encountered in their environments, the psychological mechanisms that evolved to help them solve those problems, and the way those evolved mechanisms function in current environments. This way of thinking about the brain, mind, and behavior is changing how scientists approach old topics, and is opening up new ones. This course will focus on current developments and selected topics in evolutionary psychology (e.g., foraging, mate choice, parental investment, cooperation and culture) and explore the evolution of cognition from a broad comparative perspective. Prerequisites: PY151 or junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

PY 358 Animal Learning and Cognition

[Cross-listed with BY 358] This course focuses upon how animals acquire, process, store and recall information about their environment and social partners. Topics that will be examined include

how animals perceive and classify stimuli; how they learn and remember; how they orient and navigate; how they measure time, number, and amount; how they acquire abstract concepts; how they perceive social relationships; and how they communicate. A diversity of invertebrate and vertebrate organisms will be included (sea slugs to primates!), and there will be an emphasis on understanding taxon-specific specializations as well as general patterns across animals. Prerequisites: BY140 or PY151 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Semesters

PY 359 Perception

Perception deals with our conscious experience of the world, ourselves and each other. This course will examine how perceptions are measured (psychophysics); how visual, auditory, touch and pain sensory stimulation is actively organized into conscious perceptions; developmental aspects of perception; the role of cognitive factors, such as attention; and how altered conscious states (e.g., achieved through meditation, hallucinogenic drugs) affect perception. Fundamental principles of perception discussed in this course will be used to explain how we experience the world, ourselves, and each other. Prerequisites: PY151 or junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

PY 360 Learning and Memory

The basic principles, major theories, and practical applications of learning and memory processes will be explored in humans and animals. Topics will include how knowledge is acquired (learning), how it is represented, stored and accessed (memory), and how these learning and memory principles can be applied in education and in clinical settings. The course will take a multidisciplinary approach that will allow examining the processes underlying learning and memory at the behavioral, cognitive, neurobiological, and genetic levels. Prerequisites: PY151 or junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

PY 361 Motivation and Emotion

This course examines the forces of personality, environment, and culture that lead people to want what they want, and do what they do. Motivation will be explored in the contexts of education, work, therapy, sports, and relationships. Topics include: self-efficacy, self-regulation, earned helplessness, intrinsic and extrinsic motivation, achievement motivation, goal-setting, implementation intentions, self-determination, and emotion. Recent developments in the field of motivation will be applied to the practice of motivating others. Prerequisites: PY151 or junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

PY 363 Judgment and Decision Making for the Biomedical Sciences

Decision making is using information (and in some cases emotion) to guide behavior among multiple possible courses of action—for example, which foods to choose, which stocks to invest in, who to select for a romantic partner, or which products to buy. These choices determine our success in meeting the challenges of life. This course will cover a wide variety of topics regarding how individuals and groups form judgments and make decisions, by drawing on findings from psychology, economics, and biology. We will investigate the various techniques used to study and assess human judgment and

decision making, explore how people reason under risk and uncertainty and apply the research addressed in class to real-world problems and issues. Particular focus will be given to judgment and decision-making in applied health contexts that are of high relevance for students with career goals in the biomedical sciences. Enrollment is limited to students participating in the Trudeau Semester.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Semesters

PY 370 Developmental Psychology

This course will examine normal development from conception through old age and will cover theories of development and current developmental research. Consideration will be given to interaction of physical, social and cognitive aspects. Topics include the development of self, identity, moral beliefs, language, friendship, attachment, sexuality, and death/dying. Prerequisites: PY151 or junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

PY 400 Internship - Professional Experience (Class Structure)

This course entails completing a professional experience (90 – 120 hours) through volunteer or work activities associated with psychology and writing an APA style paper that integrates the professional experience with relevant psychological literature. Examples of professional experiences include, but are not limited to, St. Lawrence Psychiatric Facility, Reach Out Crisis Hotline, Renewal House, Canton-Potsdam Hospital Chemical Dependency Unit, working in Human Resources or marketing/advertising departments, Hospice, patient advocacy, counseling, or mental health diagnoses. Note that the professional experience must be approved BEFORE the student begins the experience; please contact the Psychology Front Office for details. Prerequisites: Junior or Senior standing.

Credits: (3), Graded, Semester Calendar
Independent Study, Fall Terms
Comm Points: 2

PY 401 Internship - Clinical/Counseling Psych (individual study)

This course entails completing a professional experience (90 – 120 hours) through volunteer or work activities associated in clinical/counseling psychology and writing an APA style paper that integrates the professional experience with relevant psychological literature. Note that the professional experience must be approved BEFORE the student begins the experience; please contact the Psychology Front Office for details. This class is taught in an individual study format and can replace, if needed, the PY400 Internship - Professional Experience class. Prerequisites: Must have junior or senior standing.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Term
Comm Points: 2

PY 402 Internship: Personnel Relations (individual study format)

This course entails completing a professional experience (90 – 120 hours) through volunteer or work activities associated in relevant organizations and writing an APA style paper that integrates the professional experience with relevant psychological literature. Note that the professional experience must be approved BEFORE the student begins the experience; please contact the Psychology Front Office for details. This class is taught in an individual study format and

can replace, if needed, the PY400 Internship - Professional Experience class. Prerequisites: Must have junior or senior standing.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Term
Comm Points: 2

PY 403 Internship - Psych in Health Care Enviro (individual study)

This course entails completing a professional experience (90 – 120 hours) through volunteer or work activities associated in health care environments and writing an APA style paper that integrates the professional experience with relevant psychological literature. Note that the professional experience must be approved BEFORE the student begins the experience; please contact the Psychology Front Office for details. This class is taught in an individual study format and can replace, if needed, the PY400 Internship - Professional Experience class. Prerequisites: Must have junior or senior standing.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Term
Comm Points: 2

PY 411 Counseling Psychology: Theory and Practice

This course builds a foundation of clinical knowledge and skills for those who may pursue work in counseling or psychotherapy. It surveys the most widely accepted theories of counseling and provides experiential opportunities to learn and practice facilitative communication skills. Students explore basic concepts for integrating diagnosis, evaluative testing, treatment planning, and appropriate referral into the counseling process. The various types of counseling professions and the ethical issues surrounding counseling are also discussed. Prerequisites: Psychology major with Senior or Junior standing, or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

PY 412 Psychiatric Center Professional Experience

Students will spend one full day per week working with and observing Clinical Psychologists at the St. Lawrence Psychiatric Center in Ogdensburg, NY. The experience may include rounds at the Sex Offenders Treatment Program, Child and Youth Program, and the Adult Services Program. Activities include observing group therapy, developing a lesson plan for and delivering a therapy session under the supervision of a staff Psychologist, and observing treatment team meetings. This course is only open to Psychology majors. Prerequisites: PY151 and permission of the instructor. Acceptance into the course will be based on GPA and a short essay describing how this course will advance his/her personal and professional goals. Prerequisite: PY151

Credits: (6), Graded, Semester Calendar
Lecture, Fall Semesters

PY 453 Advanced Topics in Social Psychology

In this course students will receive an intensive treatment of several classic and cutting-edge topics in social psychology, including social motivation, self-esteem, social identity and intergroup relations, the psychology of meaning, embodied social cognition and social neuroscience. Students will develop their understanding and communication of social psychological concepts, theories, and research by engaging in class debate and discussion, giving oral presentations, and writing scientific literature reviews. Prerequisite: PY151 and PY253 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters
Comm Points: 2

PY 454 Physiological Psychology

[Cross-listed with BY 454] A comprehensive investigation of the physiological foundation of behavior. Topics include: perception, motivation, emotion, states of consciousness, learning, memory and mental illness. Prerequisites: PY151 or junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

PY 456 Experimental Psychology

This course involves research design, hypothesis testing, measurement and analysis, and includes the application and interpretation of statistics. The research methodologies covered will include experimental and quasi-experimental designs. Prerequisite: PY151 and STAT282 or STAT383 or STAT318 and Psychology major with Junior or Senior standing; or consent of the instructor. Corequisite PY457.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Fall Semesters
(TECH)

PY 457 Experimental Psychology Laboratory

Students will work in teams to design and conduct an experiment, analyze the results and write up their findings in the American Psychological Association format. Corequisite: PY456

Credits: (2), Graded, Semester Calendar

Laboratory, Fall Semesters

Comm Points: 2

PY 458 Cognitive Neuroscience

[Cross-listed with BY 458] This course introduces a sampling of the theories and research concerning how various mental processes are accomplished within the brain. Emphasis will be placed on developing an understanding of both the physiological bases of the techniques and the issues involved in relating measures of brain activity to cognitive functioning. Students will be exposed to current topics of study in a number of areas of cognition: perception, language, memory, among others. In this course we will study a number of different techniques for studying the brain, including electrophysiological recording techniques, functional imaging techniques, and methods that involve brain lesions and disrupting neural activity. Prerequisites: PY151 or junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

UNIV/IG/STS

PY 459 Neuroscience and Society

[Cross-listed with HIST 459] The word 'neuroscience' is of recent origin. Yet we can trace neuroscientific ideas back to Rene Descartes. Since Decartes, social understanding of madness, the relationship between mind and brain, and the nature of sensation and perception has changed frequently. Beginning in the Age of Mechanical Man, and ending in the Age of Prozac, this course examines how society has influenced neuroscientific thought and how, in turn, neuroscience has influenced society. Restriction: Junior or senior standing, and permission of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters
STS

Comm Points: 1

PY 460 Neurobiology

[Cross-listed with BY 460] Neurons are electrically excitable cells that initiate and control many complex functions such as sensory perception, locomotion, memory, and learning. This course introduces the study of neuronal mechanisms at the cellular and molecular level. Topics include: membrane biophysics, ion channels, electrical signaling, synaptic transmission, glia, sensory transduction, neuromodulation, and neuronal plasticity. Prerequisites: BY160 or BY360 or consent of instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

PY 461 Judgment and Decision Making

Decision making is using information (and in some cases, emotion) to guide behavior among multiple possible courses of action - which foods to choose, who to select for a romantic partner, or which products to buy. These choices determine our success in meeting the challenges of life. This course will cover a wide variety of topics regarding how people form judgments and make decisions by drawing on findings from psychology, economics, and biology. We will investigate the various techniques used to study and assess human judgment and decision making, explore how people reason under risk and uncertainty and apply the research addressed in class to real-world problems and issues. Prerequisites: PY 151 and Junior or Senior standing

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

PY 462 Abnormal Psychology

This course surveys the major syndromes of psychopathology, including schizophrenia, depression and manic-depression, anxiety disorders, and psychopathic personality. Reviews know causes, symptomatology, and both pharmacological and psychological modes of intervention. Prerequisites: PY151 or junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

PY 463 Health Psychology

This course will provide an introduction to the field of health psychology, which is concerned with the role of psychological and social factors in health and illness. The course will address three general subject areas: 1) attitudes, behavior, and lifestyle factors affecting disease prevention and development, 2) stress and the related personality and social processes associated with disease development and progression, and 3) the psychological and social consequences of physical illness. Prerequisites: PY151 or permission of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

Comm Points: 1

PY 464 Clinical Psychology

This course is designed to introduce students to the theoretical, empirical, and ethical foundations of clinical psychology. We will focus on the major roles of clinical psychologists, particularly psychotherapy, assessment, and issues in education and training. Students will also be asked to engage in self-reflection throughout the

course, as the ongoing development of self-awareness and self-knowledge are essential to effective and ethical practice. Contemporary issues and controversies that are currently shaping the field of clinical psychology will also be addressed. Prior enrollment in PY462 (Abnormal Psychology) is recommended. Prerequisites: PY151 or Junior or Senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

PY 480 Directed Study in Psychology

This is a directed reading course that will allow the student the opportunity to pursue special interests in the general psychology.

Prerequisite: consent of the instructor.
Credits: (1-6), Graded, Semester Calendar
Independent Study, Every Semester

PY 481 Directed Study in Social Psychology

This is a directed reading course that will allow the student the opportunity to pursue special interests in social psychology.

Prerequisite: consent of the instructor.
Credits: (1-6), Graded, Semester Calendar
Independent Study, Every Semester

PY 482 Directed Study in Physiological Psychology

This is a directed study course that will allow the student the opportunity to pursue special interests in physiological psychology.

Prerequisite: consent of the instructor.
Credits: (1-6), Graded, Semester Calendar
Independent Study, Every Semester

PY 483 Directed Study in Cognitive Psychology

This is a directed reading course that will allow the student the opportunity to pursue special interests in cognitive psychology.

Credits: (1-6), Graded, Semester Calendar
Independent Study, Every Semester

PY 491 Directed Research in Health Psychology

The student works one-on-one with a faculty member on a health psychology research project. The student will learn about the major theories related to the research topic and gain first-hand experience with research methodology issues, data collection, and analysis. Does not count towards the directed research requirement for the psychology major. Instructor consent required to enroll.

Credits: (1-6), Graded, Semester Calendar
Research, Every Term

PY 492 Directed Research in Psychophysiology

The student works one-on-one with a faculty member on a psychophysiological research project. The student will learn about the major theories related to the research topic and gain first-hand experience with research methodology issues, data collection, and analysis. Does not count towards the directed research requirement for the psychology major. Instructor consent required to enroll.

Credits: (1-6), Graded, Semester Calendar
Research, Every Term

PY 493 Directed Research in Cognitive Psychology

The student works one-on-one with a faculty member on a cognitive psychology research project. The student will learn about the major theories related to the research topic and gain first-hand experience with research methodology issues, data collection, and analysis. Does

not count towards the directed research requirement for the psychology major. Instructor consent required to enroll.

Credits: (1-6), Graded, Semester Calendar
Research, Every Term

PY 494 Directed Research in Social Psychology

The student works one-on-one with a faculty member on a social psychology research project. The student will learn about the major theories related to the research topic and gain first-hand experience with research methodology issues, data collection, and analysis. Does not count towards the directed research requirement for the psychology major. Prerequisite: consent of the instructor.

Credits: (1-6), Graded, Semester Calendar
Research, Every Term

PY 495 Directed Research in Clinical Psychology

The student works on-on-one with a faculty member on a clinical psychology research project. The student will learn about the major theories related to the research topic, and gain first-hand experience with research methodology issues, data collection, and analysis. Does not count towards the directed research requirement for the psychology major.

Credits: (1-6), Graded, Semester Calendar
Independent Study, Every Term

PY 496 Directed Research in Psychology

The student works one-on-one with a faculty member on a cognitive psychology research project. The student will learn about the major theories related to the research topic and gain first-hand experience with research methodology issues, data collection, and analysis. The student will write an APA style research paper. Can be used to satisfy the directed research requirement for the psychology major. Instructor consent required to enroll.

Credits: (1-6), Graded, Semester Calendar
Research, Every Term
Comm Points: 1

PY 498 Senior Thesis

Research under the direction of a faculty sponsor, who assists the student in the choice of a problem and in the planning and execution of the research. Prerequisites: senior psychology major and consent of the department faculty.

Credits: (1-10), Graded, Semester Calendar
Research, Fall Terms
Comm Points: 1

PY 499 Senior Thesis

Continuation of the research from PY498 leading to a written due at the end of the course. Can be used to satisfy the directed research requirement for the psychology major. Prerequisite: PY498.

Credits: (1-10), Graded, Semester Calendar
Research, Spring Terms
Comm Points: 1

Study Abroad

SA 300 Study Abroad

Indicates participation in the Study Abroad Program.

Credits: (12), P/NC, Semester Calendar
Independent Study

School of Arts and Sciences

SA&S 2,4,6... **School of Arts and Science Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

SA&S 100 **Co-Writing**

A writing workshop to be taken concurrently with UNIV190, Clarkson Seminar. Provides supplementary instruction and practice in critical analysis and in writing and editing techniques. Each week students have a group session and also meet one-to-one with the course instructor about work in progress in their UNIV190 classes. Corequisite: UNIV190

Credits: (1), P/NC, Semester Calendar

Lecture, Fall Semesters

SA&S 300 **Arts and Sciences Seminar**

Students attend seminars by alumni, faculty, and guest speakers. Students will attend one seminar per week. The School of Arts and Sciences will typically sponsor most of these seminars. Students may also attend seminars sponsored by the various Departments comprising Arts and Sciences. Students will write responses to at least three of the colloquia they attend over the semester. Prerequisites: Major in the School of Arts and Sciences, and at least Sophomore standing

Credits: (1), P/NC, Semester Calendar

Seminar, Every Semester

SA&S 399 **The Adirondack Speaker Series**

In this weekly seminar, students will learn about our region. The purpose of the series is to give Clarkson students a sense of place. The weekly seminar will feature talks by researchers, community members, and storytellers who will discuss all things Adirondack, including geology, economy, history, agriculture, rivers, parks, animals, art, politics, and social issues. This seminar is open to all - students, faculty, and community members.

Credits: (1), P/NC, Semester Calendar

Lecture, Fall Terms

SA&S 400 **Internship**

Students gain practical work experience by working with a professional outside their department on issues, problems, or projects that draw on concepts and methods from multiple fields. Students also prepare a report about their learning experiences in the internships.

This course may be repeated for credit.

Credits: (1-3), Graded, Semester Calendar

Independent Study

SA&S 410 **Professional Experience**

This course number is used to matriculate the Professional Experience requirement of the Clarkson Common Experience curriculum. The student must participate in a project-based professional experience such as a co-op, internship, other professional-level work experience, directed research, significant responsibility in an appropriate team project, or a community project clearly related to the student's professional goals. Enrollment requires approval by the Associate Dean or Dean of Arts and Sciences.

Requirement: Pre-approval of the experience (contact the Office of the School of Arts & Sciences for details).

Credits: (0), P/NC, Semester Calendar

Independent Study, Every Term

SA&S 499 **Biology, Behavior and Society Minor Portfolio**

The student will provide a portfolio based on (a) term papers or equivalent products from the three major required courses in the BiBS minor, (b) representative course material that shows mastery of subject matter area, and (c) will use the portfolio and materials from other courses taken for the BiBS minor to prepare a 10 page self-reflective essay on what the student has learned about the biological, psychological, and socio-cultural influences on human behavior, human cultural evolution, and human social organization. Prerequisites: HIST270, BY/PY340, and BY/PY357

Credits: (1), Graded, Semester Calendar

Independent Study

School of Business

SB 1,3,5... **Business Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar

Lecture, Transfer Credit Only

SB 2,4,6... **Business Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Management/Business Foundation Curriculum Requirement.

Credits: (2-4), Graded, Semester Calendar

Lecture, Transfer Credit Only

SB 100 **Quantitative Methods of Business and Economics**

This course is restricted to the HEOP Summer Program for incoming students. It is designed to prepare students for the required courses in the School of Business at Clarkson, and will emphasize the understanding of mathematical methods and their application to the fundamentals of business and economics. Topics will include algebraic and functional interpretation, geometry, creating and using graphs to understand and communicate data, marginal analysis, and other mathematical concepts as they are used in selected topics in business and economics. This course may not be used to satisfy business major requirements. Prerequisite: For HEOP students only.

Credits: (1-3), Graded, Semester Calendar

Lecture, Summer Terms

SB 113 **Entrepreneurship and Business Innovation I**

(CUSB Freshmen Only) SB113 provides you with exposure to a range of business theories and skills by applying and reinforcing this knowledge through actual management and entrepreneurial experience. This "learning-by-doing" approach is designed to provide you with a solid foundation for critical, analytical and lateral thinking about management and increase your confidence and competence as practicing managers, leaders, and entrepreneurs. Additionally, this course will serve as an introduction to familiarize you with the Clarkson University School of Business curriculum and introduce you to each of the business disciplines. You will be exposed to theories, applications, and skills relevant to creating an effective business plan. These include: innovation, decision making, leadership, team building, oral and written communication, market research, financial analysis, and working under conditions of uncertainty. Ultimately, the

course is centered on helping you become aware of and able to manage risk, resources, and opportunities, while understanding the importance of adding values. Restriction: Must be a CUSB Freshmen. Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Fall Semesters
Comm Points: 1

SB 114 Entrepreneurship & Business Innovation II

SB114 provides you with exposure to a wide range of business theory and skills. Using the experiences gained in SB113, students will learn about the various types of business structures and how individual and group behavior can positively or negatively impact an organization's success. Students will be exposed to topics including financial analysis, asset management, human resource management, supply chain management, intellectual property, international business and group behavior. Specifically, students will study concepts associated with managing a start up venture or new product introduction, leadership, personal accountability, stress, tolerance for uncertainty, change management and organizational flexibility. This foundation of learning is also designed to support the student's choice of emphasis in future course selection. Prerequisite: SB113.

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Spring Semesters
Comm Points: 1

SB 115 Foundations of Innovation and Entrepreneurship

This course will expose the student to a wide range of business theories and skills and serves as an introduction to the curriculum of the School of Business. The course will provide the student with an introduction to each of the business disciplines and an introduction to the theories, application, and skills necessary to create an effective business plan. These skills and topics include: innovation, analytically thinking, decision making, leadership, team building, oral and written communication, market research, and financial analysis. This course is offered only to second semester freshmen students who have internally transferred to the School of Business. This course cannot be taken by a student who has taken SB113. The course will serve as a substitute for SB113 for those students who internally transfer into the School of Business. Restriction: This course cannot be taken by any student who has taken SB113.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters
Comm Points: 1

SB 236 Introduction to Customer-Focused Design

This introductory course looks at design and innovation through both the theories and practice of design thinking, creativity, and customer-centered innovation. Students taking this class will learn to look for opportunities to innovate and focus on customer needs relating to those opportunities. We will explore product, service, and process design. Students will learn multiple ways to design and choose one to focus on for a hands-on design project. This introductory class will give students design tools that should serve as a foundation for creativity and innovation throughout the curriculum at Clarkson, in extra-curricular activities on campus, and in non-university endeavors. Prerequisite: At least Sophomore standing.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

SB 305 Cost Management

Introduces the concepts of cost management and strategic cost management. This course will present the principles involved in the determination of the cost of a product or service. A central focus is how cost management principles help managers make better decisions. Topics covered include cost-volume-profit analysis, value and supply chain analysis, operational budgeting and activity based costing, especially as they relate to cost management. Prerequisite: AC/EM 205 or junior standing

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

SB 310 CUSB Professional Experience: Internship

Project-based professional internship experience in business, related to student career interests and/or field of study. Fulfills Clarkson Common Experience Professional Experience Requirement for School of Business students. Course registration requires CUSB approval of application. Completion of course requires CUSB approval of post-internship assessment by student and employer. Offered Pass/No Credit. Prerequisite: Sophomore standing, consent of the instructor.

Credits: (0), P/NC, Semester Calendar
Independent Study, Every Semester

SB 322 Designing and Leading Innovative Ventures

This course will provide students with opportunities to understand how the shifting business environment requires innovative ventures to adapt, change and respond to ensure competitiveness. Students will explore traditional organizational structures as well as cross-functional and virtual teams and networks, and will gain an understanding of the value of rewards and incentives in helping influence innovation and structural/organizational evolution. Students will also consider benchmark techniques and approaches used to inform and advocate innovation to key internal and external stakeholders. Prerequisite: At least Sophomore standing.

Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

SB 356 Invention Development & Protection

[Cross-listed with EM356] In this course, students learn how to develop inventions and protect them. Students will work in small teams to develop and describe their inventions in a form suitable for filing provisional patent applications with the U.S. Patent and Trademark Office. Aspects of intellectual property laws in the US and other countries will be covered to guide the student inventing process. Not open to E&M students. Prerequisites: Junior Standing, not open to E&M majors.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

SB 361 Supply Chain Environmental Management

[Cross-listed with EM 361] In recent years, manufacturing organizations have increased their interest in environmental management through activities such as green purchasing, reverse logistics, product stewardship and design-for-the environment. These activities, usually involving several organizations, are often part of what is known as supply chain environment management. This course aims to gain a greater understanding of supply chain environmental management by examining: (i) the advantages and business risks of adopting and implementing environmental practices and technologies in the supply chain, (ii) the role of suppliers and customers to facilitate the adoption/ implementation of

environmental practices and technologies, and (iii) the implications of such supply chain activities on an organization's operations strategy. This course consists of a mix of lectures and class discussion and relies primarily on a set of readings and a series of cases that will be analyzed in class. Prerequisites: OM331.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

SB 381 **Logistics Management**

[Cross-Listed EM381] Logistics involves planning, implementation and control of the forward and reverse flow and storage of goods, services, and information in the supply chain in order to effectively meet customer demand. Primary topics covered include management and location of facilities, management of channel networks, warehousing, transportation, management and design of integrated logistics networks, distribution strategies, third-party logistics, international logistics, and vehicle routing. In addition to lectures, case studies, numerical assignments and simulation of logistics systems may be utilized. Prerequisites: MK 320 and OM/EM 331

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

SB 396 **Global Business Strategies**

This course takes a transnational perspective on strategic management. It explores the integrative and cross-functional nature of organizational strategy and decision-making within a global environment. Students are exposed to a wide range of strategic problems, opportunities, challenges, dilemmas/puzzles and paradoxes involved in forming and implementing organizational strategies in an era of globalization. The aim is to develop the sophisticated, critical thinking skills and understanding necessary to manage effectively in an increasingly globalized world. Prerequisites: Must have junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture

SB 437 **Commercializing Innovation**

This course focuses on how to successfully commercialize an innovation. While it is important to come up with an innovative idea and develop a product concept, it is equally critical to effectively design and launch the product in the market and ensure its long-term success. This is where the innovation efforts of a large number of entrepreneurs and companies fail. The course provides an exposure to various product design approaches and strategies. Understanding commercialization activities such as pre-product launch planning, market testing, actual product launch, and post-launch follow-up is a major part of the course. These commercialization activities among other things involve developing a marketing plan for the product, carefully testing the plan, modifying the plan based on test market results, and crafting a long-term strategy for the product. The course also provides an exposure to how market data is generated and analyzed during these activities. Prerequisites: MK436, MK332.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

SB 440 **Innovation and Entrepreneurship Strategy**

The employment of comprehensive case problems in the formulation of action programs and business policy is a major feature in this integrated course in innovation and entrepreneurship strategy. As a capstone course, it is designed to allow students to apply their

knowledge in a complex case analysis environment. The hallmark of the course is the application of learned material to realistic, multifarious management issues. Thus, each case represents a complex web of managerial issues that must be resolved. The cases will cover many different content subjects that may vary from semester to semester. The course will also focus on the process of critical thinking in the context of management decision making. Prerequisites: MK320, MK321, MK332, MK436, and senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

SB 441 **Advanced Topics in Global Supply Chain Management**

[Cross-listed with EM 441] This course introduces several emerging topics in supply chain management, including: demand management, revenue management, risk management, supply chain agility and flexibility, supply chain disruption management, and supply chain contracts. This course also provides students with the opportunity to gain experience dealing with complex supply chain issues by utilizing a simulation game. The simulation deals with both strategic and tactical aspects of management the supply chain. Prerequisite: OM341.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

SB 487 **Special Project in Business**

An investigation of a problem or in-depth topic undertaken by the student under the guidance of a faculty member.

Prerequisites: Permission of the instructor
Credits: (1-3), Graded, Semester Calendar
Research, Given When Needed

SB 490 **Internship**

An unpaid internship that is related to the student's professional goals.

Prerequisite: Permission of the Instructor
Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

SB 494 **Directed Research**

A research project will be completed; research projects may include laboratory projects, literature research, or individual study of interdisciplinary engineering and management topics not available in other Clarkson courses. Restriction: Open to Engineering and Management majors only

Credits: (1-3), Graded, Semester Calendar
Research, Given When Needed

School of Science

SC 1,3,5... **SC Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

SC 2,4,6... **SC Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Science Foundation Curriculum Requirement.

Credits: (2-4), Graded, Semester Calendar
Lecture, Transfer Credit Only

SC 31 Introduction to STEM

How do scientists and engineers think as they approach a problem? Biologists, chemists and physicists have unique approaches to problems in their respective fields and classes. Introduction to STEM provides students the basic skills and concepts they need to succeed in their first year science courses. The class is composed of three modules of Biology, Chemistry and Physics led by first year faculty in the sciences. Intended for HEOP SPREE students. Check with major department to determine whether credits count toward graduation. Credits: (2), Graded, Semester Calendar
Lecture

SC 110 Environmental Science Elective with a Lab

Credit for this course is awarded only in the following cases: 1) receipt of a score of 4 or 5 on the AP Environmental Science Exam or 2) satisfactory completion of an approved college-level introductory environmental science course with a laboratory component. Biology, Biomolecular Science, and Environmental Science (EHS and ES&P) majors may not use credit for SC110 as one of their required biology or professional science electives. Credits: (4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

SC 131 HEOP Introduction to Physics I

This course is designed to be used in the HEOP Summer Program for incoming students. Introduction to the foundations of major theories of physics and their practical applications. Topics include classical mechanics, thermodynamics, electricity and magnetism, waves, modern physics. Credit counts towards graduation only for students in Business and Liberal Arts. Prerequisite: For HEOP students only. Credits: (2), Graded, Semester Calendar
Lecture, Given When Needed

SC 141 Introduction to Physics I

College-level non-calculus based physics course with lab that covers topics in mechanics. Transfer credit for this course is awarded only in the following cases: 1) receipt of a score of 4 or 5 on the AP Physics B Exam, 2) receipt of a score of 5, 6, or 7 on the International Baccalaureate Physics Higher-Level Examination, or 3) satisfactory completion of an approved college-level non-calculus based physics course. Credits: (4), Graded, Semester Calendar
Lecture, Transfer Credit Only

SC 142 Intro to Physics II

College-level non-calculus based physics course with lab that covers topics in electricity, magnetism, heat, and/or optics. Transfer credit for this course is awarded only in the following cases: 1) receipt of a score of 5 on the AP Physics B Exam, 2) receipt of a score of 7 on the International Baccalaureate Physics Higher-Level Examination, or 3) satisfactory completion of an approved college-level non-calculus based physics course. Credits: (4), Graded, Semester Calendar
Lecture, Transfer Credit Only

SC 301 Geographical Information Systems

[Cross-listed with CE 301] An introductory course in the concepts and uses of Geographic Information Systems (GIS) including analysis of GIS-based local and global geographic datasets. Provides basic knowledge of GIS theory and applications using existing state-of-the-art GIS software and current spatial data resources. Applications

include: overlay analysis, spatial data query, map generation and terrain surface analysis. Students will also learn the basics of GPS data collection, remote sensing, 3D visualization, probability, statistics, and error analysis.

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Every Semester
(TECH)

Social Documentation**SD 200 History of Social Documentation**

This course will survey the history and ethics of photographic and time-based media in the representation of factual material commonly described as documentary media. From the earliest photographs of battles and other spectacles of the 19th century to the first documentary films of differing cultures of the early 20th century through the socially-charged and the propagandistic photography and films of the Soviet Union, the US Depression, and World War II and onto the networked and interactive social documentaries of today's new media, this course will attempt to define the ever-moving boundaries of terms such as reality, nonfiction, documentary, and social action. Students will study the history of documentary media across cultures, view and analyze notable examples, do research on particular types and movements, present their findings to the class and develop documents that help explain the new, digitally-mediated documentaries.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters
UNIV/CSO/IA
Comm Points: 1

SD 332 Documenting Social Activism

The course explores social movements in United States after World War II and allows students to describe and interpret the complex nature of cultures and societies in historical context. The movements will focus on issues of racial civil rights, workers' rights, the women's movement, the gay rights movement, the American Indian Movement and the Students' Movements. Ranging from 1945 until the present day the course illustrates the process of social, cultural, and geopolitical change over time. This is a team taught course in which students will be required to create a documentary film. Therefore students will split their time between history lectures, seminar style discussion and documentary film production. The course has 3 hours of class and 3 hours of lab per week, and students should expect to do extensive out-of-class work. Limit of 20 students. Permission of one of the instructors required.

Credits: (4), Graded, Semester Calendar
Lecture, Given When Needed
UNIV/CSO/IA
Comm Points: 1

SD 480 Major Research Seminar

Student will confer with the client to pick a topic and direction for her/his research, and coordinate this with the instructors for SD 480 and SD 490; students will do research and complete bibliographic assignments, working with both the instructor and client; each will produce a written proposal beginning with a review of research, and then outlining the project's theoretical perspective and rhetorical strategy, concluding with an outline of how this project will translate into images (if relevant) as well as words; produce a practical plan of action for the project and present it to both client and instructor; and present the developing project in a professional context to faculty and

majors from both departments. Prerequisites: Must be a social documentation major, and at least junior standing
 Credits: (3), Graded, Semester Calendar
 Seminar, Every Semester
 Comm Points: 2

SD 490 **Major Research Project**

Using the proposal and plan of action developed in SD 480, student will work with her/his client and the course instructor to complete the project. As part of this process, student will document her/his ongoing work to keep both client and instructor informed of her/his progress, filing periodic reports and drafts of the project as required by the instructor. The semester should conclude with a presentation of the completed project to the client and to the instructor.

Credits: (3), Graded, Semester Calendar
 Independent Study, Every Semester
 Comm Points: 2

Semester in Industry

SI 1,3,5... **Participates in Co-op**

Credits: (0), P/NC, Semester Calendar
 Independent Study, Transfer Credit Only

SI 300 **Professional Internship**

Practical, hands-on experience that focuses on an area directly related to the student's field of study, the internship course is an integral part of the curriculum. The student must develop all details for the internship under the supervision of the instructor and within the established course objectives; the latter will include a project that carries the course credit and is due after completion of the internship. Prerequisites: Permission from the course instructor/student's academic advisor, the Career Center, and the International Student Advisor (if applicable.)

Credits: (1-9), P/NC, Semester Calendar
 Independent Study

SI 333 **Research for International Students**

Practical, hands-on experience that focuses on an area directly related to the student's field of study. The student must develop all details for the research under the supervision of the instructor. Consent by the International Education Office is required.

Credits: (0), P/NC, Semester Calendar
 Independent Study, Given When Needed

Sociology

SOC 1,3,5... **SOC Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
 Independent Study, Transfer Credit Only

SOC 2,4,6... **SOC Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy a Humanities or Social Science Foundation Curriculum Requirement, depending on the specific designator.

Credits: (2-4), Graded, Semester Calendar
 Independent Study, Transfer Credit Only

SOC 200 **Introduction to Culture and Society**

[Cross-listed with ANTH 200] This course will introduce the student to the subject matter and basic concepts of cultural anthropology and sociology. It offers an explanation of the nature of human groups, their origin, development, change and the process of social organization. Using various societies as case studies, it provides a framework for the systematic analysis of various sociological and anthropological questions pertaining to the human condition: sources of human conflicts, bases of sex roles, the causes of stratification, etc. Credits: (3), Graded, Semester Calendar
 Lecture, Transfer Credit Only
 CGI

SOC 201 **Introduction to Society**

This course is intended to introduce students to the basic principles, concepts, and perspectives used as 'tools' in sociology to develop a more scientific approach to understanding human society. Major theoretical perspectives and concepts are presented, including sociological imagination, culture, social inequality, social change, and social structure. Students also explore the influence of social class and social institutions, such as churches, education, healthcare, government, economy, and environment. The family as a social structure is also examined. Students will investigate the origin and design of political, economic and social institutions, such as religion, the family, class and caste, education, urban and rural life styles, values, norms, roles, and sociocultural change. Students will learn to analyze, evaluate and critique social structures.

Credits: (3), Graded, Semester Calendar
 Lecture, Fall and Spring Terms
 UNIV/CSO/IG

SOC 210 **Sociology of the Family**

This course will provide an opportunity to look at something familiar (the family) in a new way. We will focus on the family as a social institution—a set of structured social arrangements for meeting certain human needs—and we will examine the larger social forces that shape those structures. We will use a comparative approach to families, emphasizing their diversity both across time and space and within present-day U.S. society— paying particular attention to how social inequality shapes family experiences. By the end of the semester, you should be able to place your own personal experience of families in a larger social, cultural, and historical context

STUDENT LEARNING OUTCOMES: 1. Understand the causes of social inequities in family experiences. Students will learn how systems of privilege organized around gender, race, class, and sexual orientation structure family life. 2. Think critically about how family shapes social life at both individual and structural levels. 3. Effectively communicate what they have learned about the sociology of family in both written and oral form. 4. Read and evaluate scholarly research on family. 5. Take their sociological education outside of the classroom and into their everyday life and or clinical practices.

Credits: (3), Graded, Semester Calendar
 Lecture, Given When Needed
 IG
 Comm Points: 1

SOC 230 **Introduction to Race and Ethnicity**

[Cross-Listed with ANTH230] Variations in phenotype--skin color--have always existed, but has 'race'? What are the bases of racial identity in the contemporary United States? How have they changed? How are 'race' and 'ethnicity' related? In this course we will address

broader questions about race by focusing on contemporary racial and ethnic divisions and by examining the history of these concepts in the Western Hemisphere.

Credits: (3), Graded, Semester Calendar

Lecture

UNIV/CGI/IG

Comm Points: 1

SOC 285 Food and Society or What to Think About What You Eat

[Cross-listed with ANTH 285] [Formerly SOC 385] Patterns of food production and consumption have dramatic impact on individuals, societies, and the environment. In this class we will examine aspects of food consumption and production in the United States. We will examine the nature and history of contemporary patterns of consumption and production and the impacts of these patterns and changes on our health and our environment. Topics to be discussed include the role of food in American society, the transformation of eating habits over the 20th century--including the rise of processed and fast food and also ethnic and organic food and vegetarian alternatives--the nature and impact of industrial agriculture and of genetically modified organisms, and the political economy of food.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

UNIV/CGI/STS

SOC 310 Women and Religion

This course will examine the position of women in the major religious traditions of the world, with a special concentration on Christianity. Historically and cross-culturally women have largely been relegated to the status of the profane and passive other in the domain of the religious. This religious alienation has profound implications not only for the spiritual lives of women but for the personal, social, political, and economic aspects of their existence as well. This course will explore andocentric patterns of domination as they are grounded in and legitimated by religious systems of meaning. We will also explore transformative alternatives that exist within the worlds' religious traditions themselves in an effort to identify sources of empowerment, mutuality and justice for women and men.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

UNIV/CGI/CSO

Comm Points: 1

SOC 320 Medical Sociology

This course provides an introduction to the sociological study of health and the institution of medicine. This includes exploring questions such as: How is social inequality connected to our health? Is healthcare enough to remedy any health inequalities that might exist? Why is it that so many things are being classified as diseases these days, when we used to just think of them as eccentricities? Nowadays, people often think of themselves as customers as well as patients- how is this change related to broader social changes about the role of medicine? Through this course, you will develop a strong understanding of the contributions that sociology has made to the study of health and illness, as well as a mature perspective on many of our society's pressing health issues.

NOTE: SOC201 (intro to society) or pre-health focus are recommended, but not required.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

IG

Comm Points: 1

SOC 330 Health, Wealth, Inequality and the Environment

This course will examine how social inequality impacts the relationship of people to their environment and how it affects their physical well being. We will look at how social and political structures perpetuation conditions of injustice for low-income communities and communities of color. One emphasis of this course will be on how social inequality impacts environmental factors involved in transmission of communicable diseases and hazards due to exposure to chemical and physical materials in our environment. We will examine sociological and public health literature pertaining to environmental health on a global level and also address public policies that may affect health and environmental justice.

Credits: (3), Graded, Semester Calendar

Lecture

UNIV/CGI/STS

Comm Points: 1

SOC 470 Environmental Policy

[Cross-listed with POL 470] Public policy is developed in response to problems or issues in society that are presumed, for whatever reasons, not to be resolvable by the private sector. In theory, public policy as it relates to environmental issues is used to intervene to alleviate problems, such as industrial pollution, that threaten the integrity of the natural resource base and the natural and built environments on which our lives and livelihoods depend. However, public policy development and implementation in general, and environmental policy in particular, are not immune to political forces and influences. Even scientific institutions that often provide the empirical basis for environmental policy are potentially influenced and shaped by the political process and political and economic interests. This course introduces students to the distinctive features or characteristics of environmental policy development and implementation. The course primarily focuses on the United States but includes international environmental issues and policies. The course will help students understand how environmental policy fits within the large-scale social and economic changes in the U.S. and elsewhere that have resulted in greater environmental awareness. We will also consider how scientific evidence is created and marshaled in support of competing interpretations of environmental problems, and the appropriate policies to address such problems. Case studies of particular environmental policies, such as regulation of transgenic crop development and commercialization, will be used to help students grasp the complexities of, and driving forces behind, environmental policy.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

STS

Comm Points: 1

SOC 490 Independent Study

Designed primarily for an advanced student who wishes to pursue special interests in sociology for one or more semesters, this series allows students to design and conduct independent study projects under faculty guidance.

Prerequisite: consent of the instructor.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Every Semester

Social Sciences

SS 1,3,5... **Social Science Elective**

For transfer credit only.
Credits: (1-9), Graded, Semester Calendar
Lecture, Transfer Credit Only

SS 2,4,6... **Social Science Elective**

For transfer credit only.
Credits: (1-9), Graded, Semester Calendar
Lecture, Transfer Credit Only

SS 220 **Introduction to Gender**

This introductory course examines how being male or female translates into the social relationships of gender. It explores the ways gender roles, identities and institutions are constructed in relation to race, ethnicity, class, and sexuality. This course provides a general introduction to the wide array of historical, cultural, social, political, economic, and philosophical topics usually included within the boundaries of gender studies.

Instructors for this course come from various disciplinary backgrounds. Course content will vary among the sections as instructors draw on their diverse disciplinary backgrounds in order to instruct students in critical thought, intellectual empathy and global perspectives.

Credits: (3), Graded, Semester Calendar
Lecture
UNIV/CGI/IG
Comm Points: 1

SS 221 **Introduction to Sexuality**

This introductory course examines how sexuality is constructed from a social perspective. It explores the ways sex acts, sexual roles, identities, relationships and institutions are constructed in relation to race, ethnicity, class, and sexuality. This course provides a general introduction to the wide array of historical, cultural, social, political, economic, and philosophical topics usually included within the boundaries of sexuality studies. Students will learn how the study of sexual intercourse and sexuality differ among disciplines and how the interdisciplinary approach differs from a singular disciplinary focus.

Credits: (3), Graded, Semester Calendar
Lecture
UNIV/CSO/IG
Comm Points: 1

SS 320 **Social and Political Issues in the Adirondacks**

[Cross-listed with EV 320] The historical, social, political, and environmental factors contributing to the fabric of the Adirondack Park is an evolving social experiment. The course readings will focus upon the New York State constitutional provisions that engendered the park, the policies that shaped the park, along with the political actions that influence the park today. The Adirondack State Park is extraordinary for its history and because it is a place where human residents live and recreate in sustainable ways that conserve resources and 'forever wild' regions of the park.

Enrollment is limited to those students participating in the Adirondack Semester Program.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
CSO
Comm Points: 2

SS 380 **Research Methods**

This course provides an introductory survey of social science research methods. The course covers a variety of quantitative and qualitative methods. Course topics include sampling strategies, use of basic population statistics, testing differences between groups, conducting in-depth interviews and participate and non-participant observation. Students will understand different approaches to conducting research in the social sciences and which approaches to utilize to maximize the effectiveness and accuracy of social inquiry.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed
(TECH)

SS 490 **Independent Study**

Designed primarily for an advanced student who wishes to pursue special interests in social sciences for one or more semesters, this series allows students to design and conduct independent study projects under faculty guidance.

Prerequisite: consent of the instructor.
Credits: (1-10), Graded, Semester Calendar
Independent Study, Every Semester

SS 499 **Minor Portfolio**

In this course, students complete their Liberal Arts Minor Portfolios under the direction of their minor advisor. The course is graded on a Pass-No Entry Basis

Credits: (0), P/NC, Semester Calendar
Independent Study

Statistics and Probability

STAT 1,3,5... **STAT Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

STAT 2,4,6... **STAT Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (2-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

STAT 282 **General Statistics**

(May be used to satisfy a CUSB MBA or MS foundation requirement.) Introduction to statistical methodology. Topics include descriptive statistics, probability distributions, use of computer packages for statistical data analysis, point and interval estimation, hypothesis testing, two-sample tests, comparisons, measuring and testing association, correlation, regression, and analysis of variance (ANOVA). Emphasis on applications to life sciences, social sciences, business. Restriction: Not open to mathematics, applied math and statistics, or computer science majors; not open to students who have taken or are taking MA 132.

Credits: (3), Graded, Semester Calendar
LectureDiscussion, Every Term

STAT 301 **Statistics Elective**

An upper-division statistics or probability course for which there is no comparable Clarkson course. Used for transfer credit only. This

course may be used to satisfy the requirements of the Mathematics or Applied Mathematics and Statistics major or the Statistics minor.
Credits: (3-4), Graded, Semester Calendar
Independent Study, Transfer Credit Only

STAT 318 **Biostatistics**

[Cross-listed with BY 318] This course introduces students to descriptive statistics, fundamentals of probability, probability distributions, and methods of statistical inference. Topics include correlation, regression, Bayes theorem, estimation, hypothesis testing, nonparametric methods, and categorical data analysis. A required 2 hour lab practicum will enable students to apply statistical concepts and analytical methods to data from a wide range of biology-related fields, such as ecology, evolution, environmental science, psychology, biotechnology, and biomedical sciences. The use of statistical software is required and data interpretation is emphasized. Prerequisites: BY140 or BY160 or equivalent; MA181 or equivalent; or consent of the instructor
Credits: (4), Graded, Semester Calendar
LectureLaboratory, Spring Semesters

STAT 381 **Probability**

[Cross-listed with MA 381] Sample spaces; axioms of probability; basic theorems; random variables (discrete and continuous); combinatorial methods; Bayes' Theorem and conditional probability; expected values and variances; distribution functions, including: binomial and multinomial, Poisson, normal and bivariate normal distributions, and others such as geometric, hypergeometric, negative binomial, exponential, gamma and beta; joint distributions; covariance and correlation; central limit theorem; geometric probability; method of transformations; introduction to stochastic processes. Prerequisite: MA231 or MA230 (MA211 Recommended)
Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

STAT 382 **Mathematical Statistics**

[Cross-listed with MA 382] A rigorous course in statistics. Topics include random variables and their distributions, data reduction, estimation, sampling distributions, testing, optimal tests, analysis of variance and nonparametric statistics. Prerequisites: MA/STAT381
Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

STAT 383 **Probability and Statistics**

A calculus based introduction to topics in probability and statistics. Probability content includes events and sample spaces, the basic axioms of probability, discrete and continuous random variables (definitions and basic characterizations such as the means and variances) including binomial, Poisson, normal, exponential, student-t, and uniform distributions. Topics in statistics include the central limit theorem, statistical inference including confidence intervals and hypothesis testing for one and two sample data, and linear regression. Students will use statistical software to read data and interpret software generated output.
Students may not receive credit for both STAT 383 and STAT 389. Prerequisites: MA132
Credits: (3), Graded, Semester Calendar
Lecture, Every Term

STAT 384 **Advanced Applied Statistics**

(Continuation of STAT 383.) Review of basic concepts (estimation, testing and simple linear regression). Multiple regression, analysis of variance and experimental design. Additional topics may include nonparametric statistics, goodness of fit tests, analysis of covariance and quality control. This course will require use of statistical software. Interpretation of computer output and applications will be emphasized throughout. Prerequisites: MA231 and STAT383
Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Terms

STAT 385 **Bayesian Data Analysis**

This course will introduce both the principles and practice of Bayesian methods for data analysis. This is a hands-on course that will use MATLAB software. Students will learn to write their own Bayesian computer programs to solve problems relevant to engineering, biology, chemistry, physics, earth science, ecology, economics, signal processing and machine learning. Topics that will be included are parameter estimation, model selection, time series and error analysis. Prerequisites: STAT 383 or MA/STAT 381, or by instructor consent
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

STAT 389 **Probability and Statistics with Multivariate Analysis**

A multivariate-calculus based introduction to probability and statistics. Probability content includes sample spaces; axioms of probability; basic theorems; random variables (discrete and continuous); Bayes' Theorem and conditional probability; expected values and variances; distribution functions, including: binomial Poisson, normal and bivariate normal distributions; joint, marginal, and conditional distributions. Optional material includes and moment generating functions, characteristic functions, and distributions of sums of RVs. Topics in statistics include sampling distributions, likelihood functions, descriptive statistics, central limit theorem, hypothesis testing and parameter estimation for normally distributed data, and maximum likelihood estimators. Optional topics include analysis of type 1 and 2 errors and statistical approaches to minimizing error. Students will use statistical software to read data and interpret software-generated output.
Students may not receive credit for both STAT 383 and STAT 389. Prerequisite: MA230 or MA231. Students may not enroll in STAT389 if they have credit for STAT383.
Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

STAT 409 **Directed Study in Probability and Statistics**

[Cross-listed with MA 409] A directed study in Probability and Statistics, intended to give a student the opportunity to further explore an area of interest to them under the supervision of a faculty member.
Credits: (1-10), Graded, Semester Calendar
Independent Study, Given When Needed

STAT 410 **Directed Study in Probability & Statistics**

A directed study in Probability & Statistics, intended to give a student the opportunity to further explore an area of interest to them under the supervision of a faculty member.
Credits: (1-10), Graded, Semester Calendar
Independent Study, Given When Needed

STAT 488**Statistics Projects**

Students engage in statistical projects under the supervision of a faculty member. The topic will be determined by student interest and faculty research programs. This course may be repeated for a maximum total of three credits.

Prerequisite: consent of the instructor.

Credits: (1-3), Graded, Semester Calendar

Independent Study, Given When Needed

Comm Points: 1

Science, Technology, Engineering, Math**STEM 330****History and Philosophy of Science and Math**

This course looks at teaching STEM-related content from historical and philosophical perspectives, as its title suggests. In this course you will not only assimilate the concepts presented but will also evaluate and create instructional strategies and materials that can infuse these concepts into your own secondary courses. This expectation is in many respects more demanding and time-consuming than expecting you to learn an abundance of historical detail and philosophical argument and regurgitate it back on an examination. This course will argue that historical and philosophical content can be used to enhance secondary students' understanding of the STEM concepts and methods they are expected to attain and ask you to develop or restructure lessons and materials to illustrate that enhancement. Ideally, having science, mathematics, and technology students in the course this year will enhance the general knowledge of all participants and help them distinguish between the unique elements of each enterprise.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

Science, Technology, & Society**STS 100****HEOP Perspectives on Science & Technology**

[Formerly LP100] This course is designed to be used in the HEOP Summer Program for incoming students. It helps student develop their critical thinking and writing skills in preparation for their college courses. Offered Pass/No Credit. Prerequisite: For HEOP students only.

Credits: (3), Graded, Semester Calendar

Lecture, Summer Semesters

STS

Comm Points: 1

STS 2,4,6...**Science, Technology & Society Elective**

A college level course for which there is no comparable Clarkson course. Used for transfer credit only. This course may be used to satisfy the Science, Technology & Society Knowledge Area requirement.

Credits: (2-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

STS

Technology**TECH 100****Design Technology**

Credit for this course is awarded only in the following cases: 1) receipt of a score of 5 through 7 on the International Baccalaureate Design Technology Higher-Level Examination or 2) satisfactory completion of a college-level course that meets the criteria for a Technology Course but for which there is not an appropriate Clarkson course prefix.

Credits: (3), Graded, Semester Calendar
Independent Study, Transfer Credit Only
(TECH)

University**UNIV 100****The Success Seminar**

This course is designed to provide strategies to help students succeed in classes and empower them to become active, responsible learners. During this course, students will learn several useful strategies regarding self-awareness, establishing goals, developing supportive relationships, identifying preferred learning styles, managing time, taking notes, and developing strategies for more effective reading of texts. Restriction: Freshman &/or Sophomore Standing

Credits: (0), P/NC, Semester Calendar

Lecture, Spring Terms

UNIV 190**The Clarkson Seminar**

The Clarkson Seminar welcomes first year students into a world of cultures, histories, and the global forces that will shape their personal and professional lives beyond Clarkson. Students will learn to define issues within a broad cultural context and gain experience evaluating and interpreting literary and nonliterary texts. Seminar classes will be a small and thematically structured, with an emphasis on discussion, critical reading and thinking, extensive writing, and collaborative work.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

UNIV 267**Introduction to Canada**

This course will introduce students to Canada and the US-Canada relationship. In particular, the course will cover a broad swath of topics across academic disciplines including: geography, history, sociology, politics/government, economics, and the arts. Particular emphasis will be placed on comparing and contrasting Canada and the United States, but will also cover important current events and other issues unique to Canada, including the Quebec question and the future of Canada. The course will be a blend of classroom lectures/discussions and experiential trips to major Canadian cities/regions, including Ottawa, Montreal, Quebec, and Toronto.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

UNIV/CGI/CSO

UNIV 299**Global Service**

The focus of this course is a one-to-two week trip abroad for a service learning experience. Each section, centered on a unifying theme and geographic location, will include three components: experience, reflection and action. Through community connections and hands-on experience, students develop deeper global awareness and stronger critical thinking and problem solving skills. Students will return empowered to make positive change in their community and beyond. The travel group will spend quality time in a community, getting to know the people and their way of life. The course instructor works directly with the community to assure each group has a valuable, impactful visit. UNIV 299 is a repeatable course allowing a student to receive credit on completing two or more different Global Service experiences.

Credits: (1), P/NC, Semester Calendar

Independent Study, Spring Semesters

UNIV 349 **International Service Learning**

This course involves collaboration with non-governmental organization to develop appropriate technology and improve quality of life in a target community overseas. During a semester-long class that meets weekly, students develop an appreciation of the issues involved in international development and an understanding of the context of their project, while at the same time working in teams to solve technological problems according to the NGO's specifications and community's needs. Following the end of the semester, students will visit the community to present their solutions, provide necessary training, and assist in implementation of the technology. Through a combination of classroom and experiential learning in the community, students will gain global awareness, improve critical thinking and problem solving skills, and get to know a foreign place and people

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

/CSO

UNIV 399 **Global Experience**

This course includes intensive study of issues in a country or region outside of the United States followed by a two- to three-week trip abroad to that location. Each section, centered on a unifying theme and geographic location, will include three components: structured classes, practitioner presentations, and visits to companies, governmental agencies, and important cultural sites. Students successfully completing this course will gain a better perspective on the economic, political, cultural issues as well as the business practices prevalent in another region of the world. Students should develop cultural awareness, an understanding of economic, cultural, and political differences between the US and other countries, and the role cultural, historical and political factors play in the conduct of business in a global economy. UNIV399 is a repeatable course allowing a student to receive credit on completing two or more different Global Study experiences. On approval from the Dean of the School of Business, this course can satisfy global business study requirement.

Credits: (3), Graded, Semester Calendar

Lecture

UNIV/CGI/CSO

Accounting

AC 603

Management Accounting

[Cross-listed with AC 604] The purpose of this module is to build on the students' knowledge of basic accounting concepts, to enhance their ability to properly evaluate and use accounting data for internal planning, control and decision making. Topics include financial statement analysis; management control; agency costs and organizational behavior; goals and strategies; information economics; responsibility center, profit center and investment center accounting; divisional control and transfer pricing; multinational corporations and foreign currency translation. Consideration is also given to usefulness of information contained in general purpose financial statements. Restriction: Admission to the MBA program required
Credits: (2), Graded, Semester Calendar
Lecture, Discussion, Fall Semesters

AC 604 Financial and Managerial Accounting for Decision Making

[Cross-listed with AC 603] This course covers Financial and Managerial Accounting concepts for MBA students. The financial accounting portion; covers the fundamentals of the accounting cycle and the evaluation of the major financial statements for external reporting purpose. Furthermore, develop the ability to analyze the financial statements. The managerial cost accounting portion will cover job costing, process costing, cost-volume-profit analysis, budgeting and pro-forma financial statement development, flexible budgets and standard costing systems, cost allocation and responsibility accounting, and tools for short-term business decisions. The overall objective of the course is to develop students' ability to construct accounting reports, understand accounting reports and make decisions from such accounting information.
Credits: (3), Graded, Quarter Calendar
Lecture, Summer Terms

AC 608

Corporate and Fiduciary Taxes

Emphasis is placed on federal income tax responsibilities of large corporate businesses. Topics covered include tax planning, tax research, compliance, and trusts. A project or presentation approved by the instructor is required of each student.
Prerequisites: Basic course in Financial Accounting or permission of instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

AC 610

Fraud and Forensic Accounting

[Formerly MBA 610] This MBA course is designed as a seminar. The primary goal of this course is to assist students in recognizing fraud, which will aid in the prevention and detection of fraud. This course will focus on the professional responsibility of accountants to act ethically. The course materials will discuss what a fraud is, how frauds can be committed, how frauds can be uncovered, and what accountants and business executives can do to prevent frauds from occurring in their organizations. We will use a variety of materials that were provided by the Association of Certified Fraud Examiners. In addition, students will analyze fraud case studies.
Credits: (3), Graded, Quarter Calendar
Lecture, Spring Terms

AC 612

Advanced Management Accounting

[Formerly MBA 612] This course is designed for students who have completed an initial course in Cost Accounting at the undergraduate

level, or Management Accounting at the graduate level. Topics include budgeting, product costing including activity-based costing, accounting-based managerial and divisional performance metrics, and transfer pricing.

Credits: (3), Graded, Quarter Calendar
Lecture, Winter Terms

AC 613

Advanced Auditing and Research

[Formerly MBA 613] This course is an advanced case and research-oriented study of topics in Auditing. Through a series of cases and related research, students will engage in the practice of auditing using real-world situations as the foundation for technical and theoretical discussions of issues facing the contemporary auditor. Cases will be chosen to reflect current and emerging topics in the practice of public accounting, financial auditing, fraud investigation, and forensic accounting. Auditing communications tools and software-based audit techniques will also be emphasized.

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

AC 623

Financial Statement Analysis

This course helps students utilize the information contained in financial statements to make decisions. It specifically discusses (1) institutional forces underlying the provision of financial statement data, (2) properties of numbers derived from financial statements, (3) key aspects of decisions using financial statement information and the environment in which they are made, (4) design of information appropriate to these decisions. The objective is to allow the student to employ these factors to exploit fully the richness of the information contained in financial statements, while appreciating its limits.
Prerequisites: AC205 or AC528 or equivalent.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

AC 630

Cost Management

A graduate level course covering basic concepts and techniques of cost management. Topics include basic cost management concepts, cost-volume-profit analysis, strategy and the master budget, the role of costs in pricing decisions, job and activity based costing (ABC) costing systems, relevant costs for decision making, operational and management control systems, target costing, value engineering, theory of constraints, the Balanced Scorecard, and the management and control of quality. Explores the analysis and presentation of information from a behavioral as well as a quantitative perspective. Introduces basic financial and sustainability concepts and reporting issues.

Credits: (2), Graded, Semester Calendar
Lecture

AC 636

Auditing

An examination of auditing standards and procedures currently followed by independent public accountants. Ethics, audit evidence and reporting standards are also considered.

Credits: (3), Graded, Quarter Calendar
Lecture, Given When Needed

AC 636

Auditing

An examination of auditing standards and procedures currently followed by independent public accountants. Ethics, audit evidence and reporting standards are also considered. Prerequisites: AC 603

and AC 623 or the equivalent of these courses.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

AC 648 Seminar in Accounting Information Systems & Auditing

A graduate level introduction to accounting information systems. Coverage includes the basic systems methodology and terminology necessary to prepare students for any of the professional accounting examinations. Emphasis is on the design, internal control mechanisms, documentation and audit problems associated with specific accounting subsystems, i.e. payroll, general ledger, inventory-production or procurement-receivables. The course introduces students to three typical aspects of information technology (IT) systems and audits: audits of computerized information systems, the computer facility, and the process of developing and implementing accounting information systems. A major course segment involves a detailed study, including hands-on experience using commercial software of at least one specific subsystem.

Credits: (3), Graded, Semester Calendar

Seminar, Spring Semesters

AC 650 Accounting Research & Theory

Introduces graduate students to accounting research and theory. Focuses on how research can help address management, uniformity and disclosure issues that regularly arise in business. Investigates ethical perspectives and emerging issues. Evaluates policy formulation of accounting standards and their impact on financial reporting. Students research, analyze, develop and present proposed solutions to accounting and related business cases encountered in practice. Prerequisites: AC404 or equivalent

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

AC 687 Special Projects in Accounting

An investigation of a problem undertaken by the student which is acceptable to and under the guidance of the faculty member and chairperson. The course provides an opportunity for the student to investigate and analyze a problem area of accounting in depth on an independent study basis.

Requirement: Instructor and Program Chair permission

Credits: (1-3), Graded, Semester Calendar

Independent Study, Given When Needed

Anthropology

ANTH 586 Food & Society or What to Think About What You Eat

[Cross-listed with EV 586, SOC 586] Patterns of food production and consumption have dramatic impact on individuals, societies, and the environment. In this class we will examine aspects of food consumption and production in the United States. We will examine the nature and history of contemporary patterns of consumption and production and the impacts of these patterns and changes on our health and our environment. Topics to be discussed include the role of food in American society, the transformation of eating habits over the 20th century--including the rise of processed and fast food and also ethnic and organic food and vegetarian alternatives--the nature and impact of industrial agriculture and of genetically modified organisms, and the political economy of food. Graduate students will have additional course work.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

Bioethics

BIE 500

Proseminar in Health and Human Values

An intensive eight-day introduction to current topics in clinical ethics and bioethics, taught seminar style with a clinical visit to Mount Sinai School of Medicine in New York City. This overview of current issues in bioethics humanities involves four special pro-seminars, case conferences and ethics rounds. There will also be training in the computer skills (demonstrations, workshops) essential to mastering distance learning. Must be taken in the first fifteen months of enrollment.

Credits: (3), Graded, Quarter Calendar

Seminar, Summer Terms

BIE 510

Biomedical Ethics

An advanced introduction to bioethics and clinical ethics focusing on such formalizations of medical morality as the Hippocratic Oath, the AMA codes, the Belmont Report and Beauchamp and Childress Principles, and the idea of casuistry. Major cases in bioethics will also be reviewed and the evolution of the core concepts and infrastructure of medical ethics and bioethics will be examined.

Credits: (3), Graded, Quarter Calendar

Lecture, Fall Terms

BIE 520

Healthcare Policy

This course provides an understanding of the public policy-making process and the political and regulatory environment in which healthcare organizations function. It also provides an understanding of managerial processes, politics, and structure of the healthcare organizations where ethical policies and practices are implemented and carried out on an ongoing basis. Policies for consideration include resource allocation, end-of life decision-making, accountability and performance measurement, and conflict of interest.

Credits: (3), Graded, Quarter Calendar

Lecture, Winter Quarters

BIE 525

Public Health Ethics

In this course, students learn about ethics and public health and the ways in which these two fields interconnect. The course focuses on ethical theory and the discipline and history of public health, using case studies to illustrate the application of ethical theory to public health practice.

Credits: (3), Graded, Quarter Calendar

Lecture, Winter Quarters

BIE 530

Bioethics and the Law

This course provides an introduction to the major legal issues and concepts arising in the field of bioethics. Emphasis will be placed on (1) mastery of key legal concepts and rules that pertain to bioethics (i.e., what the law is) and (2) demonstration of ability to critically analyze the law from a normative bioethical perspective (i.e., argue for what the law ought to be).

Credits: (3), Graded, Quarter Calendar

Lecture, Spring Terms

BIE 533

Neuroethics

The course will familiarize students with the most pertinent issues in Neuroethics, but will emphasize those issues which have some immediate application in clinical settings, such as criteria for brain death, the ethics of enhancement and justification of memory manipulation. The overall objective of the course is to demonstrate

continuity between neuroethics and other areas of bioethics, and to identify the application of major ethical principles to this new branch of ethics.

Credits: (1.5), Graded, Quarter Calendar
Lecture, Every Other Spring Quarter

BIE 535 **Medicine and Social Justice**

This course examines issues of social justice in medicine, beginning with a review of classical (Aristotle) and contemporary (Rawls) works on political philosophy, ethics and justice. Students will also read some of theoretical work of authors who focus their attention on justice in medicine (including Daniels and Menzel). Building on these philosophic underpinnings, students will then explore the issues that lie at the heart of justice in medicine: the right to health and healthcare, aggregation and utility, personal responsibility, prioritarianism, and the allocation of medical resources.

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

BIE 545 **Reproductive Ethics**

The course examines the philosophical, ethical, and legal problems arising from assisted reproductive technologies. We begin with the notion of procreative liberty. Procreative liberty is conceived as the right to make one's own reproductive decisions, whether to have or to avoid having offspring. We will not be discussing the right to avoid reproduction by contraception or abortion, as these topics would require a longer course, or even a course of its own. Instead, this course focuses on the right to reproduce: its nature, scope, and limits.

Credits: (3), Graded, Quarter Calendar
Lecture, Every Other Summer Quarter

BIE 555 **Research Ethics**

This course is designed to teach students about the ethics of scientific research, particularly research involving human participants. Upon completion of the course, students should be able to: (a) discuss in depth the principles of bioethics and how these principles should be applied to the ethical design and conduct of research involving human participants or animal subjects; (b) identify, define, and analyze ethical issues in the context of novel and potentially problematic areas of scientific research; (c) identify, through case studies, ethical issues that arise in different contexts and begin to reason through an appropriate course of action. In addition, students will be taught basic practical skills in research, writing and reviewing articles, and providing training and education in bioethics.

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

BIE 563 **Pediatric Ethics**

This course cover standards for surrogate decision making for children; ethical issues with respect to very premature neonates; withholding and withdrawing life sustaining care; genetic testing and screening; and adolescent confidentiality, truth-telling, and decision making. This course will include guest participation by members of the Icahn School of Medicine faculty, including experts in neonatology, adolescent health, genetics, and pediatric oncology.

Credits: (1.5), Graded, Quarter Calendar
Lecture, Every Other Spring Quarter

BIE 568 **Empirical Methods in Healthcare Policy**

This course is intended for those students that have prior background in reading empirical literature or in conducting empirical research.

Methods will be presented that are more advanced than those found in standard undergraduate statistics courses.

Credits: (1.5), Graded, Quarter Calendar
Lecture, Fall Terms

BIE 569 **Statistical Methods in Healthcare**

The purpose of this course is to cover statistical topics applicable to healthcare settings, not typically covered in an introductory statistics course. These topics include study designs commonly applied in healthcare, measures of disease frequency and health risk, power analysis, and non-parametric statistics.

Credits: (1.5), Graded, Quarter Calendar
Lecture, Every Other Fall Quarter

BIE 570 **Bioethics Policy: Foundations**

This course will address prospective rules designed to govern populations and categories of cases. Often, bioethics policies have the force of law (e.g., statute, agency regulation, court precedent); at other times, however, they are voluntarily adopted by institutions or groups (e.g., hospitals, insurers, IRBs, research funders, the AMA).

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

BIE 573 **Interpersonal Skills and Communication**

This course will provide students with the opportunity to learn the basic components of communication, including active listening, effective vocal style, optimal elicitation of information and the ability to create partnerships with patients, research subjects, families, clinicians and researchers. Using a variety of formats and media, students will develop and practice the interpersonal skills necessary to communicate with clinical ethicists, research ethicists, policymakers and in our daily human interactions.

Credits: (1.5), Graded, Quarter Calendar
Lecture, Every Other Spring Quarter

BIE 574 **Contemporary Issues in Bioethics**

This course is designed to expose students to contemporary and breaking issues in bioethics. Topics covered will vary from year to year, as they will be drawn from acute issues spurring widespread discussion and assessment by the bioethics community.

Credits: (1.5), Graded, Quarter Calendar
Lecture, Odd Spring Terms

BIE 575 **Bioethical Issues at the End of Life**

This course examines some of the philosophical, ethical and policy programs arising at the end of life. It begins with a discussion of death itself, including what it means to say that someone is dead and the criteria for determining that death has occurred. Additional topics covered include advance directives, assisted death and whether or not people have a 'right to die.'

Credits: (3), Graded, Quarter Calendar
Lecture, Every Other Summer Quarter

BIE 576 **Independent Study in Bioethics**

This course will be used for independent study course when needed. This will be a 1/2 course elective.

Credits: (1.5), Graded, Quarter Calendar
Independent Study, Given When Needed

BIE 580 **Research Ethics II**

This course teaches students about the ethics and policies governing scientific research, particularly research involving human participants or animal subjects. This course builds upon the knowledge and themes introduced in BIE 555 (Research Ethics I). Research Ethics II covers these topics in greater depth and explores the key US and international laws and policies that regulate the design, conduct, and oversight of trials involving human participants or animal subjects. In addition, students examine in-depth specific areas or types of biomedical research that are potentially controversial or ethically problematic. Required for research ethics track, elective for clinical ethics track. Prerequisites: BIE555
Credits: (3), Graded, Quarter Calendar
Lecture, Winter Quarters

BIE 590 **Clinical Ethics**

This course deals with the practical applications of clinical ethics, including clinical ethics consulting and its recording and documentation, the work of ethics committees and IRBs, and other practical ethics of clinical ethics.
Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

BIE 610 **Online Practicum in Clinical Ethics**

[Formerly BIE 610C] This course is designed to help students develop many of the competencies required to perform clinical ethics consultation (CEC) at a basic level. Upon completion of the course, students should be able to: (a) assess their own strengths and weaknesses with respect to CEC competencies; (b) apply a systematic method to analyze and document CEC cases; (c) practice techniques to help avoid common CEC quality gaps; and (d) recognize complex cases for which advanced-level CEC competencies are required. While the course emphasizes process skills for CEC, students will also gain experience that will augment their clinical ethics content knowledge, emotional intelligence, and critical thinking. Prerequisites: BIE590
Credits: (3), Graded, Quarter Calendar
Practicum, Winter Quarters

BIE 611 **Online Practicum in Research Ethics**

[Formerly BIE 610R] A supervised practical experience in research ethics designed to teach specific skills. Exposes students to the process of ethical review of research involving human volunteers or animal subjects, and helps students develop some of the basic skills that a working research ethics professional needs. Through online discussion and participatory exercises, students gain a practical understanding of: (a) research ethics committee structure and function, (b) applicable state and federal regulations regarding the conduct of research involving human volunteers or animal subjects, and (c) relevant organizational and management skills needed to lead a research ethics committee. In addition, students are taught practical skills in qualitative and quantitative research, report and grant writing, and bioethical training and education. Prerequisites: BIE580
Credits: (3), Graded, Quarter Calendar
Practicum, Spring Terms

BIE 612 **Online Practicum in Policy**

[Formerly BIE 610P] This course is designed as an opportunity for students to develop and refine the skills of policy analysis that they have learned in prior courses — in particular, in the prerequisites to this course — and to apply them to a range of current issues in

bioethics policy. To be as relevant as possible to students with diverse interests and career aspirations in bioethics, the course covers a broad range of policy issues in the bio-sciences, including both public and 'private' bioethics policies.

Credits: (3), Graded, Quarter Calendar
Practicum, Winter and Spring Quarters

BIE 620 **On-Site Practicum in Clinical Ethics**

[Formerly BIE 620C] A supervised practical experience in clinical ethics designed to teach skills in clinical ethics consultation. Prerequisites: BIE 590
Corequisites: BIE610
Credits: (3), Graded, Quarter Calendar
Practicum, Spring Terms

BIE 621 **On-Site Practicum in Research Ethics**

[Formerly BIE 620R] A supervised practical experience. Helps students develop and refine the practical skills introduced in BIE 611 (Online Research Ethics Practicum) through hands-on experience. These skills include: teaching and education, review and oversight of institutional research projects involving human volunteers or animal subjects, and sound management of the research endeavor, including organizational management and policy analysis, arbitration, and mediation. Prerequisites: BIE580
Corequisites: BIE611
Credits: (3), Graded, Quarter Calendar
Practicum, Spring Terms

BIE 630 **Masters Project I**

The Master's project in bioethics involves three terms of independent research (under the direction of a faculty supervisor) culminating in a written document that addresses some aspect of clinical ethics, research ethics, or bioethics policy.
Credits: (3), Pass/Fail, Quarter Calendar
Independent Study, Fall Terms

BIE 635 **Master's Project II**

The Master's project in bioethics involves three terms of independent research (under the direction of a faculty supervisor) culminating in a written document that addresses some aspect of clinical ethics, research ethics, or bioethics policy. BIE 635 Prerequisites: BIE630
Credits: (3), Graded, Quarter Calendar
Independent Study, Winter Terms

BIE 640 **Masters Project III**

The Master's project in bioethics involves three terms of independent research (under the direction of a faculty supervisor) culminating in a written document that addresses some aspect of clinical ethics, research ethics, or bioethics policy. BIE 640 Prerequisites: BIE630 and BIE635
Credits: (3), Graded, Quarter Calendar
Independent Study, Spring Terms

BIE 650 **Capstone**

Capstone practicum in which students demonstrate their mastery of clinical ethics, research ethics or bioethics policy. Each student presents their Masters Project.
Credits: (3), Graded, Quarter Calendar
Lecture, Spring Terms

BIE 670 **Proseminar in Biomedical Ethics (Spanish)**

Onsite introduction to biomedical ethics, methodology and history, as well as the responsible conduct of research. Designed to orient trainees, to serve as a springboard for the Caribbean Research Ethics Education Initiative, and to introduce trainees to the subsequent online courses and the faculty that teach them.

Credits: (3), Graded, Quarter Calendar
Lecture, Summer Terms

BIE 671 **Responsible Conduct of Research (Spanish)**

This online course provides trainees with an introduction to the ethics of scientific research, starting with a discussion of responsible conduct of research (commonly referred to by the acronym RCR).

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

BIE 672 **Human Subjects Research (Spanish)**

This online course builds upon some of the themes that were first introduced in Responsible Conduct of Research and provides trainees with additional experience in the design, conduct and oversight of trials involving human participants.

Credits: (3), Graded, Quarter Calendar
Lecture, Winter Terms

BIE 673 **Bioethics Policy and Pedagogy (Spanish)**

The purpose of this online course is to provide students with basic skills in bioethics policy making and pedagogy. The first half of this course provides trainees with an understanding of the public policy making process and the political and regulatory environment in which researchers and research ethics committees function. The second half of the course is designed to give trainees practical experience in teaching bioethics and research ethics to adult learners, covering such topics as theories of active learning, knowledge taxonomies, course planning and development, assessment and grading, and observation and feedback.

Credits: (3), Graded, Quarter Calendar
Lecture, Summer Terms

BIE 674 **Online Practicum and Project (Spanish)**

During this online course, trainees will carry out individual projects in their home countries and institutions, building off the knowledge and skills learned in Bioethics Policy and Pedagogy.

Credits: (3), Graded, Quarter Calendar
Lecture, Summer Terms

BIE 675 **Capstone (Spanish)**

The purpose of this onsite course is to assess how well students have learned the knowledge and the practical skills necessary for functioning as policymakers and research ethics educators in their home countries, and in promoting institutional change.

Credits: (3), Graded, Quarter Calendar
Lecture, Summer Terms

BIE 680 **Proseminar in Biomedical Ethics (English)**

Onsite introduction to biomedical ethics, methodology and history, as well as the responsible conduct of research. Designed to orient trainees, to serve as a springboard for the Caribbean Research Ethics Education Initiative, and to introduce trainees to the subsequent online courses and the faculty that teach them.

Credits: (3), Graded, Quarter Calendar
Lecture, Spring Terms

BIE 681 **Responsible Conduct of Research (English)**

This online course provides trainees with an introduction to the ethics of scientific research, starting with a discussion of responsible conduct of research (commonly referred to by the acronym RCR)

Credits: (3), Graded, Quarter Calendar
Lecture, Summer Terms

BIE 682 **Human Subjects Research (English)**

This online course builds upon some of the themes that were first introduced in Responsible Conduct of Research and provides trainees with additional experience in the design, conduct and oversight of trials involving human participants.

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

BIE 683 **Bioethics Policy and Pedagogy (English)**

The purpose of this online course is to provide students with basic skills in bioethics policy making and pedagogy. The first half of this course provides trainees with an understanding of the public policy making process and the political and regulatory environment in which researchers and research ethics committees function. The second half of the course is designed to give trainees practical experience in teaching bioethics and research ethics to adult learners, covering such topics as theories of active learning, knowledge taxonomies, course planning and development, assessment and grading, and observation and feedback.

Credits: (3), Graded, Quarter Calendar
Laboratory, Winter Terms

BIE 684 **Online Practicum and Project (English)**

During this online course, trainees will carry out individual projects in their home countries and institutions, building off the knowledge and skills learned in Bioethics Policy and Pedagogy.

Credits: (3), Graded, Quarter Calendar
Laboratory, Spring Terms

BIE 685 **Capstone (English)**

The purpose of this onsite course is to assess how well students have learned the knowledge and the practical skills necessary for functioning as policymakers and research ethics educators in their home countries, and in promoting institutional change.

Credits: (3), Graded, Quarter Calendar
Independent Study, Spring Terms

BIE 691 **Proseminar in Biomedical Ethics**

This onsite introductory seminar is designed to serve as a springboard for the 16-month Advanced Certificate Program in Research Ethics. Students will be immersed in discussions of biomedical methodology and history.

Credits: (3), Graded, Quarter Calendar
Lecture, Summer Terms

BIE 692 **International Bioethics**

The purpose of this online course is to provide the historical and theoretical foundations for the Advanced Certificate Program in Research Ethics. Topics will include: the history and development of key international institutions, pivotal policies and theoretical frameworks informing international bioethics and research ethics and case studies of specific areas in international bioethics.

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

BIE 693 **International Rsrch Ethics I**

In this online course, fellows will be able to identify and explain the prominent ethical, social and legal issues in research ethics and apply ethical and professional principles to those issues.

Credits: (3), Graded, Quarter Calendar

Lecture, Winter Terms

BIE 694 **International Research Ethics II**

In this online course, a continuation of Research Ethics I, fellows will master the knowledge base that will allow them to function as ethicists on research ethics committees. They will understand the legal and ethical complexities of contemporary research issues occurring in their home countries and how the local prevailing approaches and standards compare and contrast to international ones.

Credits: (3), Graded, Quarter Calendar

Lecture, Spring Terms

BIE 695 **Online Practicum and Project**

The online practicum and project course is the key vehicle for preparing fellows to facilitate institutional and societal change with regard to ethical practices in international health research. Working with a faculty supervisor, fellows carry out projects in their home institutions including: developing and teaching short courses on research ethics, conducting empirical studies of research ethics practices, writing and implementing policies for research ethics committees, improving the management of research ethics committees, and influencing the public policy agenda of governmental bodies and non-governmental organizations.

Credits: (3), Graded, Quarter Calendar

Lecture, Spring and Summer Terms

BIE 696 **Online Project**

The Online Project course is a key vehicle for preparing trainees to facilitate institutional and societal change with regard to ethical practices in international health research. During this course trainees will carry out independent projects in their home institutions, including: developing and teaching short courses in research ethics, conducting empirical studies of research ethics practices, writing and implementing policies for research ethics committees, and influencing the public policy agenda of government bodies and non-governmental agencies. Additional practical skills useful in completing the project are also taught.

Credits: (3), Graded, Quarter Calendar

Lecture, Fall Terms

BIE 699 **Onsite Practicum and Capstone**

In the combination onsite practicum and capstone, fellows will acquire and demonstrate the practical skills necessary for functioning as independent research ethicists in their home countries and in promoting institutional change. It also provides an opportunity for fellows to demonstrate they have mastered the essential knowledge base and practical skills necessary to function as a competent research ethicist in the CEE environment.

Credits: (3), Graded, Quarter Calendar

Lecture, Summer Terms

Educational Biology**BIO 555** **Ecology and the Environment**

Ecology is the study of the interactions between organisms and their environment. This course provides a survey of the environmental processes and the influence of human activities upon them. Students will acquire "ecological literacy" and develop an understanding of how scientific methods are used to construct ecological knowledge. The course's goal is to allow students to explore some of today's major ecological challenges, and the important research that is being done to address these concerns. Field Experiences to local ecological sites will be included. Upon completion, students will be able to demonstrate an understanding of environmental interrelationships and contemporary environmental issues. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture

BIO 556 **Biology Demonstrations**

Students learn by doing! It is with this premise that BIO 556 encourages the development of independent thought and research by its participants. The design of this 3-credit course is to meet the needs of students currently conducting their internship or anticipating an internship in the Master of Arts in Teaching Program at Clarkson University. The students will research publications and internet sites in order to compile a usable resource binder. The laboratory activities they investigate will relate to all conceptual areas of biology. Particular attention will be given to the learning standards and required laboratory activities necessary for successful completion of The Living Environment course taken by New York State high school students. The laboratory activities they develop will not only be presented to our class at CU, but should also be used during their internships at local high schools. The students will 'self-evaluate' lab activities using a standard form provided by the instructor. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture

BIO 580 **MAT Project in Biology (Content Area)**

The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom? Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

BIO 988 **Independent Study in Biology**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a

graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

BOE 989 Independent Study in Biology

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

Business of Energy

BOE 610 Fundamentals of the Business of Energy

An initial umbrella course designed to acquaint the student with the complexities of the present-day power system and how we arrived at this point. It will include a brief history of the industry evolution and will encompass various fuels, types of generation, regulatory authorities, power transmission, distribution, control & dispatch, planning, power markets and revenue flows.

Credits: (3), Graded, Quarter Calendar
Lecture

BOE 611 Planning and Operations of Power Systems

Operations and planning of power systems will introduce and discuss the decision process regarding generation types, fuels and transmission. Comparisons will be introduced establishing the difference between traditional vertically integrated utilities and unbundled resource suppliers. The principles of electric power systems will be studied along with the impact of deregulation.

Credits: (3), Graded, Semester Calendar
Lecture

BOE 612 Power Markets

This course will deal with the intricacies of the workings of the power markets (including gas). It will introduce and discuss the evolution from regulated pricing to market pricing. It will introduce and discuss market-based products necessary for reliable operation; hedging principles; and out-of-market products necessary for a fair and reliable market.

Credits: (3), Graded, Quarter Calendar
Lecture

BOE 613 Deregulation & Restructuring

This course will explore the history of legislation, regulation and regulatory authorities in the development of the power industry and its impact on the economy and consumers. The evolution of the relationships between regulators and the regulated; the restructuring of the natural gas and electric industry over the last three decades; and the current regulatory status of both the infrastructure and power markets will also be studied.

Credits: (3), Graded, Quarter Calendar
Lecture

BOE 614 Electric Power Industry Economics and Finance

This course will evaluate the weaving thread of economics and finance as an integral part of operations and strategic planning in the

complex energy industry. It will investigate supplier economics and finance under regulation and deregulation environments. It will evaluate market transactions, payment paths, settlements, capital requirements, financial instruments, and procedures that are identified with the industry. It will review economic issues confronting power transmission owners/providers under regulated models and merchant function models. The course will identify and encourage a knowledge-based review of new technologies and green energy as they relate to financial and economic decision making. Energy policies, metering technology, micro-grids, government influences, fuels and storage will all be explored as they relate to various present and future economic and financial models.

Credits: (3), Graded, Quarter Calendar
Lecture

BOE 615 Challenges to Upgrading Aging Infrastructure

This course will examine and evaluate the changing energy horizon as the industry embraces expanding technology, renewable energy, smart grid technology, etc.; to be exercised upon an aging infrastructure. The student will see the critical need for system knowledge and planning to continue to meet the needs and reliability of a sophisticated complex industry struggling to meet the needs of its customers and economic growth.

Credits: (3), Graded, Quarter Calendar
Lecture

BOE 616 Graduate Project in Business of Energy

This non-credit project provides a capstone experience for graduate Business of Energy students. The purpose of this project is to provide a means to further develop graduating student communication, critical thinking, and interaction skills via a capstone experience on a Business of Energy topic that holds a special interest to the student. The candidate and faculty advisor agree on project scope and evaluation process.

Credits: (0), P/NC, Quarter Calendar
Independent Study, Given When Needed

Biomedical/Rehabilitation Engineering

BR 500 Biomedical Engineering Fundamentals

[Cross-listed with BY 540] This interdisciplinary course will introduce students to the fundamental and quantitative basics of biomedical rehabilitation engineering. The course will present principles of disability and the diverse roles of engineering in medical and rehabilitation. Students will use engineering methods to study anatomical and physiological systems including applications in rehabilitation engineering, bioinstrumentation, biosignal, and image processing, biomechanics and biomaterials. Graduate students will be required to additionally write a comprehensive paper and present that paper in a short talk to the class.

Prerequisites: MA131/132, PH131/132, junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

Biology

BY 510 Developmental Biology

This course will cover the same subject area and topics as that of BY 310. Additional materials at the graduate level will be expected of those who register under this catalog number.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

BY 512 **Molecular Biology Laboratory**

This course will deal with the same subject area and topics as that of BY 412. Additional materials at the graduate level will be expected of those who register under this catalog number.

Prerequisites: graduate standing.

Credits: (4), Graded, Semester Calendar
Laboratory, Fall Terms

BY 514 **Bioinformatics**

This course and companion lab will cover the same subject area and topics as BY314. Additional materials at the graduate level will be expected of those who register under this catalog number.

Prerequisite: Graduate standing.

Credits: (4), Graded, Semester Calendar
Lecture, Laboratory, Spring Semesters

BY 515 **Recent Advances in Immunology Research**

The objective of this course is to present recent advances in immunological and microbiological research, and to prepare students for advanced work in an immunology research lab. Students will receive one credit for attending seminars (9 per semester), reading a journal article prior to each presentation, writing short review of each seminar, and participating in discussions. This course will cover the same subject area and topics as that of BY 415. Additional materials at the graduate level will be expected of those who register under this catalog number.

Credits: (1), Graded, Semester Calendar
Lecture, Fall Semesters

BY 518 **Principles of Toxicology and Epidemiology**

[Cross-listed with IH 416, BY 416, IH 518] This course covers the same topics as IH416 (BY416) and includes additional material on the graduate level.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

BY 519 **Immunology**

This course will cover the same subject area and topics as that of BY 419. Additional materials at the graduate level will be expected of those who register under this catalog number.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

BY 520 **Microbiology**

This course will cover the same subject area and topics as that of BY 320. Additional materials at the graduate level will be expected of those who register under this catalog number.

Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Semesters

BY 522 **Evolution**

The course will deal with the same subject area and topics as that of BY 420. Additional materials at the graduate level will be expected of those who register under this catalog number.

Prerequisites: graduate standing.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

BY 524 **Experimental Evolution Laboratory**

[Cross-listed with BY424] An introduction to experimental

approaches used in evolutionary biology. Students will conduct lab experiments using microbes to investigate a range of topics in experimental evolution, observing and exploring evolution as it happens in real time. Topics explored will include adaptive diversification, the evolution of fitness trade-offs, evolutionary loss of redundant traits, and evolutionary rescue. Prerequisites: BY522

Credits: (2), Graded, Semester Calendar
Laboratory, Fall Terms

BY 525 **Biological Systems and Environmental Change**

Human activities are resulting in dramatic global environmental change, in the forms of biodiversity loss, altered biogeochemical cycles, introduced invasive species, chemical toxicification of the environment, climate change, unsustainable exploitation of natural resources, and habitat loss, degradation, and fragmentation. In this course, we will examine how these forms of environmental change disturb biological systems by critically reading key research papers, and discussing their implications for future research and policy action.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

BY 526 **Introduction to Biophysics**

[Cross-listed by PH 526] This course concentrates on the fundamental physical processes that occur within living organisms, particularly the cell. Topics include the structure and physics of macromolecules, biological membranes, the thermodynamics of living systems, muscle contraction and the propagation of signals in nerve cells.

Prerequisite: graduate standing.

Credits: (3), Graded, Semester Calendar
Lecture,

BY 527 **Advanced Mass Spectrometry**

Practical Applications will introduce the students to mass spectrometry and its applications within different fields, including pharmaceutical and biotech industry, academia, government, forensics, etc. Various types of instruments will be discussed, as well as their their application within different fields. The course will then focus on different types of well-known "omics", such as proteomics, metabolomics, glycomics, or lipidomics, but also on specialized types of "omics" such as peptidomics, post-translational modification-omics (PTM-omics), interactomics, foodomics, microbiomics, venomomics, DNA- RNA- & Protein- adductomics, genomics, proteogenomics or transcriptomics. Particular applications of all these kinds of "omics" in biotechnology & pharmaceutical industry, healthcare, biowarfare and forensics will also be discussed.

Prerequisites: CM/BY460/560, or consent of the instructor

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

BY 528 **Conservation Biology**

BY528 provides a graduate-level overview of the core theory of conservation biology, and how conservation biology is applied for environmental conservation and management. Major topics of this course will include conservation prioritization, the problems of small population size on the long-term persistence of a species, conservation genetics, habitat fragmentation and nature reserve design, invasive species, consequences of extinctions on an ecosystem processes and community structure, and the possible effects on biodiversity of global climate change. A course emphasis will be on the challenge of translating the core lessons of conservation biology to effective policy and environmental management. BY52

students will do additional readings, mathematical simulation exercises, and recitations beyond BY428 students.

Prerequisite: Graduate Standing.

Credits: (3), Graded, Semester Calendar
Lecture

BY 531**Limnology**

Limnology (aquatic science) is the study of physical, chemical, and biological properties of fresh water bodies, e.g. lakes, rivers, reservoirs, and wetlands. This introductory course will provide an array of topics that will, by the multi-disciplinary nature of limnology, call upon students' knowledge of biology, chemistry and physics and place them within the context of aquatic science. The focus of the instruction will be aquatic ecology at all levels of biological organization. Upon completion of the course, the student will be able to characterize the physical, chemical and biological/ecological properties of freshwater through the selection and application of appropriate sampling methods. This course covers the same subject area as BY 431 and includes additional materials at the graduate level. Prerequisite: BY222 or CM132 or consent of the instructor. Corequisite: BY 532

Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Semesters

BY 532**Limnology Laboratory**

This co-requisite of Limnology (aquatic science) will provide students the opportunity to engage in water sampling of regional lakes and rivers, analysis of samples in the laboratory, introduction to data synthesis, and report writing. Some fieldwork will be required. Corequisite: BY 531

Credits: (2), Graded, Semester Calendar
Laboratory, Even Fall Semesters

BY 540 Intro to Biomedical Rehabilitation Engineering and Science

[Cross-listed with BR 500] This interdisciplinary course will introduce students to basic principles of biomedical rehabilitation engineering. The course will present principles of disability and the diverse roles of engineering in medicine and rehabilitation. Students will use engineering methods to study anatomical and physiological systems including applications in rehabilitation engineering, bioinstrumentation, biosignal and image processing, biomechanics, and biomaterials.

Prerequisites: MA131/132, PH131/132, junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

BY 548**Medical Microbiology**

This course will cover the same subject area and topics as that of BY 448. Additional materials at the graduate level will be expected of those who register under this catalog number.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

BY 553**Pharmacology Lab**

The goal of this graduate level course is to facilitate a greater understanding of key concepts in pharmacodynamics, pharmacokinetics and observe how they are applied in the context of research and clinical environments. The lab will be simulation based, requiring students to produce and interpret dose-response data from virtual animal experiments, and derive appropriate diagnosis and dosing strategies from patient case study information. Graduate

students enrolled in this course will be required to submit additional course work, an additional exam, and display a deeper and broader knowledge of the literature, relative to undergraduate enrollees in this course.

Credits: (2), Graded, Semester Calendar
Laboratory, Even Spring Semesters

BY 555**Cell and Molecular Biology of Cancer**

This course will deal with the same subject area and topics as that of BY455. Additional materials at the graduate level will be expected of those who register under this catalog number.

Prerequisites: graduate standing.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

BY 560**Comparative Physiology**

In this course, graduate students will be instructed in all the main branches of modern animal physiology with a strong emphasis on the integration of physiological knowledge, ecology, and evolutionary biology. In addition to an in-depth treatment of mammalian physiology, graduate students will be exposed to the various physiological systems that have evolved in other vertebrate, as well as invertebrate, animals. In addition to meeting the demands of the BY360 course, graduate students will be required to do additional reading and submit a literature review concerning a topic of their choice relating to the course material.

Prerequisite: Graduate Standing.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

BY 561**Neurobiology**

This course will cover the same subject area and topics as that of BY 460. Additional materials at the graduate level will be expected of students who register under this catalog number.

Prerequisites: graduate standing.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

BY 562**Comparative Physiology Laboratory**

In this laboratory-based course, graduate students will gain practical exposure to basic research techniques used in the study of animal physiology. Class activities include studying action potential propagation, the mammalian dive reflex, electrooculography and the physiological effects of exercise. Additional materials at the graduate level will be expected of those who register for this course, including a short research proposal and additional reading not required of BY362 undergraduate students. Corequisites: BY560.

Credits: (2), Graded, Semester Calendar
Laboratory

BY 565**Molecular and Genome Evolution**

[Cross-Listed with BY465]An overview of the molecular underpinnings of evolution, and how those molecular changes can be used to characterize and understand the evolutionary history of genes, proteins and organisms. Topics include how and why DNA sequences and genomes change, molecular phylogenetics and evolutionary models, gene duplication and the evolution of gene families, and horizontal gene transfer. For BY 565, additional readings and an additional written and oral report will be required.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

BY 571 Anatomy & Physiology I

This is the first semester of a two-semester sequence covering the basic principles of Human Anatomy and Physiology. The course will focus on the anatomical organization and physiology of the human body using a systems approach. Lectures will emphasize a basic understanding of how anatomical organization at the cell, tissue and organ level correlates with physiological processes. Clinical connections will be drawn wherever relevant. In addition to covering the same subject areas as that of BY471, some advanced topics will be discussed and the students will be given additional reading and writing assignments. This course can assist students in finding a relevant research question to pursue investigation in the field of biomedical science.

Prerequisite: Graduate standing, or permission of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 572 Anatomy & Physiology II

This is the second semester of a two-semester sequence covering the basic principles of Human Anatomy and Physiology. The course will focus on the anatomical organization and physiology of the human body using a systems approach. Lectures will emphasize a basic understanding of how anatomical organization at the cell, tissue and organ level correlates with physiological processes. Clinical connections will be drawn wherever relevant. In addition to covering the same subject areas as that of BY472, some advanced topics will be discussed and the students will be given additional reading and writing assignments. This course can assist students in finding a relevant research question to pursue investigation in the field of biomedical science.

Prerequisites: Graduate standing, or permission of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

BY 573 Anatomy & Physiology I Laboratory

This is the first semester of a two-semester sequence covering the basic principles of Human Anatomy and Physiology. This is the corresponding laboratory for BY571 and will involve anatomical study using a computer-assisted methodology and demonstrations of anatomical models and specimens. In addition to covering the same subject areas as that of BY473, some advanced topics will be discussed and the students will be given additional reading and writing assignments. Corequisite: BY 571

Credits: (2), Graded, Semester Calendar, Laboratory, Fall Semesters

BY 574 Anatomy & Physiology II Laboratory

This is the corresponding laboratory for BY572. The laboratory exercises will focus on physiology and will involve study using a computer-assisted methodology. The students will learn the principles and methodologies of various physiological measurements including bioelectric signals, pulmonary function tests and nerve reflexes. The course will require students to submit a written project and give an oral presentation for successful completion. In addition to covering the same subject areas as that of BY474, some advanced topics will be discussed and the students will be given additional reading and writing assignments. Corequisite: BY 572

Credits: (2), Graded, Semester Calendar

Laboratory, Spring Terms

BY 576 Current Topics in Biology and Medicine

This course will cover the same subject area and topics as that of BY476. Additional materials at the graduate level will be expected of students who register under this catalog.

Prerequisites: graduate standing.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 580 Advanced Cell Biology

This course will cover the same subject area and topics as that of BY 480. Additional materials at the graduate level will be expected of those who register under this catalog number.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

BY 582 Molecular Genetics

This course will provide students with detailed information on the structure, packages, and expression of genes within the genome of both prokaryotes and eukaryotes. Topics will include chromatin packaging and structure; DNA replication mutation and repair; transcription; RNA splicing; translation; and control of gene expression. Included with each of these topics will be primary research papers, which will be discussed during class. During discussions, experiments in the papers will be analyzed as to how they work (focusing on current biotechnology) and critical analysis of the conclusions. Evaluation will involve exams based on material presented during the course as well as participation in discussions and written analysis of presented research papers. This course contains advanced topics and is designed primarily for graduate or advanced undergraduate students. Graduate students will do additional course work.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

BY 586 Molecular Biotechnology

Molecular biotechnology is a rapidly evolving scientific discipline impacting on many aspects of our daily life. This course will review basic concepts and methodologies in recombinant DNA technology, cover the use of molecular biotechnology for the production of useful products in areas of microbial, plant and animal biotechnology and address social and economic issues rising with the availability of these technologies. Additional materials will be expected at the graduate level.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 588 Stem Cells and Regenerative Medicine

This course will cover biological and medical perspectives of stem cells from their fundamental basic biology and mechanisms of organ regeneration through the use of induced-pluripotent stem cells (iPSCs) for therapeutic benefit. It will deal with mammalian and human embryonic stem cells (hESCs) and focus on how iPSCs generate distinct fates during human development and how this can be used for regenerative therapy of common human diseases. Additional materials expected at the graduate level.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 600 Directed Study in Bioscience

Students study advanced topics in bioscience not otherwise available in formal graduate courses. Under supervision of a faculty member, a semester-long course of study is designed based on readings from appropriate texts and primary literature.

Prerequisites: Graduate standing and consent of the instructor.

Credits: (1-4), Graded, Semester Calendar

Independent Study, Given When Needed

BY 604 Molecular Pharmacology

In this course, students will be introduced to the techniques used to study the structure and function of membrane receptor proteins, in particular those of two families that together comprise over 80% of pharmaceutical drug targets: ion channels and G protein-coupled receptors. Specifically, students will see how knowledge of a receptor's 3-dimensional structure and signal transduction mechanism aids understanding of drug action and can assist in the design of newer, better therapeutic agents.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 608 Teaching in Biosciences

This course is intended to improve bioscience teaching training for graduate students. Graduate students will read literature based on the current state of biology education at the university level (e.g. AAAS Vision and Change in Undergraduate Biology Education). Students will also learn how to design undergraduate bioscience teaching labs, and effectively teach the labs. Activities will include writing a course syllabus, and designing and conducting an original lab activity with resources available on the Clarkson campus. The designed lab can be at the level of a freshman lab, or an upper level biology course. Students will need to consider how the lab will be conducted, what is expected for pre-lab and post-lab assignments, and how lab students will be evaluated. Other activities will include how to write effective laboratory protocols and learning to manage a bioscience laboratory.

Credits: (2), Graded, Semester Calendar

Lecture, Spring Semesters

BY 610 Ecological Statistics and Experimental Design

Ecological statistics and experimental design covers a broad and eclectic area of applied statistics used in data description, exploratory data analysis, and statistical hypothesis testing used in environmental science. This course also introduces R as a powerful application for doing experimental design and statistics.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Every Semester

BY 615 Gene Regulatory Networks

Introduction to the current topics and advances of Gene regulatory networks, this course will offer graduate students both theory and hands-on practice to become proficient when tackling primary literature on genomics, proteomics, genetic evolution, and systems biology. Meets twice a week for (a) 3 hour lecture/discussion, and (b) 3 hours practicum (computer required). Objective: learn the fundamental basics of how genes interact in order to orchestrate organismal development and how to combine empirical and theoretical knowledge to understand, test, and predict outcomes upon changing biological variables. Outcomes: Students will become

proficient in interpreting primary literature, acquire critical thinking skills, and knowledgeable in the areas of gene regulation and network cross-talks.

Credits: (4), Graded, Semester Calendar

Lecture, Laboratory, Spring Semesters

BY 622 Graduate Seminar

Weekly meetings to discuss topics of current research interest and attendance of research seminars presented in the biology department. When a graduate student is ready to present his or her own research in a seminar, this course can be taken for 2 credits.

Prerequisites: graduate standing.

Credits: (1-2), P/NC, Semester Calendar

Seminar, Every Semester

BY 650 Biochemistry I

[Cross-listed as CM 560] This course covers the same topics as BY 450 and includes additional material on the graduate level.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

BY 651 Biochemistry II

[Cross-listed with CM 561] This course will cover the same subject area and topics as that of BY 451. Additional materials at the graduate level will be expected of those who register under this catalog number.

Prerequisites: graduate standing.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

BY 690 Critical Thinking and Research Proposal Devel in Biology

This course provides a thorough coverage of the essential elements of research proposal writing, a skill that is required throughout one's scientific career but for which formal training is frequently lacking. After an introductory lecture that provides a general overview of the conceptualization and writing of a research proposal, students will be guided through a series of exercises designed to develop these critical skills. Subsequent meetings will be in the form of small tutorial groups with a faculty member leading discussion of primary literature and the outstanding questions in a particular field of research. Students will exchange their written reports with their peers to get feedback from their peers at different stages of draft preparation before submitting them to the faculty instructor for grading. Students will be encouraged to meet with their peers outside of class hours to discuss their reports/proposals. This course aims at preparing IB&B PhD students for their pre-proposal and full proposal writing, which are the written requirements for their qualifying examination at the end of their second year. It will also help these students prepare for their oral examination. Other graduate students (MS, PhD in life-science related disciplines) may also benefit from this course.

Credits: (2), P/NC, Semester Calendar

Lecture, Odd Spring Terms

BY 900 Thesis, Dissertation or Special Project in Bioscience

Student performs independent research toward a masters or doctorate degree under the guidance of a faculty thesis advisor. A graduate thesis committee monitors student progress and provides guidance toward completion of the project. Work done in satisfaction of the requirements for a degree will be assigned a grade when the

thesis is submitted and approved.

Prerequisites: Graduate standing.

Credits: (1-15), Thesis, Semester Calendar

Thesis Research, Every Semester

BY 999

Special Graduate Topics

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Transfer Credit Only

Civil and Environmental Engineering

CE 501

Fracture Mechanics of Concrete Structures

Failure of structures. Principles of linear elastic and nonlinear fracture mechanics. Fracture processes in concrete. Mode I quasi-brittle fracture. Test methods to determine Mode I fracture properties for concrete and rock. R-curves for quasi-brittle materials. Mixed-mode fracture. Applications of fracture mechanics to concrete structures: associated changes in current design practice and applicable building codes. Fracture mechanics and compressive failure. Toughening mechanisms in fiber-reinforced concrete. Applications to advanced cement-based composites.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

CE 506

Advanced Construction Engineering

A study of emerging technologies, trend setting techniques, and new means and methods in construction engineering management. Topics include: emerging technologies which are intended to enhance the analysis, design, construction, performance, and asset management for construction engineering projects; lessons learned from construction sites covering infrastructure and building projects; construction equipment management and selection for construction applications; composite, hybrid, or new materials for construction applications, emerging trends in project delivery, project cost control, and procurement of construction services. Restriction: Graduate standing required.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CE 510

Sustainable Infrastructure and Building

An application of the use of sustainability rating systems for infrastructure and building projects. Students will use the USGBC LEED and the ISI Envision systems to execute an analysis of a real or realistic project. Focusing on fundamentals of sustainable construction, this course will acquaint students with the processes required to certify/verify projects to meet an independent rating standard. This course will prepare students to take the LEED GA and/or Envision ENV PV exams

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

CE 512

Structural Dynamics

Response of discrete/continuous systems to dynamic loading. Formulation/solution of problems of one or more degrees of freedom. Modal analysis. Numerical integration and transform techniques. Response of dynamic systems to base motion using response spectrum methods.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Terms

CE 513

Elastic Waves and Non-Destructive Tests

The course will include 3 modules: elastic waves, inversion, and applications to real-world problems. The module of elastic waves will cover stress propagation problems in elastic solids and waveguides. The module of inversion will include (i) the fundamentals on inverse theory, experimental data and signal processing, (ii) basic inversion methods (global and deterministic optimizations, simulated annealing and genetic algorithm, Gauss-Newton and gradient methods, etc.). Lastly, the module of real-world problems will consist of applications in site characterization, sinkhole detection, unknown foundation, bridge deck evaluation.

Prerequisites: Numerical Methods, Partial Differential Equations

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CE 515

Foundations, Stability, and Retaining Structures

Application of principles of soil mechanics to the design of shallow and deep foundations, retaining structures and slope stability. Interpretation of soil boring logs as related to geotechnical engineering design. Preparation of design templates using spreadsheets. (3 credits of design)

Prerequisite: CE310.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

CE 516

Advanced Soil Mechanics

This course presents the following topics: stress-strain behavior of sands and clays, theory and practice of in-situ and laboratory testing, total and effective stress analysis, three-dimensional failure criterion, and basic soil models.

Prerequisite: CE415 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CE 520

Computational Methods of Structural Analysis

The matrix stiffness method, theory and implementation in MATLAB, for the analysis for trusses, beams, frames, and grids. Discussion of thermal effects, support settlements, nonlinear effects, and other modeling considerations.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

CE 521

Advanced Mechanics of Composite Materials

Nature of composite materials. Classification and characteristics of composite materials, mechanical behavior of composite materials. Macromechanical and micromechanical elastic behavior of unidirectional lamina. Constitutive and transformation relations. Strength of unidirectional lamina. Composite failure theory. Mechanics of multidirectional structural laminates. Lamination theory. Strength and failure analysis of multidirectional laminates. Effect of temperature and moisture.

Prerequisite: ES222 and ES260.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CE 527

Advanced Fluid Mechanics

An introductory level graduate course in fluid mechanics. Spatial and material coordinates, kinematics of fluid motion, continuity and momentum equations, constitutive relations, simple solutions, potential flows, boundary layer theory, creeping flow, flow through porous media, particle motion, interfacial phenomena, turbulence.

Prerequisite: CH301 or ES330 or equivalents. Prerequisites: CH301 or ES330 or equivalent

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Fall Terms

CE 533 Human Exposure Analysis

Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Terms

CE 534 Sustainable Development Engineering

This course outlines the principles of sustainable engineering for improving sanitation and environmental health in developing communities both internationally and nationally. Topics include sustainable development and appropriate technologies for water and wastewater treatment, water storage and delivery, watershed management, solid waste management, and indoor air quality. The course highlights the importance of community participation and relationship building throughout the development and implementation of engineering projects. At least 2/3 of the course is dedicated to a team-based, sustainable development design project. (2 credits of design)

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CE 535 Groundwater Hydrology and Geochemistry

[Cross-listed with EV 535] This class provides fundamental understanding of the key physical and chemical processes impacting groundwater resources and quality. Emphasis is on groundwater geology, physical characteristics of flow, and geochemical properties of groundwater. Groundwater contamination and contaminant transport and modeling will be introduced. The course will prepare students to qualitatively and quantitatively analyze fluid and contaminant flow in varied geologic systems.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Terms

CE 538 Finite Element Methods

[Cross-listed with MA 572, ME 515] This course is an introduction to the finite element method, from a mathematical as well as a modeling and applications point of view. The basic theory and implementation will be discussed in the context of continuum problems in linear elasticity, potential flow and plate modeling. If time permits, additional applications such as structures, electromagnetics, fluid mechanics, ground water and geotechnics will also be discussed. Topics include: weak formulations and the principle of virtual work, discretization and interpolation-function selection, assembly and solution of the system equations, error estimates and accuracy assessment. When taught in conjunction with CE 438/ME 453 the course requires additional independent work for those registered for the graduate course.

Prerequisite: MA232, MA339, or MA330, ES222, ES330 and the ability to program. Consent of the instructor may be used to replace some prerequisites.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CE 549 Experimental Methods in Structures

This course will introduce fundamental principles, procedures, and applications of experimental methods in structures. Topics covered in this course include sensors, data acquisition, vibration measurement, signal processing, similitude law, system identification, and structural

modeling. Students will learn Labview programming to design a simple experiment. If time allows, state-of-the-art experimental methods such as hybrid simulation will be presented. The course consists of lectures and hands-on laboratory sessions.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CE 551 Theory of Elasticity

[Cross-listed with ME 551] A study of the mathematical theory of elasticity and its application to engineering problems; development of general stress-strain relationships, equations of equilibrium and compatibility; plane stress and plane strain; stress functions; applications to beam bending and torsion.

Prerequisite: ES222, CE/ME554 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CE 553 Properties and Performance of Concrete Materials

This course explores the materials science aspects of properties and behavior of Portland Cement Concrete, including the properties of raw materials in concrete such as cement, aggregates, mineral and chemical admixtures, and fibers. Topics include: physical and chemical aspects of cement hydration and the role of binder types, the influence of type and morphology of hydrates, fresh and hardened concrete properties, introduction to fracture behavior of concrete, and concrete durability issues such as freezing and thawing, sulfate attack, and corrosion of reinforcing steel.

Prerequisite: ES260.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CE 554 Continuum Mechanics

[Cross-listed with ME 554] The course involves the analysis of stress and deformation at a point and the derivation of the fundamental equations by applying the basic laws of conservation of mass, energy, and momentum and those of thermodynamics. Vector and cartesian tensors are reviewed. Relationships (constitutive laws) are then developed between stress, strain, and strain rate. The basic equations governing the behavior of any continuum and applications to solids and fluids are covered.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CE 556 Engineering Analysis

Topics will include limit processes, infinite series, singular integrals, mathematical representation of periodic phenomena, complex variable methods, vector and tensor algebra, linear analysis, integral equations, Green's functions, transform methods, engineering applications drawn from mechanics.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

CE 563 Railroad Engineering

[Cross Listed with CE463] This course is designed to help students gain knowledge in following topics: Railroad engineering efficiency, economics, and energy; Cost-benefit analyses of rail transportation systems; Geometric design of railroad alignment; Train speed, power, and acceleration requirements; Railroad engineering materials characterization (rail, crosstie, ballast, sub-ballast, and subgrade); Subgrade design and construction and drainage; and High Speed Rail (HSR) design and construction. Graduate students are required to do

an independent term project which allows them to study a particular area of railway engineering in more depth, and gives the students experience with the railroad engineering literature as well as more experience in technical communications (the term paper).

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CE 569 **Watershed Analysis**

Conceptual and quantitative analysis of watershed processes will be introduced with an emphasis on modeling surface water hydrology and water resources management. Watershed modeling concepts including analysis of time series, spatially variable data, model calibration, and uncertainty analysis will be studied and demonstrated. The course will emphasize critical analysis of current hydrologic computational methods through literature review and hands-on use of watershed models.

Prerequisites: Hydrology/Water Resources Engineering

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CE 570 **Stream Riparian System and Fluvial Morphology**

This course provides fundamental understanding of hydrologic, hydraulic, and geomorphic processes of the stream riparian system and their ecological impacts. Emphasis will be given to fluvial geomorphology and hydraulic design of stream restoration projects. Computer modeling of river hydraulics and stream dynamics with applications to stream restoration design will be introduced.

Credits: (3), Graded, Semester Calendar

Lecture

CE 571 **Computational River Dynamics**

This course covers basic principles and numerical methods for modeling free-surface turbulent flow, sediment transport and contaminant transport. Topics include mathematical description of free-surface flow and sediment transport, fundamentals of sediment transport, advanced numerical methods, one-, two- and three-dimensional models, domain decomposition and model integration, simulation of dam-break fluvial processes, simulation of vegetation effects on flow and sediment transport, cohesive sediment transport modeling, and contaminant transport modeling.

Prerequisites: Hydraulics, Numerical Methods, Sediment Transport

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CE 572 **Advanced Open Channel Hydraulics**

Introduction to open channel flows, uniform flow and flow resistance, energy and momentum principles, critical depth, gradually varied flow and water surface profiles, rapidly varied flow and channel controls, unsteady flow and translator waves, boundary layers theory, water waves, turbulence in artificial and natural channels and measurements, and shallow water equations and numerical solutions. Application of 1D/2D/3D hydraulic models to engineering problem solving.

Prerequisites: Undergraduate Fluid Mechanics, Water Resources Engineering I or equivalent or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Terms

CE 573 **Sediment Transport**

Incipient motion, bed forms, depth-discharge relation for alluvial streams, transport of bed load and suspended load, natural river and coastal processes.

Prerequisite: CE430 or CE572 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CE 574 **Ecohydraulics**

Introduction to ecohydraulics: Instream flow requirements and fish habitat suitability; River connectivity and fishpasses; Fishpass hydraulics and design optimization; Fish hydrodynamics; Effect of turbulence on fish stability; Mixing and dispersion in rivers and its effect to fish (fickian diffusion, turbulent shear flows, advective diffusion, turbulent dispersion and mixing); Transport and reaction of water pollutants; and Stream water temperature modeling with a case study.

Prerequisites: Undergraduate Fluid Mechanics, Water Resources Engineering I or equivalent or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Fall Terms

CE 575 **Coastal Engineering**

Theory of water waves; tides and harbor oscillations; wave forces on coastal structures; wind wave analysis; beach erosion and shore protection; off-shore pipelines and outfall diffusers.

Prerequisite: CE572 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CE 576 **Hydraulic Engineering in Cold Regions**

Ice engineering for rivers, lakes and coastal zones. Topics to be covered include thermal regimes in surface water bodies; frazil ice; river ice hydraulics; transport of ice in lakes and coastal zones and ice force on structures.

Prerequisite: CE430 or CE572 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CE 577 **Atmospheric Chemistry**

[Cross-listed with CH 576, CM 576] The course will cover the evolution of the atmosphere from its initial formation to its natural background condition to its current state perturbed by human activities; detailed descriptions of the chemistry of the carbon, nitrogen and sulfur cycles; characterization of the atmospheric aerosol and its role in heterogeneous reactions and materials transport; stratospheric ozone and problems with its depletion; airborne radioactivity and its role in atmospheric ion chemistry. This course covers the same topics as CE 477 and includes additional material on the graduate level.

Prerequisite: CM370 or CM371 or ES340.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

CE 579 **Water and Wastewater Treatment Design**

A study of the physical, chemical and biological operations and processes utilized in the treatment of water and wastewater for both municipalities and industries. The course emphasizes both theoretical and design aspects of these processes, and includes appropriate laboratory demonstrations. Preparation of an individual design report will be required. (2 credits of design)

Prerequisites: ES330 or consent of the instructor. No credit if credit given for CE479 or similar course.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CE 580 Environmental Chemistry

The fundamentals of inorganic, organic, and physical chemistry with particular emphasis on those topics having application to environmental engineering practice. Chemical equilibria among gaseous, aqueous and solid phases are stressed with a strong mathematical approach. This course provides a basis for the understanding of chemical phenomena in aquatic environments.

Prerequisite: consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CE 581 Hazardous Waste Management Engineering

This course is an introduction to the emerging field of hazardous waste management. This course provides an understanding of environmental regulations, management, techniques to minimize the generation and disposal of hazardous wastes, and technologies to treat wastes and remediate disposal site. (1.5 credits of design)

Prerequisites: CE340 or CE579 or equivalent course, or consent of instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

CE 582 Environmental Systems Analysis and Design

This course presents the basic principles of systems analysis as applied to resource allocation and design problems commonly encountered in the field of environmental engineering. Central to the material covered is the concept of optimal problem solution and its use in choosing among alternative designs or policies. All students will complete a semester project; a greater level of quantitative analysis will be expected from students taking the course for graduate credit. (2 credits of design)

Prerequisites: CE340 or CE579 or equivalent course, EC350, or consent of instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Terms

CE 584 Chemodynamics

This course investigates what happens to a chemical when it is introduced into the environment and the factors that determine and influence its distribution. The dynamics of pollutant transfer in the environment, the relationship between their physical-chemical properties and transport, their persistence in the biosphere and their partitioning in biota are studied. Quantitative models of pollutant transfer between air-water, air-soil and water-sediment are developed. (1 credit of design)

Prerequisite: consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CE 586 Industrial Ecology

An exploration of the methods necessary for designing and implementing changes in manufacturing processes to increase sustainability. This course will identify the impacts associated with resource consumption and environmental pollution, and present the quantitative tools necessary for assessing environmental impacts and to design for sustainability. Topics include: industrial ecology, life

cycle analysis and the integration of the environment into economic activities. (1 credit of design)

Prerequisites: prior college level exposure to the concepts of mass and energy conservations, one of the following: CE340, CH250, ES330, ES340, CH301, CH271 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Terms

CE 590 Graduate Degree Completion Project

A project in civil and environmental engineering under the direction of a faculty advisor or program director. Credit for this work is given when the requirements for the degree are completed including the presentation of a project as appropriate to the degree program.

Credits: (1-6), Graded, Semester Calendar
Lecture, Every Term

CE 591 Special Topics in Construction Engineering Management

This course includes lectures and seminars covering emerging topics in civil and environmental engineering. Topics will include, but are not limited to: emerging technologies, including both software and hardware systems, which are intended to enhance the analysis, design construction, performance, and asset management for civil and environmental engineering projects; lessons learned from construction, civil, and environmental engineering sites covering infrastructure and building projects; and construction, civil and environmental engineering equipment management and selection for site applications. Presentations are given by subject area experts with complement lectures by the instructor. Case studies will be reviewed and researched for further development and discussion within the course. Restriction: Graduate standing required.

Credits: (3), Graded, Semester Calendar
Lecture,

CE 595 Special Topics in Civil and Environmental Engineering

Advanced study of selected topics in the area of civil and environmental engineering.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

CE 610 Civil and Environmental Engineering Seminar

Students, staff and visiting lecturers present research results and topics of current interest.

Credits: (1-2), P/NC, Semester Calendar
Seminar, Every Semester

CE 612 Thesis, Dissertation Credits

Analytical or experimental studies in civil and environmental engineering under the direction of a faculty adviser. Credit for this work is given when the requirements for the degree are completed including the presentation of a thesis or dissertation as appropriate to the degree program.

Credits: (1-15), Thesis, Semester Calendar
Thesis Research, Every Semester

CE 621 Advanced Structural Dynamics

This course provides fundamental and advanced theories of structural dynamics and their applications to natural hazards engineering. Topics covered in the course include numerical integration methods for dynamic analysis; nonlinear hysteresis models; nonlinear time history analysis; soil-foundation-structure/fluid-structure interactions; state-of-the-art simulation methods for civil

infrastructure systems. Prerequisite: CE512 or permission of instructor

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Terms

CE 622 Uncertainty Quantification & Optimization in Comp Mech

Uncertainty Quantification plays an essential role in the validation of the predictive content of computational engineering and science models. Uncertainty in the simulation-based paradigm is typically manifested either in the form of variability of model parameters or in the stochastic external effects to which this system is subjected. In this course, students will be introduced to the mathematical foundations, numerical algorithms, and computational tools necessary for: (1) the propagation of parametric uncertainty in computational mechanics simulations; (2) the analysis of the response of simulation based models to random inputs; and (3) the rational treatment of uncertainty in design optimization problems. The course will involve a term project. Prerequisites: CE538/ME515 and EE529/ME529

Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Terms

CE 631 Cement Chemistry

This is an advanced graduate level course. It covers materials science aspects of conventional and modified portland cement concrete including (i) dry and wet cement chemistry (ii) hydration mechanisms, and microstructure modification (iii) techniques to characterize cementitious systems (SEM, TEM, MIP, NMR, BET, Pore Solution Analysis etc.) and (iv) materials science based discussions on mechanical and durability performance of concrete. Prerequisites: CE 553, Properties and Performance of Concrete Materials

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CE 633 Plasticity

This course provides an introduction to the subject of plasticity. The physical background of inelastic deformation in metals and geological materials is discussed. Continuum constitutive theory is presented including yield criteria, flow rules, and plastic hardening. Extension to the rate-dependent (viscoplastic) material is discussed. Uniqueness and extremum theorems are derived and discussed and field equations for general, two-dimensional and axisymmetric problems are presented. Selected problems from metal and soil/rock plasticity are presented and solved using various techniques, including slip-line theory, limit analysis and 'exact' methods. Other topics such as localization and diffuse instability in plastic deformation and application of FEM in plasticity are presented as time allows.

Prerequisite: CE554 or ME554; recommended CE551 or ME551.

Credits: (3), Graded, Semester Calendar
Lecture,

CE 681 Environmental Physico-Chemical Processes

This class provides fundamental understanding of the chemical and physical processes that govern the migration and fate of pollutants in environmental systems. Emphasis will be placed on the application of these concepts to water treatment processes. Topics include: mass transfer and kinetics, coagulation, precipitation, adsorption, ion exchange, chemical oxidation, sedimentation, filtration and related processes.

Prerequisites: CE340 or CE579 or equivalent course, CE580, or

consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CE 682 Environmental Biological Processes

Principles and applications of biological phenomena and processes in relation to environmental engineering practice. Emphasis is given to biokinetic analysis and design of biological treatment processes applicable to the treatment of water, municipal and industrial wastewater and hazardous wastes. Topics include: microbial growth kinetics and bioenergetics; aerobic, anaerobic fixed-film, nitrification, denitrification and phosphorus removal biological processes; sludge treatment and disposal; advanced wastewater treatment processes. Prerequisites: CE340 or CE579 or equivalent course, CE580, CE584, and BY323, or consent of instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CE 684 Special Topics in Environmental Engineering

Advanced topics in specialized aspects of environmental engineering. Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

CE 686 Environmental Engineering Design

Emphasis will be on water and wastewater treatment plant design, hazardous waste site remediation, groundwater remediation and solid waste disposal.

Prerequisites: CE681 and CE682 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CE 999 Civil and Environmental Engineering Elective

A graduate level course for which there is no comparable Clarkson course. Used for transfer credit only. (Not offered at Clarkson, for transfer credit only.)

Credits: (1-10), Graded, Semester Calendar
Independent Study, Transfer Credit Only

Chemical Engineering

CH 501 Directed Study in Chemical Engineering Principles I

For graduate students with a baccalaureate degree in a field other than chemical engineering.

Credits: (1-4), Graded, Semester Calendar
Independent Study,

CH 502 Directed Study in Chemical Engineering Principles II

For graduate students with a baccalaureate degree in a field other than chemical engineering.

Credits: (1-4), Graded, Semester Calendar
Independent Study, Spring Semesters

CH 503 Directed Study in Chemical Engineering III

For graduate students with a baccalaureate degree in a field other than chemical engineering.

Credits: (1-4), Graded, Semester Calendar
Independent Study, Given When Needed

CH 509 Receptor Modeling in Environmental Chemistry

[Cross-listed with CM 509] This course focuses on the sampling, chemical analysis, and application of data analysis methods to

ambient air in order to identify the nature of the sources of the observed concentrations, their possible locations, and quantitatively apportion the contributions of their sources.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

CH 515 **Polymer Materials**

An introduction to the chemical and physical properties of polymeric materials, including basic polymer chemistry, elementary rheology, polymerization processes and polymer properties.

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Semesters

CH 530 **Chemical Process Safety**

Applications of chemical process principles to process safety and hazards analysis, mitigation and prevention, with emphasis on the chemical process industries.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

CH 541 **Introduction to Nanophotonics**

This course introduces the principles of nanophotonics—an emerging frontier at the nexus of nanotechnology and photonics. Nanophotonics deals with light-matter interactions on the nanometer length scale, and provides enormous opportunities for fundamental research and new applications. The course will cover the theoretical foundations of nanoscale optical interactions, growth and characterization of optical nanomaterials, nanolithography, plasmonics, metamaterials, manipulation and integration of nanostructured architectures, nanoscale optical microscopy, nanophotonic devices and systems, as well as a review of applications of nanophotonics, especially in biotechnology and nanomedicine. The students will be exposed to various new concepts, properties and phenomena in a bright nanoworld.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

CH 546 **Chemical Reactor Analysis II**

Advanced topics in chemical reactor analysis, including residence time distributions, reactor stability, fixed and fluidized bed reactors and advanced design methods.

Prerequisites: CH445.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

CH 547 **Advanced Hydrocarbon Thermodynamics**

This course will provide a consistent approach to the use of thermodynamics for the solution of practical process engineering problems encountered during the design and simulation of chemical processing plants with special emphasis on gas plants and refineries. Topics such as industrial equations of state, pressure-temperature diagrams, modeling with water, high pressure thermodynamic equilibrium, critical phenomena and inclusion of solids in the understanding of phase diagrams will be studied.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Fall Semesters

CH 551 **Multicomponent Mass Transfer**

Principles of mass transfer in multicomponent mixtures. Models of multicomponent diffusion, interaction effects, and applications to processes such as distillation and condensation.

Prerequisites: CH330

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CH 560 **Transport Phenomena**

A study of fluid mechanics, heat, and mass transport, identifying analogies where appropriate, with emphasis on physical understanding. Topics include conservation equations and constitutive relations, boundary conditions, solutions in simple situations, boundary layers, forced and natural convection, phase change phenomena, multicomponent mass transport, film and penetration models, mass transport with chemical reaction, simultaneous heat and mass transport, and experimental techniques.

Prerequisite: CH330 and CH370 or equivalent

Co-requisite: CH561

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

CH 561 **Chemical Engineering Analysis**

Analysis of chemical engineering problems in transport phenomena, reactor engineering and engineering thermodynamics.

Prerequisites: MA331 or equivalent.

Corequisites: CH330 or ES330.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

CH 571 **Advanced Chemical Engineering Thermodynamics**

Laws, principles and concepts of classical thermodynamics, including the properties of pure fluids and of solutions, the thermodynamics of flow processes, chemical reaction equilibria, etc.

Prerequisite: CH260 and CH320

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

CH 576 **Atmospheric Chemistry**

[Cross-listed with CE 577, CM 576] The course will cover the evolution of the atmosphere from its initial formation to its natural background condition to its current state perturbed by human activities; detailed descriptions of the chemistry of the carbon, nitrogen and sulfur cycles; characterization of the atmospheric aerosol and its role in heterogeneous reactions and materials transport; stratospheric ozone and problems with its depletion; airborne radioactivity and its role in atmospheric ion chemistry. This course covers the same topics as CE 477 and includes additional material on the graduate level.

Prerequisite: CM370 or CM371 or ES340.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

CH 582 **Design Project**

A comprehensive design is performed independently. When possible, the work will be done in a team.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

CH 586 **Industrial Chemistry**

[Cross-Listed with CH486/CM486/586] This course will benefit junior and senior undergrads plus grads in chemistry and chemical engineering, and allow them to learn of real ways such talents are used in the professional world. It will involve different industrial chemists and chemical engineers to come to Clarkson University for each of 12 of the 14 weeks of a semester and give two lectures of

about 1 hour 15 min each - one on an afternoon and the other following morning. The first lecture will relate the areas of chemistry their company was known for; the second lecture an in-depth discussion on how one project was carried out at the bench and the pitfalls that had to be resolved along the way to achieve success. The intent is to select lecturers from Clarkson Chemistry and Chemical Engineering major alumni at various lengths of time they have been professionals.

Credits: (1), Graded, Semester Calendar

Lecture, Spring Terms

CH 590 **Elementary Transport Phenomena**

(Cannot be taken by MS or PhD students in Chemical Engineering). Principles of transport of momentum, energy, and mass will be covered from a fundamental perspective, pointing out analogies where appropriate. Topics include the Navier-Stokes and continuity equations, analysis of one dimensional flows, boundary layer theory, the energy and species conservation equations, energy transport by conduction and convection, steady two-dimensional problems, and unsteady one-dimensional problems.

Prerequisites: CH 330 and a 3.5 GPA, or instructor consent

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

CH 610 **Chemical Engineering Seminar**

Students, staff and visiting lecturers present research results and topics of current interest. Attendance is required.

Credits: (1-2), P/NC, Semester Calendar

Seminar, Every Semester

CH 611 **Thesis, Dissertation Credits**

Analytical or experimental studies in chemical engineering under the direction of a faculty adviser. Credit for this work is given when the requirements for the degree are completed including the presentation of a thesis or dissertation as appropriate to the degree program.

Credits: (1-15), Thesis, Semester Calendar

Thesis Research, Every Semester

CH 612 **Directed Study**

Special reading or laboratory study of a specific problem under the direction of a member of the faculty.

Credits: (1-4), Graded, Semester Calendar

Independent Study, Every Semester

CH 665 **Selected Topics in Polymers and Soft Materials**

An advanced graduate course in science and engineering of polymers and soft materials. Topics of special interest will be selected to conform to the mutual interests and needs of students and faculty.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CH 999 **Special Topics in Chemical Engineering**

Used for awarding transfer credits for graduate courses completed elsewhere for which no equivalent Clarkson university graduate course can be identified.

Credits: (1-4), Graded, Semester Calendar

Independent Study, Transfer Credit Only

Educational Chemistry

CHM 561

Chemistry Demonstrations

The focus of this 3-credit course is to provide future science educators with the tools to foster the natural wonder of students. This course will develop the skills necessary to create effective and meaningful activities that elicit student curiosity, deepen understanding of science concepts, and engage students in science that models real world application. Using the text 'Teach Like a Pirate' by David Burgess, candidates will analyze and reflect upon the components of engaging lessons that overcome current distractions of student technology and 'as seen on YouTube' science lessons. During the course, the candidates will find, assess, create, and modify chemistry demonstrations, activities and lessons. The emphasis is on learning how to use demonstrations in a chemistry class and each student will leave the course knowing chemistry laboratories that can be used successfully with secondary school students. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture

CHM 580

MAT Project in Chemistry (Content Area)

The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom? Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture

CHM 988

Independent Study in Chemistry

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Independent Study, Given When Needed

CHM 989

Independent Study in Chemistry

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Independent Study, Given When Needed

Chinese Language

CHN 515

Teaching Chinese in American Schools

Students will become familiar with American public secondary education through reading, discussion, writing, and onsite school observation. A strong emphasis will be on professional writing, reading, and professional communication skills as required by

American teachers. Students will be prepared professionally and culturally to enter the public school classroom. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

CHN 517 Curriculum and Methods of Teaching Chinese

[Formerly CHN 517A] This course is designed to strengthen students' understanding of second language acquisition theory and teaching strategies. Its primary focus is on Chinese as a second language at the K-12 level. The course assumes that students in the course are already teaching in a Chinese language program with some or minimal CFL training. The course emphasizes instructional strategies, planning, and assessment common to most methods courses. In addition, this course introduces students to program development and assessment since most K-12 programs require their Chinese teachers to build out the language program over a series of several years. The course will address students' real time issues and concerns in the classroom as well as learn to see the 'bigger picture' of the CFL program and curriculum. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

CHN 530 Chinese Grammar and Linguistics

This 3-credit course is designed for students who contemplate a career teaching Chinese at the secondary or college level. The purpose of the class is to provide students with a general overview of the basic issues in Chinese linguistics from phonetics, morphology to syntax. Teaching strategies related to these issues will also be briefly discussed. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

CHN 580 MAT Project in Chinese (Content Area)

The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom? Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture

CHN 988 Independent Study in Chinese

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Independent Study, Given When Needed

CHN 989 Independent Study in Chinese

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Independent Study, Given When Needed

Chemistry

CM 509 Receptor Modeling in Environmental Chemistry

[Cross-listed with CH 509] This course focuses on the sampling, chemical analysis, and application of data analysis methods to ambient air in order to identify the nature of the sources of the observed concentrations, their possible locations, and quantitatively apportion the contributions of their sources.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

CM 513 Carbon Capture and Sequestration

[Cross-listed with CH 513] Sustainable energy generation is seen as one of the largest challenges of our generation. All long-term solutions rely on the direct or indirect conversion of solar energy, yet these solutions appear to be years from implementation. In the coming decades then, while the relative importance of fossil fuels will decrease, absolute use of fossil fuels will not. Carbon Capture and Sequestration (CCS) employed on a global scale can sustain the world's energy use and help mitigate alarmingly high carbon dioxide levels in the atmosphere. The goal of this course is to provide students with a modern view of current and emerging research in CCS. Topics will include our current understanding of carbon dioxide in and around the planet, the geological storage of carbon dioxide, and the science and technology of capturing carbon dioxide with focus on material chemistry aspects. Development of analytical methods and characterization tools for assessing CCS properties and materials will also be discussed. Through this series of lectures, students will learn about the contemporary research related to CCS, as well as learn to develop, analyze, and compare various CCS solutions.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

CM 520 Separations and Electrochemistry

This course covers the same topics as CM 320 and includes additional material on the graduate level. Restriction: Non-chemistry majors only.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

CM 522 Advanced Mass Spectrometry: Practical Applications

Practical Applications will introduce the students to mass spectrometry and its applications within different fields, including pharmaceutical and biotech industry, academia, government, forensics, etc. Various types of instruments will be discussed, as well as their application within different fields. The course will then focus on different types of well-known "omics", such as proteomics, metabolomics, glycomics, or lipidomics, but also on specialized types of "omics" such as peptidomics, post-translational modification-omics (PTM-omics), interactomics, foodomics, microbiomics, venomics, DNA- RNA- & Protein- adductomics, genomics, proteogenomics or transcriptomics. Particular applications of all these kinds of "omics" in biotechnology & pharmaceutical industry,

healthcare, biowarfare and forensics will also be discussed.
Prerequisites: CM/BY460/560, or consent of the instructor
Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CM 525 **Advanced Bioanalytical Chemistry**

The goal of this course is to provide graduate students and advanced undergraduates with a modern view of current and emerging research in bioanalytical technologies, analytical method development and validation and their applications. Topics include: biomolecules (enzymes, DNA, antibodies), biochemical aspects, kinetics and energetics, analysis and quantification of biomolecules, biomolecular recognition, bio-immobilization, chromatography of biomolecules, spectroscopic methods in bioanalysis, principles and applications of electrophoresis, immunochemical techniques, fundamentals of bio-analytical sensors, single molecule detection and single cell analysis, analytical method validation.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CM 530 **Colloid and Interfaces**

Physico-chemical principles and experimental techniques related to the characterization and investigation of colloidal systems and interfaces are covered on an introductory level. From the many areas of application, the emphasis will be on those situations that are encountered in everyday life such as environmental problems (aerosols, water treatment), biological aspects (transport and absorption of fat, biological membranes), foods and cosmetics (emulsions), detergency and various technological processes. This course covers the same topics as CM 430 and includes additional material on the graduate level.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CM 532 **Fine Particle Characterization**

This course is intended to familiarize the students with the analytic techniques routinely used to characterize the size, size distribution, shape, composition, structure, and surface properties (composition, charge, topography) of individual particles as well as the properties of dispersion particles. In conjunction with the latter, the course will discuss many concepts covered by colloids and surface science courses. Graduate students will do additional work.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 535 **Better Materials through Chemistry**

[Cross-Listed with CM435]Our physical world relies on a broad spectrum of materials of different properties around us to fulfill their functions to serve our daily life. It is one of the missions of chemists to improve and optimize materials chemically to make them more efficient and effective in diverse processes and devices. In this course, subsequent to a brief survey of the fundamental chemistry and physics of polymers, ionic liquids, carbon nanomaterials and composite materials their potential and current applications will be treated. Particularly, preparations, characterizations and applications of porous polymers and carbons, membranes and "smart" materials will be delineated.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Terms

CM 541 **Physical Organic Chemistry**

This course covers the same topics as CM 441 and includes additional material on the graduate level.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 542 **Advanced Organic Chemistry**

The course will cover essential topics of organic chemistry including dynamic stereochemistry, conformational analysis, photochemistry, pericyclic reactions, and chemistry of free radicals.

This course covers the same topics as CM 442 and includes additional material on the graduate level.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 543 **Reactive Intermediates in Organic Chemistry**

This course covers the same topics as CM 443 and includes additional material on the graduate level.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 544 **Medicinal Chemistry**

This course covers the same topics as CM 444 and includes additional material on the graduate level.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 545 **Organometallic Chemistry**

[Cross-listed with CM445]The course will provide introduction into structure and properties of compounds possessing metal-carbon bonds and their reactions with emphasis on homogeneous catalysis. Graduate students will do additional course work.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Terms

CM 546 **Modern Spectroscopic Methods in Organic Chemistry**

No prerequisites. This course covers the same topics as CM 446 and includes additional material on the graduate level.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 550 **Introduction to Polymer Chemistry**

This course covers the same topics as CM 450 and includes additional material on the graduate level.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CM 551 **Manufacturing Implications of Adv Materials Processing**

The processing of materials into manufactured goods requires an understanding of the chemical composition of the starting substrates, the nature of intermediates, and the properties of final products. This course focuses on the preparation, modification, characterization, and the applications of fine, ultra-fine, and nanosize metallic particles. The objectives are to: a) provide an overview of the relevant theoretical and practical aspects related to the preparation, characterization, and modification of fine particles in general and metallic particles in particular, b) familiarize students with the industrial approaches for developing and manufacturing fine particles on large scale, and c) teach students how the properties of the resulting particles/colloids can be tailored in order to ensure optimal performance in specific applications. During the semester the

students will also participate in several practical sessions in which metal colloids will be prepared and characterized. Graduate students will do additional work, such as a term paper or review presentation. Prerequisites: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CM 553 Introduction to Biomaterials

This course deals with biomaterials in medical and pharmaceutical applications. Basic concepts and requirements of biomaterials will be introduced. Classification and properties of a wide range of biomaterials will be discussed according to their particular applications such as drug delivery, artificial organs, implants and devices. In addition, standard testing and evaluation aspects of the biomaterials will also be addressed.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

CM 560 Biochemistry I

[Cross-listed with BY 650] This course covers the same topics as CM 460 and includes additional material on the graduate level.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

CM 561 Biochemistry II

[Cross-listed with BY 651] This course covers the same topics as CM 461 and includes additional material on the graduate level.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

CM 563 Protein Chemistry & Proteomics

This course covers the same topics as CM463, and includes additional material on the graduate level. Prerequisite: CM560 (Biochemistry I)

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CM 566 Bioelectronics & Bionanotechnology

This course covers novel areas in science and technology that have high importance for fundamental science and practical applications. Bioelectronics is a scientific and technological area that includes electronic coupling of biomaterials (enzymes, DNA, recognition proteins, biological cells) with electronic devices. The bioelectronic systems can be used to develop sensing devices (enzyme-based biosensors, DNA sensors, immunosensors, etc.) and to develop biofuel cells (implantable biofuel cells for biomedical applications, self-powered biosensors, autonomously operated devices). New methods and new materials (functionalized nanoparticles, quantum dots, carbon nanotubes, etc.) developed due to the tremendous recent success in nanotechnology pave the way for the novel possibilities to couple biomaterials and electronic transducers, thus resulting in the new technological field named Bionanotechnology. The students will be introduced into the most important areas of Bioelectronics and Bionanotechnology.

Prerequisites: CM372, CM460.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CM 567 Biofuel Cells – Design and Applications

This is a lecture course designed to provide graduate students with a working knowledge in the highly multidisciplinary research area of biofuel cells (including microbial, enzyme-based and “abiotic” biofuel cells, their construction, operation and various applications). The course will include a brief overview of microbial fuel cells. The “abiotic” biofuel cells based on the use of inorganic catalytic species (mostly catalytic nanoparticles) will be studied in connection with the general information on nanoparticles and their immobilization on electrodes. The main part of the course will be devoted to the enzyme-based biofuel cells and their biomedical applications, particularly as a potential power source for implantable biomedical devices (e.g., pacemakers). The scientific advances and technical problems will be discussed. The course is addressed to graduate students with different backgrounds, including students from chemistry and biomolecular science, biology, chemical engineering and electrical engineering. Since the attending students can have very different backgrounds, not necessarily with deep knowledge of chemistry, biochemistry and electrochemistry, the course will be started with a short basic introduction to the enzyme catalysis and electrocatalysis. In addition to the lectures, the course will provide homework with reading of important publications in the research area followed by the class discussions. At the end of the course the students will be asked to prepare short talks delivered to the class on selected topics related to the biofuel cells studied. Overall, the course will provide general introduction to the important areas of electrochemical and bioelectrochemical catalysis, enzyme-based bioelectrocatalytic electrodes, biofuel cells and their various applications.

Credits: (1), Graded, Semester Calendar

Lecture, Odd Spring Terms

CM 570 Biochemistry & Biotechnology Laboratory

This course is a one semester course in the fundamental laboratory approaches for biochemistry and biotechnology. While largely a hands-on course, laboratory experiments will be supplemented with lectures that integrate the theoretical and practical principals covered in the exercises. Topics include protein purification, characterization and analysis, enzyme kinetics and molecular modeling.

Prerequisites: BY312 or CY450 or CM460 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Laboratory, Spring Semesters

CM 571 Fundamental Chemical Kinetics

Basic principles. From stoichiometry and rate law to mechanism. Simple gas-phase reactions. Collision and transition-state theories. Temperature effects. Catalysis.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CM 572 Chemistry at Surfaces: Structure and Catalysis

This senior undergraduate and graduate course will survey the field of surface chemistry, with specific attention dedicated to the structure of solid surfaces and chemical processes at solid interfaces. This course will cover the basics of the structure of periodic solids, relate that understanding to solid interfaces, and finally address how surface structure and reduced dimensionality impact chemical reactions (i.e. heterogeneous catalysis). Analytical techniques

common to this discipline will also be discussed. Graduate students will be assessed differently than undergraduates in this course. Graduate students will have the additional responsibility of delivering a presentation discussing one of several primary research articles germane to the field that were selected by the instructor, while undergraduate students will submit a paper describing one of these articles in detail.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Terms

CM 575 Sustainable Nanotechnology

[Cross-listed with MSE 575, and ES 575] This course covers the same topics as CM 475 and includes additional coursework on the graduate level.

Credits: (3), Graded, Semester Calendar
Lecture

CM 576 Atmospheric Chemistry

[Cross-listed with CE 577, CH 576] The course will cover the evolution of the atmosphere from its initial formation to its natural background condition to its current state perturbed by human activities; detailed descriptions of the chemistry of the carbon, nitrogen and sulfur cycles; characterization of the atmospheric aerosol and its role in heterogeneous reactions and materials transport; stratospheric ozone and problems with its depletion; airborne radioactivity and its role in atmospheric ion chemistry. This course covers the same topics as CE 477 and includes additional material on the graduate level.

Prerequisite: CM370 or CM371 or ES340.
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CM 583 Introduction to Polymer Science

[Cross-listed with PH 583] This course is about fundamental aspects of polymer science. It introduces the world of chain molecules from synthesis and properties to applications. Basic knowledge from polymer chemistry and physics are combined in the one course in a form appropriate for undergraduates and graduates in chemistry, physics and engineering to develop the understanding of polymeric behavior in synthetic materials and natures.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CM 584 Functional Polymer Systems

[Cross listed with CM484] This senior undergraduate and graduate course will introduce students to the world of polymer materials, which deliver concrete functions and may serve our daily life in our modern society. These polymer systems exist in different structural forms and can have multicomponents, including surfactants, fillers, etc. The role of the interfacial phenomena in controlling specific functions and materials performance is strongly emphasized in the course through the fundamentals of polymer and colloid science. Main modern tendencies in polymer advanced materials (nanocomposites, smart polymer materials, (nano)porous materials, membranes, biocompatible polymeric materials, applications of polymers in electrochemical energy devices, sensor design and actuator fabrication) are covered in the course. Students are encouraged to take CM483/CM583 before participation of this course. Graduate students will do additional work.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Terms

CM 585 Nanostructured Materials

[Cross-listed with PH 585] This course reviews the methods to make nanoscale building blocks and approaches to arrange the building blocks into functional architectures for advanced materials. The list of topics includes: chemical patterning and lithography, layer-by-layer self assembly, synthesis and self assembly of nanoparticles, nanotubes and nanowires, properties of nanoclusters and self assembled structures (photonic crystals, plasmonic effects, quantum dots, porous materials, biomimetics).

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

CM 586 Industrial Chemistry

[Cross-Listed with CM486/CH486/586] This course will benefit junior and senior undergrads plus grads in chemistry and chemical engineering, and allow them to learn of real ways such talents are used in the professional world. It will involve different industrial chemists and chemical engineers to come to Clarkson University for each of 12 of the 14 weeks of a semester and give two lectures of about 1 hour 15 min each - one on an afternoon and the other following morning. The first lecture will relate the areas of chemistry their company was known for; the second lecture an in-depth discussion on how one project was carried out at the bench and the pitfalls that had to be resolved along the way to achieve success. The intent is to select lecturers from Clarkson Chemistry and Chemical Engineering major alumni at various lengths of time they have been professionals.

Credits: (1), Graded, Semester Calendar
Lecture, Spring Terms

CM 587 Applications of Synchrotron and Electron Based Techniques

The purpose of the course is to familiarize all students with the x-ray and electron based experimental techniques available at Brookhaven National Lab and other similar facilities. Students will be cognizant of the applications of these cutting edge facilities, and well positioned to use them in their own research. This course is suitable for graduate students, postdocs, and advanced undergrads in physical sciences and engineering, as well as students in biological, environmental, and chemical sciences who may have the interest to learn more about the techniques they may use for their research.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CM 735 Special Topics in Colloid and Surface Chemistry

Topics in colloid and surface chemistry and related areas selected to meet the needs of the class.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

CM 755 Special Topics in Polymer Chemistry

Topics in polymer chemistry and related areas selected to meet the needs of the class.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

CM 765 Special Topics in Biochemistry

Topics in biochemistry and related areas selected to meet the needs of the class.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

CM 775 **Special Topics in Physical Chemistry**

Topics in physical chemistry and related areas selected to meet the needs of the class.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

CM 890 **Directed Study**

The study, on the graduate level, of a subject not otherwise available in formal courses may be undertaken under the supervision of a faculty member.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

CM 900 **Seminar**

Reports are made by students on topics from the current literature, or by students, faculty members or outside speakers on their own research.

Credits: (1-2), P/NC, Semester Calendar
Seminar, Every Semester

CM 990 **Thesis, Dissertation or Special Project**

Each student does independent, original work on a project under the guidance and supervision of an instructor. A grade on all of the credits for this work presented in satisfaction of the requirements for a degree is given when those requirements are completed.

Credits: (1-15), Thesis, Semester Calendar
Thesis Research, Every Semester

CM 999 **Special Graduate Topics**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Transfer Credit Only

Communication**COMM 513** **Professional Communication**

Students will learn how to design and present effective professional documents, both print and electronic. The course emphasizes a rhetorical approach to analyzing the issues and details important to the communication to be produced (e.g., audience, style, format, purpose, media). Students will practice writing both individually and collaboratively and will be expected to present their work orally on occasion. Students will encounter topics such as, but not limited to, abstracts, email, instructions, letters, memoranda, proposals, and various types of reports, and will read and discuss current research on professional communication practice and theory; students will be required to develop a course project connecting that practice and theory to their own disciplinary fields.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

COMM 999 **Special Graduate Topics**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Transfer Credit Only

Computer Science**CS 500** **Network and Security Systems**

[Formerly CSC 560] This course explores critical business challenges: how to protect an organization's computer networks, systems, applications and information. Students learn how to design procedures, protocols, and policies that address both engineering and human issues. Engineered security is examined through the application or cryptography, digital signatures and certificates, authentication protocol, firewalls, and intrusion detection. Also considered are security issues related to people's use of organization's networks and systems including policies and practices for password management and protecting privacy rights. Students also study options for maintaining business continuity in the event of a disruption of business operations. Specific case studies are used to highlight the choices that must be made to balance operational efficiency of business functions with protecting the business from the onslaught of security threats. Prerequisite expertise: Networking protocols. The student should have taken a course in computer communications/networking and have programming experience such as C/C++, or JAVA or PHP. (The programming experience will allow the course to include hands on security project).

Credits: (3), Graded, Quarter Calendar
Lecture

CS 501 **Software Quality Management**

[Formerly CSC 561] This course prepares students to apply a quality mindset to both the development process and the developed software. Students learn the theory and practice of quality assurance and testing computer software. Topics of study include the use of metrics to measure quality, software quality standards as a baseline for establishing and assessing quality, the effects of the economics on product reliability, and software testing practices (including test design, coverage, and tools). Students will study specific cases that highlight practical techniques and reveal the relationship between software quality management and meeting an organization's business objectives

Credits: (3), Graded, Semester Calendar
Lecture

CS 502 **Business Intelligence**

[Formerly CSC 562] This course offers an interdisciplinary look at computing technologies in support of forming valuable business insights and making effective decisions. Students acquire knowledge of the conceptual basis for data warehousing (collection and organization of data in database management systems) and data mining (detecting of patterns in business data). Students then build the skills to extract business intelligence from collected and analyzed data and present it for use in business decision-making activities. Various practical applications are studies such as customer segmentation, Customer Relationship Management (CRM), Group Decision Support Systems (GDSS), and Executive Information Systems (EIS). Students will learn about trends in the use of business intelligence software and techniques and examine specific case studies. There will be an opportunity for students to develop their own application project. Prerequisite expertise: database management systems.

Credits: (3), Graded, Quarter Calendar
Lecture

CS 503 Systems Analysis and Design Methods

[Formerly CSC 564] The application of information technology has extended to all quarters of the business world. While the nature and the scope of information systems vary widely depending on the business context, the fundamental knowledge underlying their development remains the same. This course aims to provide technology students with a solid understanding of the important methodologies and tools & techniques related to the development of information systems in a variety of contexts.

Credits: (3), Graded, Quarter Calendar

Lecture

CS 504 Enterprise Architecture

[Formerly CSC 570] This course provides students with an understanding of the basic concepts and practices of Enterprise Architecture (EA). This is not a course on information systems development, web/application programming, database development, or network design. The course focuses on understanding how information technology resources can best be leveraged to support an organization's strategic goals and business requirements. Basic proficiency is developed in the understanding of several EA methodologies, number of governments and major corporations around the world, as well as the U.S. Federal Government's approach to EA. Students learn the theory and practice of EA through a combination of lectures, student-led class instructions, analysis papers, exams, and a written project with a verbal presentation.

Credits: (3), Graded, Quarter Calendar

Lecture

CS 505 Business Data & Communications & Networking

[Formerly CSC 583B] This course is designed to convey the essentials of data communication networks. It will cover concepts, technologies and architectures. There will be practical lessons built into the semester's topics and assignments whenever possible. A single course cannot cover all possible networking topics and issues, so we will cover the major conceptual areas balanced with practical discussions and exercises. We will also discuss important network management topics such as domain management and security. Specifically, the following topics will be covered: Fundamentals of Networking Technologies, OSI Model, Physical Layer, Data Link Layer, Local Area Networks, Wireless Local Area Networks, Network/Transport Layers TCP/IP, Backbone Networks, Wide Area Networks, Application Layer, The Internet, Network Design, Network Management and Network Troubleshooting, Network Security, Voice over IP.

Credits: (3), Graded, Quarter Calendar

Lecture

CS 506 Engineering Statistics

[Cross-listed with EE 602, ME 577] [Formerly CSC 572] Modern engineering practice makes extensive use of statistical methods for the efficient collection and analysis of engineering data, and to support data-based decision making. This course will introduce the statistical tools that are of greatest importance for practicing engineers. Core topics to be covered will include probability and distribution theory, the construction and interpretation of statistical intervals, statistical hypothesis testing, regression analysis and empirical modeling, statistical experimental design, and statistical

quality/process control. Additional specialized topics may also be covered, depending upon the interests of the class; possible topics include system reliability analysis, measurement system analysis, process capability analysis (and "six-sigma"), accelerated life testing, and acceptance sampling.

Credits: (3), Graded, Quarter Calendar

Lecture

CS 511 Foundations of Computer Science

This course covers a variety of topics fundamental to Computer Science. Topics will vary from year to year to accommodate the background and interests of the participants. Possible topics include: mathematical foundations, analysis of algorithms, data abstraction, elementary data structures and algorithms such as lists, stacks and sorting, advanced data structures and algorithms such as heaps, hashing, dynamic programming, and graph algorithms, object-oriented programming, and basic automata theory.

Prerequisites: programming experience.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

CS 541 Introduction to Automata Theory and Formal Languages

This course covers an introduction to formal languages and their relation to automata. Topics include: regular languages, deterministic and nondeterministic finite automata, closure properties for regular sets, context free grammars, normal forms, ambiguity, pushdown automata, a treatment of closure properties and decision algorithms for context free languages. Also included are a treatment of recursive and recursively enumerable sets, Turing machines, decidability and undecidability.

Prerequisites: MA211, MA346 or equivalent.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

CS 542 Computational Complexity

The complexity of a computational problem is the amount of computer resources it requires. Computational complexity theory studies the complexity of computational problems as well as relationships between different types of resources. This course will cover both classical and research-related topics in computational complexity, such as: complexity measures and complexity classes for sequential machines and Boolean circuits, reductions and completeness, hierarchy theorems, relativization, circuit complexity, and proof complexity. Students will be expected to independently explore some of the course material.

Prerequisites: CS345 or CS541, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CS 543 Parallel Programming

The performance of single microprocessors is no longer increasing rapidly, and most of the increase in computing power in the future is anticipated to come from multiprocessor and parallel systems. But parallel programming is much more difficult than writing single-threaded sequential programs, and this course will introduce students to the techniques, design strategies, and programming interfaces for creating reliable and efficient parallel programs. Students will program for clusters of workstations using the MPI parallel message passing library, and will write multi-threaded

programs for shared-memory multiprocessors. Students will learn methods and tools for predicting and measuring the performance of parallel algorithms. Students will also read and discuss research papers on parallel architectures and algorithms.

Credits: (3), Graded, Semester Calendar
Lecture

CS 544 **Operating Systems**

This course is an introduction to the concepts of operating systems, their structures and organization. Major topics include process management (asynchronous processes, interprocess communication and synchronization, multithreading), storage management (paging/segmentation, virtual memory, file systems), protection and security issues, and distributed systems. To demonstrate these concepts, case studies of operating systems will be presented, and a programming project will be an integral part of the course.

Prerequisites: CS344, EE264 or equivalent, or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Spring Semesters

CS 545 **Compiler Construction I**

A graduate-level study of compiler design. Overview of the compilation process. Formal definition of syntax, lexical scanning, parsing including LL and LR grammars, run-time structures, intermediate code generation, and storage allocation. Students develop a compiler for a substantial subset of a high-level language using compiler tools such as lex and yacc.

Prerequisites: CS241, CS341, or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

CS 547 **Computer Algorithms**

[Cross-listed with EE 667] This course will study and contrast a variety of computational algorithms and develop tools for algorithm analysis. Methods and topics such as dynamic programming, greedy algorithms, graph algorithms, circuits, parallel algorithms, matrix and polynomial algorithms, string matching, and geometrical algorithms will be explored. The theory of NP-completeness and methods of managing NP-complete problems will also be covered.

Prerequisites: CS344, MA211 or MA346.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

CS 549 **Computational Learning**

Computational learning studies algorithmic problems for inferring patterns and relations from data. This course describes the mathematical foundations of learning and explores the important connections and applications to areas such as artificial intelligence, cryptography, statistics, and bioinformatics. A list of relevant topics may include perceptron and online learning, graphical models and probabilistic inference, decision tree induction and boosting, analysis of Boolean functions, sample complexity bounds, cryptographic and complexity hardness, and reinforcement learning. Basic ideas from computer science and mathematics are employed to describe the main ideas and major developments in computational learning. Students are expected to learn and explore recent research ideas in the area. Corequisites: CS 541 and CS 547, or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CS 550 **Software Design and Development**

Working in teams, students will learn tools and strategies for designing and implementing medium/large software projects. Suitable project ideas will be solicited from the community in order to match student teams with real users where possible. Students will learn to elicit requirements from users and to work in an effective team. Students will learn and practice techniques for software testing including black-box testing, stress testing, performance testing, code reviews, and code coverage tools. Students will produce documentation that is appropriate at various stages in the software life cycle including for example, requirements documents, project plans and user manuals. The work will include oral presentations and written reports. Students will be expected to independently explore some aspects of the course material. Students taking the course for graduate credit Students taking this course for graduate credit are required to do additional work beyond students in CS 350.

Prerequisites: CS242 or CS344, or permission of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

CS 551 **Artificial Intelligence**

[Cross-listed with EE 565] This course is an introduction to the computational study of intelligent systems. Topics include heuristic search, knowledge representation, automated reasoning, knowledge-based systems, reasoning under uncertainty, planning, and intelligent agents. Additional topics may be drawn from machine learning, neural networks, computer vision, and natural language understanding. AI programming techniques and methods will also be covered throughout the course.

Prerequisites: CS344 or equivalent or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CS 552 **Computer Graphics**

[Cross-listed with EE 505] An introduction to computer graphics. Graphics hardware, algorithms for generating and displaying two and three-dimensional geometric figures, animation, interactive displays. Programming projects using OpenGL will be assigned. Students will be expected to independently explore some aspects of the course material. Prerequisites: Programming experience in C/C++ family language, basic concepts in linear algebra and matrices.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

CS 555 **Computer Networks**

[Cross-listed with EE 507] This course covers layered protocols, network architectures, OSI, digital networks, local area networks, metropolitan networks, wide area networks, and interconnection of local area networks and non-uniform networks. Students will be expected to explore independently advanced aspects of the subject area. Prerequisites: One of course in computer architecture (EE264, CS241 or IT502 or equivalent). One course in computer programming (EE261, CS141 or equivalent.) Note: IT501 also satisfies the programming requirement.

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Fall Semesters

CS 556 **Cryptography**

Cryptography is the discipline which studies the making of 'secret' codes. This course will examine some of the methods of cryptography together with many surprising applications. The language of modern

cryptography is primarily number theory, and various tools of number theory will be developed as needed. No background in number theory or cryptography will be necessary, but some mathematical sophistication and familiarity with proofs will be assumed. Topics will include: one-way functions, public-key cryptosystems, digital signatures, probabilistic encryption, primality testing, interactive proof systems, and methods of secret sharing.

Prerequisites: MA211, MA346, or equivalent.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

CS 557 Computer and Network Security

[Cross-listed with EE 510] Attacks on networked computer systems are an increasingly important problem. This course covers the types of vulnerabilities that are present in modern computer systems and the types of malicious software that exploit these vulnerabilities. It also covers best practices for preventing, detecting and responding to such attacks including anti-virus software, defensive programming techniques, intrusion detection systems, honeypots and firewalls.

Prerequisites: A general course in computer networking such as CS455/555 or EE407/507. Programming experience to the level of CS142 or EE361.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CS 558 Formal Methods for Program Verification

Formal methods are algorithms and techniques that actually prove that a program meets its design criteria, and are the only way to guarantee that a program works correctly. As computer software increases in size and complexity, formal methods are becoming an essential part of software engineering. This is especially true of safety critical and life critical systems, where software errors can have life threatening consequences. Until recently, formal methods have had limited application because they were difficult to use. This is changing, and they are receiving greater acceptance from software engineers in industry and government. This course introduces students to the basic concepts and methods of program verification. A variety of techniques and tools will be covered, and students will gain experience in applying the tools to actual programs. After completing the course, students will have sufficient expertise to learn new methods as they become available.

Prerequisites: MA211 or MA346, CS344.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

CS 559 Human-Computer Interaction

This course provides an introduction to the field of human-computer interaction (HCI). This discipline focuses on the design, evaluation and implementation of interactive computing systems from a user's point of view. The course will give a broad overview of the ideas, techniques, and tools in the subject, with a systematic approach to designing visual interfaces and evaluating their effectiveness. Case studies of existing interfaces, technologies, and data display methods will be discussed and critiqued. Topics include: programming and command languages; menus and forms graphical user interfaces, computer-supported cooperative work, information search and visualization; input/output devices; and display design. A

collaborative course project will explore issues in HCI and design.

Prerequisites: proficiency in C++, Java or C. Prerequisites: CS242 or EE408

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

CS 560 Database Systems

[Cross-listed with EE 568] An introduction to database systems. The entity-relationship and relational models are presented and applied to the design of typical databases. New developments in object-oriented and multimedia databases are presented. Emphasis will be placed on database design for applications in the context of an existing database management system such as ORACLE or ACCESS. Substantial independent investigation of advanced topics will be required.

Prerequisites: programming experience in a high level language.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

CS 561 Mixed Reality

[Cross-Listed with CS461] This course provides an introduction to the mathematics and computing underlying virtual (VR) and augmented reality (AR). Students will learn stereo camera geometry for VR, recovery of 3D scene structure from images for content manipulation in AR, acquiring of illumination maps for photorealistic AR, and capture of human interaction for virtual environments. Students will perform several short and long projects as part of the course. Students will also analyze seminal papers in supporting fields such as graphics, vision, and computational photography.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

CS 565 Mobile Robotics and Human-Machine Interaction

This course provides an introduction to robotic systems and human interaction methods with such systems from a computational perspective. In this course students will learn about the definitional problems for robotics with a human-centric flavor, and look at how they are being solved in practice and by the research community. The emphasis is on algorithms, inference mechanisms and behavior strategies although we will also survey the kinds of mechanical and electronic systems that constitute a robot today.

Prerequisite: CS 344 (Algorithms and Data Structures)

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CS 566 Blockchain Technologies

Blockchain technologies are the underlying technological foundation of almost all digital currencies, such as Bitcoin and Ethereum. Without the need of a trusted authority or central server, Blockchain technologies can securely archive and are inherently resistant to modification of data. The course will cover the basics and advanced topics of Blockchain technologies. The basics include public key cryptography and cryptocurrency, hashing algorithms, mining process, proof of work, block structures, transactions and wallets. Advanced topics may include consensus algorithms, smart contracts, blockchain network security and applications. We will discuss the limitations of current applications and explore new systems and

proposals that overcome them. The course will offer many hands-on lab components and a blockchain-based course project. Students should already have had solid programming skills, such as C, C++ or Python, to take the course. Students will be expected to independently explore some of the course material.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CS 569 **Quantum Information and Computation**

This course studies information and computation based on quantum mechanical laws. The first part of the course will cover the relevant background in quantum information theory. A brief discussion of several universal quantum computational models will be given. The second part will cover algorithmic techniques important for developing quantum algorithms. Topics to be covered include amplitude amplification, quantum walks, phase estimation, hidden subgroup problems, and quantum protocols. Background in physics would be helpful but is not required. As part of a research project, students are expected to explore topics of interest from the literature.

Prerequisites: CS344, and MA232 or MA339, or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CS 570 **Deep Learning**

This course will cover the principles of modern deep learning architectures from a theoretical and practical perspective. Course topics covered will include an introduction to machine learning and basic neural network architectures, and in-depth discussions on convolutional neural networks, recurrent neural networks based on units such as LSTMs and GRUs, and, if time permits, GANs. Students will be required to implement programming assignments and projects that apply deep learning architectures to solve classification and regression problems. Students will read and assess papers on current evolutions to these architectures. Graduate students will do additional work.

Prerequisites: CS142, EE262 or EE361, and MA339, or consent of instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CS 571 **System Administration and Network Operations**

This course is designed to give students the basic skills and knowledge to administer Unix/Linux machines as standalone workstations or in a network environment. For example, students will learn to install and configure the Linux operating system, create and maintain system users and groups, maintain and administer a file system, configure and maintain network services, troubleshoot system and network problems, and secure the system and network environment. Comprehensive hands-on labs throughout the course will reinforce learning and develop skills and competency. Graduate students will be expected to explore independently advanced aspects of the subject area.

Prerequisite: CS241 or equivalent
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CS 607 **Topics in Computer Science**

A graduate course in the field of Computer Science. Areas of coverage will be selected to conform to the mutual interests and needs of students and faculty.

Credits: (1-15), Graded, Semester Calendar
Independent Study, Given When Needed

CS 608 **Topics in Computer Science**

A graduate course in the field of Computer Science. Areas of coverage will be selected to conform to the mutual interests and needs of students and faculty.

Credits: (1-15), Graded, Semester Calendar
Independent Study, Given When Needed

CS 611 **Topics in Applied Computer Science**

A graduate course in the field of Applied Computer Science. Areas of coverage will be selected to conform to the mutual interests and needs of students and faculty.

Credits: (1-15), Graded, Semester Calendar
Independent Study, Given When Needed

CS 612 **Topics in Applied Computer Science**

A graduate course in the field of Applied Computer Science. Areas of coverage will be selected to conform to the mutual interests and needs of students and faculty.

Credits: (1-15), Graded, Semester Calendar
Independent Study, Given When Needed

CS 634 **Thesis**

Each student does independent, original work on a project under the guidance and supervision of an instructor. A grade on all of the credits for this work presented in satisfaction of the requirements for a degree is given when those requirements are completed.

MS in Computer Science.
Credits: (1-15), Thesis, Semester Calendar
Thesis Research, Given When Needed

CS 644 **Current Issues in Operating Systems Research**

In this course we will read both classic and current publications of operating systems research. Students will gain experience reading and critiquing research papers. Class times will be devoted to discussing the papers and possible extensions of the work. Projects may consist of a small piece of research.

Prerequisites: CS444 or consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

CS 647 **Advanced Algorithms**

This course covers advanced topics in computer algorithms. Topics covered include, but are not restricted to, linear programming and combinatorial optimization, randomized algorithms and probabilistic methods, competitive analysis and online algorithms, algorithms for algebraic and geometric problems, and space-efficient algorithms. The emphasis will be on methods and techniques instead of specific applications. As part of a research project, students are to explore specific topics of interest from the literature. Prerequisite: CS 547

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

CS 649 **Current Issues In Machine Learning**

In this course, we will read current publications of machine learning research. Students will gain experience reading and critiquing research papers. Class times will be devoted to discussing the papers and possible extensions of the work. Projects may consist of a small piece of research.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CS 652 **Computer Vision**

[Cross-listed with EE 652] This course will cover both classical and recent progress in the field of computer vision, both on the theory and practice. Material covered will be from both the textbook and relevant research papers in the area. After taking this course, students will achieve the necessary knowledge to solve various practical computer-vision problems and build a solid background for further computer-vision research. Topics covered include: Early vision on one and multiple images (linear filters, edge detection, stereopsis), mid-level vision (segmentation, object tracking), high-level vision (model-based vision, graph-based image segmentation) and applications (medical image analysis, image-based rendering).

Prerequisites: CS344 and MA339 (or equivalent, with consent from the instructor)

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CS 653 **Automated Reasoning**

This course will cover advanced topics in Automated Reasoning research. Students will gain experience reading and discussing research papers. Students will be expected to conduct research-related work in Automated Reasoning.

Prerequisites: CS541 and CS547, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CS 654 **Current Issues in Computer Networking Research**

In this course we will read both classic and current publications of networking research. Students will gain experience reading and critiquing research papers. Class times will be devoted to discussing the papers and possible extensions of the work. Projects will consist of a small piece of research.

Prerequisites: CS454/554 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CS 657 **Advanced Topics in Computer Security**

This course will cover advanced topics in computer security research. Students will gain experience reading and discussing research papers. Students will be expected to conduct research-related work in computer security.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CS 665 **Adv Topics in Robotics and Human-Machine Interaction**

This course focuses on recent developments on the computational aspects of mobile robotics and human-robot interaction (HRI), with a focus on human-in-the-loop problems. The course is organized around a collection of research articles in robotics, machine perception and HRI. Students will acquire experience in reading, analyzing, and presenting research articles from these areas. A small research project will be an integral part of the course, where each

student is expected to clarify, expand, or improve some of the articles discussed.

Prerequisite: CS465/565 or equivalent, or (in exceptional cases) consent of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CS 667 **Cloud Systems and Networks**

[Cross-listed with EE 512] This course is an introduction to cloud computing systems and cloud networks. The primary focus will be communication infrastructures and networking principles for cloud computing with an emphasis placed on network virtualization, mobile cloud computing and inter-data-center networks. Topics will include: a thorough presentation of cloud computing service models, namely Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a Service (SaaS); detailed investigation of cloud management issues with an emphasis on mobile cloud computing, cloud data center management and provisioning in cloud networks; security and privacy in the cloud; and sustainability of cloud systems from a communications perspective. Reading contemporary issues on cloud systems and networking will be an important part of this course. Several technical paper reading/presentation assignments and one term project will be given throughout the semester.

Prerequisite: EE 507, Computer Networks (or permission of the instructor)

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CS 668 **Natural Language Processing**

This course introduces students to the fundamental concepts and ideas in natural language processing (NLP). In this course students will learn how to create systems that are able to understand and produce language for applications ranging from plagiarism detection to information extraction to automated summarization. The course will focus on four key areas: understanding and recognizing words; syntax (i.e. structure of language); semantics (i.e. meaning of language); pragmatics/discourse (i.e. interpretation of language in context). Students will be introduced to document similarity techniques using frequency and sequence based techniques; n-gram models; parts of speech tagging; named entity recognition; word sense disambiguation; machine translation; use of deep learning in NLP. Students will work with large scale datasets spanning from open source repositories to news articles. As part of the course students will read the latest literature in NLP and provide oral and written summaries.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

CS 707 **Seminar in Computer Science**

Credits: (1-15), P/NC, Semester Calendar

Seminar, Given When Needed

CS 708 **Seminar in Computer Science**

Credits: (1-15), P/NC, Semester Calendar

Seminar, Given When Needed

Educational Technology**CS 570** **Computers in the Language Arts Classroom**

Credits: (3), Graded, Semester Calendar

Lecture

Digital Arts

DA 500 Directed Study & Collaborative Projects

DA500 will involve the creation of advanced projects under the guidance of the instructor. Topics may include but are not limited to: data visualization, scientific visualization, UI/UX interface design & app development, outreach projects structured around STEM Education, and STEM based virtual reality experiences.

Credits: (3), Pass/Fail, Semester Calendar

Independent Study, Fall and Spring Terms

English for Academic Purposes

EAP 550 Academic Writing for Graduates I

[Formerly ESL550] This course, designed for non-native speakers of English at a low-advanced level of proficiency in written English, focuses on reading and writing for the academic context. Students read material from a variety of fields and develop their writing skills in definition, description, comparison and contrast, and analysis. The course also includes vocabulary-building techniques and a review of grammatical structures needed for effective writing.

Prerequisite: placement test.

Credits: (3), P/NC, Semester Calendar

Lecture, Fall Semesters

EAP 552 Academic Writing for Graduates II

[Formerly ESL552] This course integrates academic reading, writing, and critical thinking for non-native speakers of English who are at an advanced level of proficiency in written English. Students read short academic articles on various topics by a variety of authors, discuss and evaluate ideas, and write a number of analytical and argumentative papers, including a documented paper based on outside sources. Attention is given to key academic writing skills, e.g., summary, paraphrase, use of citations, and effective support of ideas.

Credits: (3), P/NC, Semester Calendar

Lecture, Spring Semesters

EAP 554 Academic Writing Seminar for Graduates II

[Formerly ESL554] This writing seminar will provide high advanced non-native speakers of English with tools and teacher feedback to shape their writing skills for university level writing requirements. This seminar will focus primarily on the American cultural expectations/conventional structures for successful academic writing courses; students will enhance their tone, form, and structure of texts.

Prerequisites: Placement test or permission of the instructor

Credits: (2), P/NC, Semester Calendar

Lecture, Spring Semesters

EAP 555 Academic Spoken Comm Skills

[Formerly ESL555] This course is intended for international TAs and other international graduate students who need to improve their spoken English skills in order to interact effectively with students and faculty. The course focuses on development of effective communication skills (including appropriate grammar and vocabulary) for various academic purposes (e.g., leading discussions, making presentations, answering questions). As a group and individually, students also work on pronunciation, intonation patterns, and other features of fluent American English.

Credits: (3), P/NC, Semester Calendar

Lecture, Fall Semesters

Economics

EC 604 Applied Economics (MBA Module)

[Cross-listed with EC 605] A graduate course in applied economics. An investigation of economic concepts and models likely to be useful for managers involved in financial, economic and strategic decision-making at various levels. Quantitative techniques and selected econometric procedures are emphasized. This course is designed for MBA students and meets five hours per week for five weeks. Restriction: Admission to the MBA program required

Credits: (2), Graded, Semester Calendar, Lecture, Fall Semesters

EC 605 Managerial Economics

[Cross-listed with EC 604] This is an advanced and applied course in managerial economics, with introductory material in microeconomic principles. The course starts with selected principles topics such as demand and supply analysis, market equilibrium, household behavior, production and costs, and firm behavior. We then move on to more sophisticated theories of consumption and production such as demand elasticity measures, profit maximization and sensitivity analysis, price discrimination, demand estimation, theories of risk and uncertainty, market structures, and game theory. Students participate in economics games and experiments throughout the course, and examples drawn from the business and financial worlds are used to illustrate the key concepts.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

EC 624 Sports Economics

[Formerly MBA 624] Topics covered in this course include the measurement of competitive balance and its impact on sports leagues; discrimination in sports; efficiency of sports teams and individual athletes; labor unions and labor relations in professional sports; the efficiency of sports wagering markets; and the estimation of marginal product for professional athletes.

Credits: (3), Graded, Quarter Calendar

Lecture, Spring Terms

EC 651 Industrial Organization in the Supply Chain

[Cross-listed with EC 652] This is an industrial organization course that focuses on the strategic interactions within the supply chain under various market conditions. Models of industry structures are explored along with the discussion of business clusters and networks. Topics include horizontal and vertical integration, outsourcing, contract negotiations and incentives, logistics issues, capacity constraints, pricing strategies and network issues all from the perspective of the supply chain. Students apply the models covered in class through several case studies to evolve in the art of strategic thinking.

Prerequisites: EC604 or EC605

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

EC 652 Industrial Organization in the Supply Chain

[Cross-listed with EC 651] This is an industrial organization course that focuses on the strategic interactions within the supply chain under various market conditions. Models of industry structures are explored along with the discussion of business clusters and networks. Starting with a review of basic microeconomics principles: other topics include horizontal and vertical integration, outsourcing, contract negotiations and incentives, logistics issues, capacity constraints, pricing strategies and network issues all from the perspective of the supply chain.

Students apply the models covered in class through several case studies to evolve in the art of strategic thinking.

Credits: (3), Graded, Quarter Calendar

Lecture, Given When Needed

EC 660 Environmental Economics

This course considers environmental problems from an economic perspective. Topics include the theoretical foundations of environmental economics, measuring the costs and benefits of environmental policies, environmental policy issues, and special topics including risk and uncertainty in environmental regulation, sustainable development, and issues in natural resource damage assessment.

Prerequisites: EC150 or EC350 or EC151 or equivalent.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

EC 687 Special Projects in Economics

An investigation of a problem undertaken by the student which is acceptable to and under the guidance of the faculty member and chairperson. The course provides an opportunity for the student to investigate and analyze a problem area of economics in depth on an independent study basis.

Prerequisites: permission of the Department of Economics Chair, and the faculty member involved.

Credits: (1-6), Graded, Semester Calendar

Independent Study, Every Semester

Education

ED 501 Teaching Practicum

Formerly EDS 500F] MAT interns must complete 75 hours total (12 full school days) of observation and/or teaching either before the residency or at the beginning of the residency. 30 hours of the practicum should be completed with the mentor and with other department members assigned by the mentor and/or supervisor. The Practicum must include at least 15 hours in each of the following settings: students with disabilities, low socio-economic, and English as a New Language (ENL). Half of the total Practicum must be in grades 7-9, and the other half in grades 10-12. Residency supervisors must meet with the intern and mentor during the first weeks of school to review the Practicum requirements for the individual intern. The supervisor will help facilitate each intern's Practicum in collaboration with the mentor and intern and arrange observations in other schools, if needed. During the Practicum, the intern will understand the differences in adolescents' learning challenges, cognitive abilities, emotional and physical needs (CAEP InTASC 1.1); interpret students' behaviors, diverse cultures, and communities to gain a broader understanding of adolescents (CAEP InTASC 1.2); analyze observed learning environments that support individual and collaborative learning, productive behavior, positive social interaction, and engagement in learning (CAEP InTASC 1.3); analyze how experienced teachers structure their discipline and make their teaching accessible and meaningful for learners (CAEP InTASC 1.4); identify and analyze various observed instructional strategies that encourage learners to develop an understanding of the content area (CAEP InTASC 1.8). Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (1), Pass/Fail, Semester Calendar

Practicum, Fall Terms

ED 502 NYS Requirements

[Formerly EDS 500G] This course provides the NYS requirements for teacher certification. This course covers the prevention and intervention of school violence, child abuse identification and reporting, prevention of child abduction, drug, alcohol and tobacco abuse prevention and dignity for all students. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (1), Pass/Fail, Semester Calendar

Lecture, Fall Terms

ED 503 Professionalism in Teaching I

Coursework in diversity and inclusion, career preparation, New York State Certification Exam preparation, and residency seminar.

Corequisites: ED550 and ED551

Credits: (0), P/NC, Semester Calendar

Lecture, Given When Needed

ED 504 Professionalism in Teaching II

Coursework in diversity and inclusion, career preparation, New York State Certification Exam preparation, and residency seminar. This is a continuation of ED 503 Professionalism in Teaching I.

Credits: (1), Graded, Semester Calendar

Lecture, Given When Needed

ED 511 Curriculum and Methods of Teaching English

[Formerly EDS 511] Curricular Planning and Instruction for the Teaching of English at the secondary level includes an analysis of secondary language arts curricula including New York State Frameworks for language arts, the Common Core State Standards, instructional techniques and strategies, designing and locating instructional materials, planning, implementing, and evaluating lessons and units. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Summer Terms

ED 512 Curriculum and Methods of Teaching Mathematics

[Formerly EDS 512] Curricular Planning and Instruction for the Teaching of Mathematics at the secondary school level will include an analysis of classic and current secondary mathematics curricula including New York State Frameworks for mathematics, the Common Core State Standards, instructional techniques and strategies, designing and locating instructional materials, planning, implementing, and evaluating lessons and units. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Summer Terms

ED 513 Curriculum and Methods of Teaching Languages

[Formerly EDS 513] Curricular Planning and Instruction for the Teaching of Second Languages at the secondary school level will include an analysis of secondary language curricula including New York State Frameworks for languages; instructional techniques; the teaching of speaking, listening, reading, and writing; designing and locating instructional materials; planning, implementing, and evaluating lessons and units. This course is based on a view of teaching and learning as facilitated by social interaction and that each individual brings unique background knowledge and beliefs to their

learning. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Summer Terms

ED 514 Curriculum and Methods of Teaching Sciences

[Formerly EDS 514] Curricular Planning and Instruction for the Teaching of Science at the secondary school level will include an analysis of secondary science curricula including New York State Frameworks for sciences; instructional techniques and strategies for teaching scientific concepts; laboratory methods and safety, designing and locating instructional materials; planning, implementing, and evaluating lessons and units. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Summer Terms

ED 515 Curriculum and Methods of Teaching Social Studies

[Formerly EDS 515] Curricular Planning and Instruction for the Teaching of Social Studies at the secondary school level will include an analysis of secondary social studies curricula including the New York State Frameworks for social studies; models and techniques for teaching and integrating the various social sciences; designing and locating instructional materials; planning, implementing, and evaluating lessons and units. This course is required for MAT social studies candidates. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Summer Terms

ED 516 Curriculum and Methods of Teaching Technology

[Formerly EDS 516] Designed for those with a technology or engineering background, this course will help prepare technology educators to promote students' learning by the use of multiple instructional models. The course builds teacher skills in lesson planning, content organization, and hard and software evaluation and use. New York State Standards for technology and evolving approaches to integration of technology in the teaching/learning process will also be explored. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Summer Terms

ED 517 Curriculum and Methods of Teaching Business and Marketing

The primary objective of this class is to prepare you to teach business and marketing subjects at the 7th - 12th grade levels. This field includes, but is not limited to, accounting, marketing, finance, information systems, data analysis, and keyboarding. The class emphasizes methodology, curriculum planning, unit and lesson planning, and classroom management. It is assumed that students will be able to apply business and marketing subject matter knowledge to their new learning in the field of pedagogy.

Credits: (3), Graded, Quarter Calendar

Lecture, Given When Needed

ED 540 Psychology of Teaching

[Formerly EDS 540] The Psychology of Teaching is a foundational introduction to teaching: audience, planning, instruction, basic concepts, standards, classroom management, assessment, motivation, discipline, and ethical and professional considerations. Theories of learning and memory applied to instruction; models and research on teaching in secondary schools. Includes thematic analysis of relevant teaching topics such as special needs, differentiated instruction, human development, and foundations of education.

In Psychology of Teaching Microteaching Laboratory graduate students prepare and present several lessons using a variety of instructional models. Models include anticipatory sets, discussion concepts, skills and inquiry with attention paid to themes such as special needs, differentiated instruction, literacy, second language, learners and service learning. Lessons are digitally recorded and critiqued by peer-coaches and laboratory faculty. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Summer Terms

ED 541 Essential Reading Literacy

[Formerly EDS 541] Essential Reading Literacy focuses on a teacher-centered exposure to the basic concepts, skills, and contexts for teaching reading in secondary classrooms. Teachers of the 21st century face many challenges, including the large spectrum of reading abilities in their classrooms. Graduate students will be exposed to the concept of adolescent literacy and basic principles of teaching it, including reading habits, skills, extensive knowledge of the reading process, and the development of a repertoire of strategies and skills to help influence and improve the teaching of reading in all classrooms across all disciplines.

Credits: (3), Graded, Semester Calendar

Lecture, Summer Terms

ED 544 Literacy for the Content Classroom

[Formerly EDS 544] This course familiarizes MAT students with the necessity for and techniques of increasing student literacy (skills, attitudes, and dispositions) in each content area. Participants read background information, explore their own literacy skills, and practice applying reading and writing activities in lesson plans. Students will recognize the importance of literacy in all content areas; expand their definitions of literacy, exploring the skills and dispositions which make it possible for students to read and write for meaning for a wide variety of academic and personal purposes; explore and develop their own skills as proficient readers and writers in general and in their chosen content areas; become aware of issues of literacy through readings and discussions; become aware of how the kinds of writing assigned to students shape their thinking; develop, analyze, and integrate literacy skills in classroom lessons; integrate writing into classroom lessons in a variety of ways to stimulate and shape thinking; address NYS standards and CCSS in their content area. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

ED 545 STEM Methods with Lab

This course is to introduce graduate teaching assistants in STEM fields to the latest methods in instructional science. No familiarity with educational pedagogy is assumed. Emphasis is on applying

instructional techniques in settings with undergraduates that teaching assistants are expected to encounter. The course includes a Teaching Lab component during which students will apply what they are learning to an authentic classroom setting. Restriction: This course is open only to students matriculated in the Department of Education Summer Institute for Graduate Teaching Assistants (or by instructor consent)

Credits: (4), Graded, Semester Calendar

Lecture, Laboratory, Summer Terms

ED 546

STEM Literacy

This course raises awareness of literacies specific to the disciplines of science, technology, engineering, and math. It will help TAs think critically about the many data sources and promote higher-order thinking skills among their students. Strategies for decoding unfamiliar terms, recognizing advanced vocabulary, and making sense of increasingly complex texts and interrelated ideas will be taught. Problem-solving skills and cognitive training will be emphasized to improve student learning. Restriction: This course is open only to students matriculated in the Department of Education Summer Institute for Graduate Teaching Assistants (or by instructor consent)

Credits: (2), Graded, Semester Calendar

Lecture, Summer Terms

ED 547

Professional Communication

This course is designed to help graduate students, particularly graduate TAs, develop the communications skills necessary to be successful in their graduate programs. Students will work on improving their oral comprehensibility, impromptu speaking skills and interactions with undergraduates. The course also addresses intercultural communication in the classroom and common pedagogical approaches in the United States. Students will be able to improve their cultural and sociolinguistic competence. Some parts of the course are designed for international students but is open to anyone interested in developing intercultural competence. The course will help TAs form their identity in the classroom. Restriction: This course is open only to students matriculated in the Department of Education Summer Institute for Graduate Teaching Assistants (or by instructor consent)

Credits: (1), Graded, Semester Calendar

Lecture, Summer Terms

ED 550

Effective Teaching for All Learners

[Formerly EDS 550A] Effective Teaching for All Learners at the secondary level will explore teaching and assessment for the full range of students a teacher encounters: at-risk students, special needs populations, English as a new language learners, struggling readers, disaffected learners, etc. The resources and strategies available to assist classroom teachers will be discussed and implemented. Graduate students will learn how to evaluate the effectiveness of their teaching as it relates to all their students' progress. In order to gain this understanding, graduate students will evaluate various learning assessments through the lens of different student populations, and design and evaluate a range of assessments. Awareness, empathy, and empowerment are the goals for both teachers and their students. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

ED 551

Teaching Residency I

[Formerly EDS 551] The 4-credit internship begins after the Intern completes the New York State required Field Experience or Practicum. The Intern will have been observing and co-teaching with his/her Mentor since the beginning of the school year to fulfill part of the requirements of the Practicum. Once the requirements of the Practicum are completed, the Intern is expected to gradually assume responsibility for two of the mentor's classes, at first co-teaching with the Mentor, but independently by mid-November if prepared to do so. A full-year intern is in school for a minimum of half of the school day. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (4), Graded, Semester Calendar, Ind Study, Every Term

ED 552

Teaching Residency II

[Formerly EDS 552] The 4-credit internship begins after the Intern completes the New York State required Field Experience or Practicum. The Intern will have been observing and co-teaching with his/her Mentor since the beginning of the school year to fulfill part of the requirements of the Practicum. Once the requirements of the Practicum are completed, the Intern is expected to gradually assume responsibility for two of the mentor's classes, at first co-teaching with the Mentor, but independently by mid-November if prepared to do so. A full-year intern is in school for a minimum of half of the school day. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (4), Graded, Semester Calendar

Independent Study, Spring Terms

ED 560

The Modern Teacher

[Formerly EDS 550C] This course is designed to acquaint students with current school reform issues while exposing students to the large number of digital resources, websites, strategies, software and hardware that will help them in their classroom today. Students will be able to:

- Analyze and evaluate the school reform movement from a historical perspective.
- Communicate more productively with students, parents and colleagues and streamline their digital workflow.
- Differentiate instruction within their class using digital means and modern pedagogy.
- Work cooperatively to teach their classmates about school reform and technology.
- Design a school reform proposal using digital means.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

ED 570

Middle School Students, Structures and Standards

[Formerly EDS 570] This course is designed to prepare students for the teaching of grades 5 and 6. It is designed to offer students a chance to explore topics and methodology that are most appropriate for the teaching of students at the middle adolescence level. It is a course based on the theoretical and practical aspects of the teaching experience and on helping develop students into what we need today: competent, energetic and dedicated teachers at the middle level. This is a professional course which demands professional responsibility, a regular commitment, initiative and attentiveness. It is not in any way an exploratory course but one in which a commitment to teaching is assumed. This course and ED 571 qualify students with a grade 7-12 teaching certificate to be also certified to teach grades 5 and 6 in New York State.

Prerequisites: Adolescent 7 – 12 Teacher Certification in a content area.

Credits: (3), Graded, Semester Calendar
Lecture, Summer Terms

ED 571 **Middle Adolescence Literacy**

[Formerly EDS 571] This course is designed to prepare you to teach and develop literacy skills across the curriculum in grades 5 and 6. Completion of this course and ED 570 will qualify you with a grade 7-12 teaching certificate for additional certification in your content area in grades 5-6 in New York state. This course is based on both theoretical and practical aspects of the teaching experience. Students will review research, policy briefs and position statements on developing reading, writings, listening, speaking, viewing, and thinking as it applies to the middle adolescent level. The overall goals of this course will require you to connect, collaborate, and create to expand your concept of literacy; to understand the elements of effective literacy instructions in your content area for grades 5 and 6; and to acknowledge your role as a "reading teacher" no matter what your content area specialty is.

Credits: (3), Graded, Semester Calendar
Lecture, Summer Terms

ED 572 Teaching Foreign Language to Elementary School Children

This course aims to prepare participating teachers for elementary school foreign language classrooms in light of the ACTFL National Foreign Language Standards. Through discussion, practice and the development of thematic units, participants will become familiar with the process of curriculum development and lesson planning, and will develop strategies for instruction and assessment. Participants will also gain understanding of the working environment and classroom culture of the elementary school setting and build up skills for effective teaching. Multiple modes of learning, methods, instructional strategies, language and literacy development, and resources for teaching foreign languages to elementary school children will be covered. Emphasis is on the development of literacy and communicative skills. Participants will build knowledge and understanding of this grade range through the viewing and analysis of classroom video.

Credits: (3), Graded, Semester Calendar
Lecture, Summer Terms

ED 580 **MAT Project**

The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom?

Credits: (3), Graded, Semester Calendar
Independent Study, Spring Terms

ED 590 **Inquiry Research and Methods**

Students will engage in inquiry through the investigation of documents and research-based methodologies. Focus will be placed on practical applications of materials in the full-year residency.

Credits: (1), P/NC, Semester Calendar
Lecture, Every Term

EDS 550B **Seminar in Instruction and Evaluation**

Credits: (3), Graded, Semester Calendar
Seminar

Electrical & Computer Engineering

EE 501 **Digital Signal Processing**

An introduction to discrete-time signal processing. Topics include: A review of orthogonality, Fourier series, Fourier transforms and sampling theory. Smoothing, interpolation, D/A conversion. Digital filters, windows. Design of nonrecursive filters, recursive filters. Correlation and spectra of random signals, spectral estimation. Substantial in depth investigation of advanced topics will be required.

Prerequisite: EE321.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

EE 503 **Advanced Topics in Neuromorphic Computing**

Neuromorphic Computing was originally referred to as the hardware that mimics neuro-biological architectures, and was then extended to the computing systems that can run bio-inspired computing models such as neural networks and deep learning networks. In this course, students will learn the basic knowledge of artificial neural networks and the advanced hardware architectures/systems for efficient neural network computing. We will emphasize both the basic knowledge and practical tricks through a series of hand-on practices including paper readings and projects.

Credits: (3), Graded, Semester Calendar
Lecture

EE 505 **Computer Graphics**

[Cross-listed with CS 552] An introduction to computer graphics. Graphics hardware, algorithms for generating and displaying two and three-dimensional geometric figures, animation, interactive displays. Programming projects using OpenGL will be assigned. Students will be expected to independently explore some aspects of the course material.

Prerequisites: Programming experience in C/C++ family language, basic concepts in linear algebra and matrices.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

EE 507 **Computer Networks**

[Cross-listed with CS 555] This course covers layered networking protocols with an emphasis on common Internet protocols such as TCP, IP, HTTP, and SMTP. It also covers local area networking, focusing on link layer standards such as the IEEE standards for Ethernet and wireless. Additional topics such as security and congestion control will also be covered. EE407 and CS455 are offered each fall as one course with multiple listings.

Prerequisites: One of course in computer architecture (EE264, CS241 or IT502 or equivalent). One course in computer programming (EE261, CS141 or equivalent.) Note: IT501 also satisfies the programming requirement.

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Fall Semesters

EE 510 **Computer and Network Security**

[Cross-listed with CS 557] Attacks on networked computer systems are an increasingly important problem. This course covers the types of vulnerabilities that are present in modern computer systems and

the types of malicious software that exploit these vulnerabilities. It also covers best practices for preventing, detecting and responding to such attacks including anti-virus software, defensive programming techniques, intrusion detection systems, honeypots and firewalls.

Prerequisites: A general course in computer networking such as CS455/555 or EE407/507. Programming experience to the level of CS142 or EE361.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EE 511 **Wireless Sensor Networks**

This course will present state-of-the-art wireless sensor networks. Both hardware and operating system considerations based on the OSI protocol stack will be covered. Clustering and localization techniques will be presented along with security threats and solutions. Various wireless sensor network applications will be presented.

Prerequisites: EE408/CS455 Computer Networks or permission of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Semesters

EE 512 **Cloud Systems and Networks**

[Cross-listed with CS 667] This course is an introduction to cloud computing systems and cloud networks. The primary focus will be communication infrastructures and networking principles for cloud computing with an emphasis placed on network virtualization, mobile cloud computing and inter-data-center networks. Topics will include: a thorough presentation of cloud computing service models, namely Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a Service (SaaS); detailed investigation of cloud management issues with an emphasis on mobile cloud computing, cloud data center management and provisioning in cloud networks; security and privacy in the cloud; and sustainability of cloud systems from a communications perspective. Reading contemporary issues on cloud systems and networking will be an important part of this course. Several technical paper reading/presentation assignments and one term project will be given throughout the semester. Prerequisites: EE 507, Computer Networks (or permission of the instructor)

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EE 519 **High Performance Computing**

Principles and practices of high-performance computing (HPC) programming, associated computer architectures, and techniques for computing performance optimization. Topics include concepts of parallel and distributed computing, multicore CPU architecture, POSIX threads programming, OpenMP (Open Multi-Processing), GPGPU (General purpose GPU) architecture, NVIDIA CUDA programming, computer cluster management system, MPI (Message Passing Interface) programming, and case studies regarding large-scale engineering applications through HPC and computing performance improvement. Hands-on assignments utilizing Linux based open source tools and compilers will be assigned. Students must have basic C/C++ programming skills to enroll. Suitable for junior and senior undergraduate and graduate students in all engineering and computer science majors. Prerequisites: EE262 or CS142, or consent of instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EE 520 **Data Driven Analysis of Complex Systems**

The goal of this course will be an integration of concepts of complex systems with big data analysis. Methodology will be drawn from statistical and Bayesian analysis, time-frequency analysis, image processing, linear algebra and principal component analysis, machine learning and image recognition, dimensionality reduction for dynamical systems, system identification, data assimilation, compressed sensing, and equation free modeling. Applications may include PDEs such as advection diffusion from atmospheric data and also steady flow, networked and social data-sets, feature identification in neurological applications, music analysis and identification, and image denoising.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

EE 522 **Adv Signal Processing with Biomedical and Other App**

Statistical aspects of signal processing that includes such topics as: autocorrelation/crosscorrelation, autoregressive, moving average models, linear prediction, power spectral density, adaptive filters. Each student will utilize real data for an application from his/her research or data from a biomedical application can be provided. Each subject will be approached in three states: fundamental, advanced, and application. Class participation is critical through presentations which include: (1) journal papers for Advanced section, (2) results from their data for Application section, and (3) semester project results.

Prerequisites: Programming experience in C/C++ or Matlab, basic understanding of signal processing and probability. Prerequisites: EE529

Recommended: EE401 or EE501
Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Terms

EE 523 **Introduction to Biometrics**

Biometrics is the automated recognition of an individual based on their physiological or behavioral characteristics. This course is an introduction of fingerprint, face, voice, and iris recognition, as well as related aspects of system design, security, privacy, performance evaluation, and novel biometric modalities.

Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Spring Semesters

EE 526 **Detection and Estimation Theory**

Combines the classical techniques of statistical inference and the random process characterization of communication, radar, and other modern data processing systems. Prerequisites: EE529 or equivalent, or instructor approval

Restriction: Admission to the graduate Electrical Engineering program
Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Terms

EE 529 **Stochastic Processes in Engineering**

[Cross-listed as ME 529] Review of the theory of probability. Single and multiple random variables topics, such as distributions, moments, conditioning, central limit theorem, and Laws of Large Numbers. Stochastic processes. Stationary and nonstationary processes. Time averaging and ergodicity. Correlation and power spectrum. Langevin's equation and Markov processes. Poisson and Gaussian processes. Response of linear systems. Approximate methods for analysis of nonlinear stochastic equations Application to engineering problems,

such as random vibrations, turbulence, estimation theory, signal detection, and others.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EE 530 High-Voltage Techniques and Measurements

Generation of high-voltage AC, DC and impulse. High-voltage dielectric loss measurements. Discharge measurements. High-voltage insulation problems.

Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Semesters

EE 531 Power System Planning

Long-term planning will identify a financially viable and physically feasible mix of resources, including traditional generation and transmission sources as well as advanced techniques such as renewable generation, demand response, and the microgrid, to enhance the overall reliability of power systems. This course will introduce the students generation and transmission expansion planning of a vertically integrated utility and in a competitive market. Prerequisites: EE333

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EE 532 Advanced Electric Machines and Drives

Development of state models of conventional and electronically controlled electric machinery and drive systems. Use of linear transformations in the development of dynamic models of synchronous, induction, permanent magnet, and other rotating machinery, as well as electronically controlled drive systems. Study of the dynamic and transient characteristics of these machinery and drive systems by computer-aided methods. Study of the effects of electronic power conditioning and associated harmonics on the design of these machinery systems, including nonlinearities.

Prerequisite: EE 331 (Energy Conversion) or equivalent
Credits: (3), Graded, Semester Calendar
Lecture

EE 533 Operation and Control of Electric Power Systems

Course topics include: modeling of generators and transmission networks; security-constrained economic dispatch and security-constrained unit commitment formulations (linear programming and mixed-integer programming) and methodologies (dynamic programming, Lagrangian relaxation, and Benders decomposition); market clearing under different time scales; locational marginal price. Prerequisite: EE 333 or equivalent.

Credits: (3), Graded, Semester Calendar
Lecture

EE 535 Power System Reliability

Power system reliability will take a close look at modern electrical power systems from the generation/transmission/distribution capacity planning ("adequacy") point of view. The main topics will include the application of probability theory to power systems including generating capacity, loss of load expectation, expected energy not supplied, interruption frequency indices, interruption duration indices, and service availability indices. This course will cover the computational techniques for the above probabilistic metrics of power system reliability. Commercial reliability software will be

introduced into the class to help students get hands-on experiences on industry power system reliability studies.

Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Terms

EE 536 Advanced Topics in Energy Power Systems

This course is designed to discuss advanced topics in emerging power systems. In particular, this course will cover various issues related to the Microgrid. This course will discuss concepts, technical features, operational and management issues, economic viability and market participation in deregulated environment of Microgrid with the presence of significant distributed energy resources (DER).

Prerequisite: EE331.

Credits: (3), Graded, Semester Calendar
Lecture

EE 537 Power System Protection

Power system fault performance, protective system goals, fault sensing and protection algorithms. Applications to generator, transformer, bus transmission line, and distribution line protection. Distributed generation and the connection to the grid.

Prerequisite: EE333, or knowledge of symmetrical components and fault current calculations

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

EE 538 Alternate Energy Systems

The basic technology of emerging renewable or non-carbon based energy sources will be considered, and contrasted with traditional sources of energy. Topics will include photovoltaic, wind and others. The impacts of energy storage and electrified transportation will be discussed. The capability of these technologies will be assessed, and barriers to implementation will be explored. The role of the electric power grid in enabling alternate energy technologies will be covered.

Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Semesters

EE 539 Dielectrics

Dielectric properties of materials and polarization models. Complex permittivity and relaxation spectra. Electrical breakdown in gases, liquids and solids.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Semesters

EE 541 Electronic Devices for IC Simulation

Study of modern electronic devices, p-n junctions, bipolar junction transistors (BJTs) and metal-oxide-semiconductor field-effect transistors (MOSFETs), for integrated circuit applications. SPICE device models are introduced, and several SPICE simulation projects are given for integrated circuit design and analysis. This course provides a foundation for understanding SPICE device models and the basics of the microelectronic technology.

Prerequisites: ES260 and EE341, or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

EE 542 CMOS IC Design

An introduction to CMOS integrated circuit design and simulation. Students will learn CMOS device models and study design, simulation

and layout of digital CMOS integrated circuit blocks.

Prerequisites: EE264 and EE341, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

EE 544 Semiconductor Material and Devices for Engineers

[Cross-listed with EE443] Fundamentals of quantum mechanics, energy band concept in crystalline materials, band structure modeling, band structure modification, semiconductor device physics, carrier recombination processes, carrier transport phenomena, lattice vibrations, advanced concepts in quantum device technology.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

EE 550 Control Systems

Introduction to the analysis and design of continuous-time feedback control systems. Topics include: mathematical representation of physical systems with linear differential equations, Laplace transforms, transfer functions, block diagrams and signal flow graphs, feedback, sensitivity, transient specifications, steady-state tracking errors, stability, root locus plots, compensator design, simulation.

Prerequisite: EE321.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EE 551 Digital Control

Introduction to the analysis and design of discrete-time feedback control systems. Topics include: mathematical representation of physical systems with linear difference equations, z-transforms, transfer functions, sampling, A/D and D/A converters, sampled-data systems, discrete equivalent systems, transient specifications, steady-state tracking errors, stability, controller design, quantization effects. Significant independent investigation of advanced topics will be required.

Prerequisite: EE321.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

EE 552 Optimization Techniques in Engineering

Introduction to optimization techniques in engineering. Topics include: engineering applications of optimization, types of optimization problems, linear programming and the simplex method, one-dimensional optimization, unconstrained nonlinear programming, nonlinear programming with equality and inequality constraints, advanced optimization techniques, practical aspects of optimization. Prerequisites: MA339 or equivalent or consent of instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EE 554 Deregulated Power Systems

Deregulated Power Systems will take a close look at the restructuring of electric power systems and discuss the major differences between regulated and restructured power systems. The main topics will include the application of location based marginal prices for electricity market clearing and contractual transmission rights for transmission pricing to hedge the financial risks. Course will cover the mathematical formulation and optimization based computational techniques for above market clearing mechanisms. Commercial market clearing software will be introduced into the class to help

students get hands on experiences on industry electricity market study.

Prerequisite: Power Flow Analysis

Credits: (3), Graded, Semester Calendar

Lecture

EE 555 Robotics I

[Cross-Listed EE445] The course presents an introduction to the fundamentals of mobile robotic systems including common mechanical configurations with sensors and actuators, as well as the typical sensory, perceptual, and cognitive layers that comprise the field of study. Topics explored will include: Mobile Robot Locomotion (e.g., Legged, Wheeled, and Aerial), Mobile Robot Kinematics (e.g., Models and Constraints, Maneuverability, Workspace Analysis, and Motion Control), Mobile Robot Perception (e.g., Exploration of Sensors, Fundamentals of Computer Vision, Fundamentals of Image Processing, Feature Extraction, and Place Recognition), Mobile Robot Localization (e.g., Noise and Aliasing, Localization-Based Navigation, Map Representations, Probabilistic Map-Based Localization and Autonomous Map Building), and Planning and Navigation (Path Planning, Obstacle Avoidance, and Navigation Architectures). Throughout the course, students will work in teams with a supplied robotics kit of parts to design and implement a mobile robot system that demonstrates various aspects of the course applied to a real-world problem.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

EE 556 Robotics II

The course presents an introduction to the fundamentals of industrial robotics. Topics explored will include: Robotic manipulation, direct kinematics, inverse kinematics, workspace analysis and trajectory planning, differential motion and statics, manipulator dynamics, robot control, robot vision and task planning. Throughout the course, students will work in teams with a supplied robotics kit of parts and appropriate software tools to design and implement a robot manipulator that demonstrates various aspects of the course applied to a real-world problem.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

EE 559 Microgrid Design and Control

The focus of the course will be microgrid design with PV, Wind, and Energy Storage, and their control and integration into the power systems using power electronics devices. Various topics will be covered in this course to provide students with cutting-edge knowledge in microgrid applications, design, and control. In this course, students will have a chance to 1) learn power converters (DC/DC, DC/AC, and AC/DC) and utilize the converters to create an AC or DC Microgrid with PV, Wind, or Batteries, 2) learn how to control the power quality (voltage, frequency) in islanded and grid-connected modes, 3) learn how to regulate the power flow in islanded and grid-connected modes, and 4) learn about anti-islanding controls and low voltage ride through requirements.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

EE 561 Many-Core Architecture and Programming Model

This course will introduce students with the concepts of the state-of-the-art many-core processors. It intends to provide students with deep understandings of hardware architecture as well as the software

programming model of such processors. The advanced dynamic power management features will also be covered. The students will have the opportunity to gain hands-on experience through programming a real many-core processor.

Prerequisites: EE446 or equivalent or consent of instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

EE 562 Field Programmable Gate Arrays for Dig Signal Processing

This is an advanced project based graduate level course on embedded digital signal processing (DSP) system design using Field Programmable Gate Arrays (FPGAs). FPGAs provide a highly reliable and high performance alternative to the ubiquitous microprocessor based DSP platforms. This course introduces advanced DSP theory and algorithms and applications that can be implemented using MATLAB/Simulink blocks from leading FPGA vendors. The course will have a strong lab component. Students will use tools to design DSP systems using demo FPGA boards.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

EE 563 Advanced Software Engineering

Study of the principles and practices of software engineering. Topics include software quality concepts, process models, software requirements analysis, design methodologies, software testing, and software maintenance. Hands-on experience building a software system using the waterfall life cycle model and CASE tools. Students working in teams develop all life cycle deliverables: requirements document, specification and design documents, system codes, and user manuals. Students will learn theoretical concepts from research, such as APFD and PORT for test case prioritization, and apply these concepts to their project.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

EE 564 Enterprise Software Development

This course will examine the design, implementation, and deployment of distributed applications in the J2EE environment. Common J2EE architectures, models, technologies, and components will be discussed including RMI, SOAP, JDBC, servlets, JSP, MVC, EJB, and JMS. Students will be required to design and develop a multi-tier, enterprise application using the J2EE and a state-of-the-art J2EE application development tool.

Prerequisites: EE408, CS242 or equivalent.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

EE 565 Artificial Intelligence: Theory and Practice

[Cross-listed with CS 551] This course is an introduction to the computational study of intelligent systems. Topics include heuristic search, knowledge representation, automated reasoning, knowledge-based systems, reasoning under uncertainty, planning, and intelligent agents. Additional topics may be drawn from machine learning, neural networks, computer vision, and natural language understanding. AI programming techniques and methods will also be covered throughout the course.

Prerequisites: CS344 or equivalent or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

EE 566

Computer Architecture

A study of computer system design. Topics include system structure, instruction sets and addressing modes, software control structures, microprogramming, cache memory and different replacement policies, memory hierarchies, paging, vector processing, pipeline techniques, parallel architectures and interconnection networks. Independent investigation of advanced topics is required.

Prerequisite: EE264.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EE 567

Software System Architecture

A study of system software components in the context of a modern operating system such as UNIX, together with the necessary tools and utilities for software development. Topics will include software development tools, operating system interfaces and utilities, and network access methods. Emphasis will be placed on conceptual understanding and practical use of system software components rather than on detailed implementation. Independent investigation of advanced topics will be required.

Prerequisite: EE261 or equivalent programming experience in C.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Spring Semesters

EE 568

Database Systems

[Cross-listed with CS 560] An introduction to database systems. The entity-relationship and relational models are presented and applied to the design of typical databases. New developments in object-oriented and multimedia databases are presented. Emphasis will be placed on database design for applications in the context of an existing database management system such as ORACLE or ACCESS. Substantial independent investigation of advanced topics will be required.

Prerequisite: programming experience in a high level language.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

EE 570

Coding and Information Transmission

Error detecting and error correcting codes. Encoding of sources and data compression. Huffman codes. Concepts of entropy. Limits on attainable data compression. Limits on data rates for reliable or errorless transmission. Selected advanced topics from rate distortion theory, channel capacity theorem, and the asymptotic equipartition property.

Corequisite: MA/STAT381 or MA/STAT383 (MA/STAT381 is preferred.) Prerequisites: STAT383 or STAT381 or equivalent, or instructor approval

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

EE 572

Digital Communications

A graduate course covering the foundations of digital communications. Topics covered include EM propagation, multipath and antennas for wireless communications. Communication standards for 3G, WiFi and LTE. Advanced topics include channel capacity, digital modulation techniques, and error correcting codes for data communications. Prerequisites: EE321, and STAT383 or STAT381 or equivalent, or instructor approval

Credits: (3), Graded, Semester Calendar

Lecture, Odd Fall Terms

EE 574 Pattern Recognition and Neural Networks

Bayes decision theory, discriminant functions and decision surfaces. Supervised learning, parametric methods, Parzan windows, nearest neighbor classification, Fisher's linear discriminant. Unsupervised learning and clustering. Neural networks, single-layer perceptron convergence algorithm, gradient descent training, generalizations to multilayer feed-forward networks. Classifier complexity and sample size. Hopfield networks for autoassociative memory, unsupervised and self-organizing networks.

Prerequisite: MA/STAT381 or equivalent. Prerequisites: MA/STAT383, or MA/STAT381, or EE529 or equivalent

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Terms

EE 575 Empirical Methods in Software Engineering

The purpose of this course is to introduce students to the role of empiricism in software engineering research. Students will learn how to plan, conduct, assess, validate, and report on research by utilizing empirical methods. The course is geared toward students who are interested in, and are conducting research that requires empirical validation.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

EE 576 Secure Computer System Design

An advanced course on cybersecurity with focus on hardware security. Roles that computer hardware plays in cybersecurity which include: implementing cryptography primitives in hardware, security threats from hardware and their countermeasures, and enhancement of system security and trust by hardware.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Fall Terms

EE 579 Distributed Algorithms for Wireless Sensor Networks

This research-driven course involves the study of state-of-the-art distributed algorithms for wireless sensor networks. We will study algorithms for inference. We will also examine algorithms that are fully distributed, specifically, algorithms in the family of consensus methods. Prerequisites: EE529 or instructor approval. A graduate course in detection and estimation theory and a strong grounding in linear algebra is recommended.

Credits: (3), Graded, Semester Calendar

Research, Even Fall Terms

EE 582 Advanced Electromagnetics

Study of time-varying electromagnetic fields and applications. Fundamental electromagnetic theory will be covered in order to analyze the solutions of time-varying Maxwell's equations in problems involving wave propagation, radiation and guidance.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

EE 583 Modeling and Design of Electromagnetic Structures

This course will cover the theory, analytical and numerical modeling and design of various composite engineered structures that operate in different spectral ranges, including devices that operate in the optical region, others that operate in the IR, and others in microwave spectral range. Devices and structures that will be studied include: surface plasmonic structures, photonic crystals, metamaterials,

diffraction grating, antennas. The modeling tools HFSS and Lumerical FDTD will be covered.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

EE 584 Metamaterials

This course will teach the theory and application on metamaterials. The different types of metamaterials that are covered include materials that operate in the ultraviolet, visible, infrared and microwave spectral ranges. Acoustic metamaterials are also covered. Negative index of refraction, hyperbolic metamaterials, near-zero metamaterials, cloaking materials, and light trapping structures will be studied. Prerequisite: EE583 or permission of the instructor

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Terms

EE 585 Neural Engineering

This course applies engineering principles to the study of neuroscience and to the design of devices or techniques intended to replace missing or augment existing functions such as seeing, hearing, speaking, and walking. The course provides a detailed overview of sensorimotor systems, neurophysiology, neuroanatomy, neuropathology and clinical neurology. The class sequences through the various sensory and movement systems, providing a quantitative basis for how the nervous systems works for these systems, for how it dysfunctions, for the disability produced, and finally for how function can be restored by neuroprostheses. Students will prepare and present a paper on a neural engineering topic.

Prerequisites: MA132 and PH132 or PH142.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EE 586 Advanced Electromagnetics II

This course will cover the second half of Balanis's book Advanced Engineering Electromagnetics. The topics covered will be waveguides and cavities, transmission lines, scattering, integral equations and method of moments, the geometrical theory of diffraction, diffraction by wedges and Green's functions. Prerequisites: EE582 and PH580

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

EE 591 Blockchain Technology: Cryptocurrencies and Beyond

Blockchains, the basis of the foundational technology underpinning cryptocurrencies, offer many desirable features to end users such as anonymity, immutability, and direct, peer-to-peer transactions. There is immense interest in applying this technology to disrupt and reshape other areas such as cybersecurity, supply chains, health-care, finance & taxation, media, government & administration, and transportation. Goals of adopting this technology include minimizing fraud, providing decentralization, and maximizing efficiency, security, and transparency. This course will introduce blockchain design, including the blockchain data structure, distributed systems, consensus management, public key cryptography, hashing, transactions, smart contracts, proofs of work, and wallets. Based on this groundwork, the course will explore political, economic and social implications of blockchain technology in the context of course projects. Basic knowledge of computer programming is expected. Students from different disciplines are welcome to enroll and encouraged to work in teams to define & implement blockchain-based projects.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

EE 600 Disruptive Technology

[Cross-listed with ME 600] [Formerly EER 600] This course is designed to prepare the student to be able to efficiently evaluate potential disruptive technologies and their potential for application/commercialization. The course will cover such topics as the CO2 Mitigation, Solid state Energy Systems, Bio Energy and Fusion that have potential to impact the future. In order to cover this broad range of technical topics, the course will utilize multiple instructors that have technical depths as well as experience in the field.

Credits: (3), Graded, Quarter Calendar
Lecture

EE 601 Sustainability

[Cross listed as ME 601] [Formerly EER 601] The focus of this course is to build an understanding of what is meant by Sustainable Energy and to be able to analyze a range of different opportunities. The intent is to perform a value analysis on each opportunity in order to determine which are practical, on a variety of scales, while considering all aspects of the opportunity. Attention will be placed on efficiencies, scale, and impact of each opportunity as well as what limitations may exist.

Credits: (3), Graded, Quarter Calendar
Lecture

EE 602 Engineering Statistics

[Cross-listed with CS 506, ME 577] [Formerly EER 572] Modern engineering practice makes extensive use of statistical methods for the efficient collection and analysis of engineering data, and to support data-based decision making. This course will introduce the statistical tools that are of greatest importance for practicing engineers. Core topics to be covered will include probability and distribution theory, the construction and interpretation of statistical intervals, statistical hypothesis testing, regression analysis and empirical modeling, statistical experimental design, and statistical quality/process control. Additional specialized topics may also be covered, depending upon the interests of the class; possible topics include system reliability analysis, measurement system analysis, process capability analysis (and "six-sigma"), accelerated life testing, and acceptance sampling.

Credits: (3), Graded, Quarter Calendar
Lecture

EE 606 Motor Acoustics

[Cross-listed with ME 579] [Formerly EER 576] Development of the fundamental principles and equations for motor noise and vibration. Focus on development of analytical methods for predicting the acoustic performance of motors, along with an overview of numerical methods. Develop an understanding of the key principles and governing equations of motor acoustics. This covers noise generation by the motor, its structural dynamics response, and its sound radiation. Apply those equations to the analytical prediction of the noise sources and acoustic responses of motors. Understand the bounds of applicability of the analytical formulas, and the numerical methods which are available to predict the response of complex motors.

Credits: (3), Graded, Quarter Calendar
Lecture,

EE 610 ECE Seminar

Credits: (1-10), P/NC, Semester Calendar
Seminar

EE 613 Thesis, Dissertation Credits

Analytical or experimental studies in electrical and computer engineering under the direction of a faculty adviser. Credit for this work is given when the requirements for the degree are completed including the presentation of a thesis or dissertation as appropriate to the degree program.

Credits: (1-15), Thesis, Semester Calendar
Thesis Research, Every Semester

EE 616 Special Project Credits

Engineering project credits associated with a Masters of Engineering degree under the direction of a faculty advisor.

Credits: (1-7), Pass/Fail, Semester Calendar
Project Team, Every Semester

EE 622 Advanced Biometrics

This special topics graduate level course will focus on the field of biometrics. With increasing reliance on the cyber-domain, knowledge of the individual plays a vital role in trusted electronic transactions, whether they be social, professional or financial. The course will be driven by in-depth review and discussion of journal papers, as well as a semester long project. Students will explore a variety of topics within biometrics including various modalities (fingerprint, iris, face, voice, keystroke, ECG), multi-modal fusion, image processing, pattern recognition, quality assessment, vulnerabilities, social implications, and performance evaluation. Prerequisites: EE523 or equivalent

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EE 628 Adaptive Signal Processing

An introduction to adaptive signal processing. Topics include; Applications of adaptive systems, adaptive linear combiner, Wiener least-squares solution, gradient search, the LMS/RLS algorithms, block time/frequency domain LMS, system identification. Prerequisites: EE401/501 or equivalent, and EE529 or equivalent, or instructor approval.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Terms

EE 640 Fuel Cell Science and Hydrogen Engineering

[Cross-listed with ME 581] [Formerly EER 580] Introduce the student to the science and engineering of fuel cell technology. Emphasis will be on developing an understanding of different types of fuel cells, their applications, and the engineering of complete fuel cell systems. Elements of the class will include: electrochemistry; polymer materials science for proton exchange membrane (PEM) based systems; ceramics for solid oxide fuel cells; liquid-electrolytes for phosphoric acid and alkaline fuel cells; and other methods of generating power directly from a fuel and an oxidant. The system requirements of the fuel cell stack will be introduced to provide a complete picture of the technology. Other elements addressed during the course will include thermochemistry; electrochemistry; fuel processing or reforming; electrical & power management; polymer science and systems engineering. Developing an understanding of the proton exchange membrane fuel cell will be the primary objective. After completing this course, the student is expected to have an understanding of the technical needs, challenges, and opportunities of fuel cell systems. The overall essence of the class will be to address the essentials of fuel cells and fuel cell systems and related electrochemical systems. Elements of the entrepreneurial aspects of the industry will also be covered. Hydrogen will be discussed

throughout the semester as it relates to fuel cells and the emerging changes in power generation models.

Credits: (3), Graded, Quarter Calendar
Lecture

EE 642 Electronic Power Conversion

[Formerly EER 542] This course examines the application of power semiconductor devices to the efficient conversion of electrical energy. Circuit analysis, signal analysis, and energy concepts are integrated to develop steady-state and dynamic models of generic power converters. Specific topics include AC/DC conversion, DC/DC conversion, DC/AC conversion, and AC/AC conversion. These generic converters are applied as controlled rectifiers, switching power supplies, motor drives, HVDC transmission, induction heating, and others. Ancillary circuits needed for the proper operation and control of power semiconductor devices are also discussed. Prerequisites: Courses in circuit analysis, signals and systems.

Credits: (3), Graded, Quarter Calendar
Lecture

EE 643 Photovoltaic Engineering

[Cross-listed with ME 582] [Formerly EER 580A] The course focuses on the physical principles, technology, and design of efficient semiconductor photovoltaics. Course goals equip students with the concepts and analytical skills to understand efficiency limitations, to assess the viability of various solar and thermophotovoltaic technologies, and to introduce the physics required for understanding photovoltaic energy conversion. The course will focus on three primary aspects of photovoltaic energy conversion, (i) the transfer and conversion of solar (i.e. thermal) radiation to electronic energy, (ii) the theory and design of the semiconductor photovoltaic cell and (iii) photovoltaic systems and applications.

Credits: (3), Graded, Quarter Calendar
Lecture

EE 644 Solid State Electronics

[Formerly EER 574] Course reviews the physics and technology of semiconductor electronic devices and their dynamic behavior. Emphasis will be placed on semiconductor devices used in high-power and high frequency applications such as power electronic switching elements and microwave power amplifiers. Course emphasizes physical understanding of device operation and limitations through energy band diagrams, electron carrier statistics and transport, charge control equations, and equivalent circuit models. Derivation of electrical characteristics and dynamic limitations will be presented for (1) power diodes, (2) bipolar devices such as the power bipolar junction transistor and thyristors, (3) unipolar devices such as the microwave field effect devices and (4) new classes of controlled power electronic devices such as the insulated gate bipolar transistor. Issues such as reduction of parasitic electrical losses, high band-gap semiconductor material development, and thermal management will be discussed.

Credits: (3), Graded, Quarter Calendar
Lecture

EE 645 Superconductivity

[Cross-listed with ME 570] [Formerly EER 551] Superconductivity is a complex physical phenomenon still at the forefront of research. This course is designed to provide a fundamental working knowledge of this technology, the importance and integration of material properties and a broad understanding/appreciation of the

applications in the areas of power equipment and electronics. The course will also focus on active research and technological barriers for future applications.

Credits: (3), Graded, Quarter Calendar
Lecture

EE 652 Computer Vision

[Cross-listed with CS 652] This course will cover both classical and recent progress in the field of computer vision, both on the theory and practice. Material covered will be from both the textbook and relevant research papers in the area. After taking this course, students will achieve the necessary knowledge to solve various practical computer-vision problems and build a solid background for further computer-vision research. Topics covered include: Early vision on one and multiple images (linear filters, edge detection, stereopsis), mid-level vision (segmentation, object tracking), high-level vision (model-based vision, graph-based image segmentation) and applications (medical image analysis, image-based rendering). Prerequisites: CS344 and MA339 (or equivalent, with consent from the instructor)

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EE 653 Modeling and Control of Energy Conversion

[Formerly EER 542A] This course examines modeling and control techniques appropriate for application to power electronic and electric machine systems. The course will involve examination of the appropriate theory, followed by application through examples and small design projects. Simulation will be used to evaluate the merits of various techniques.

Credits: (3), Graded, Quarter Calendar
Lecture

EE 657 Linear Control Systems

[Cross-listed with ME 560] [Formerly EER 522] This course addresses practical control system design primarily from a classical perspective. Beginning with transfer function modeling of dynamic systems, the course moves through transient, root locus, and frequency response analysis to end with frequency domain techniques for controller design.

Credits: (3), Graded, Quarter Calendar
Lecture

EE 658 Digital Control Systems

[Formerly EER 528] The course begins with a brief review of continuous-time control methods before transitioning to the theory and implementation techniques for control of dynamic processes by digital computers. Topics covered include discrete system analysis, sampled data systems, quantization effects, state space representation of digital control systems, and the design of digital control algorithms.

Credits: (3), Graded, Quarter Calendar
Lecture

EE 667 Computer Algorithms

[Cross-listed with CS 547] This course will study and contrast a variety of computational algorithms and develop tools for algorithm analysis. Methods and topics such as dynamic programming, greedy algorithms, graph algorithms, circuits, parallel algorithms, matrix and polynomial algorithms, string matching, and geometrical algorithms

will be explored. The theory of NP-completeness and methods of managing NP-complete problems will also be covered.

Prerequisites: CS344, MA211 or MA346.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

EE 680 **Power System Analysis I**

[Formerly EER 560] Power and energy in AC circuits. Single-phase, three-phase and poly-phase circuits in balanced and unbalanced regimes. Measurement of three-phase power. Determination of three-phase sequence. Single-line diagrams. Per-unit method of representation and computations. Transformers and synchronous machines in power systems. Parameters of transmission lines.

Prerequisite: Electric Circuits or equivalent.

Credits: (3), Graded, Quarter Calendar, Lecture

EE 681 **Power System Analysis II**

[Formerly EER 561] Wave-propagation in transmission lines. Analysis of power networks, load-flow solutions and control. Three-phase faults and symmetrical components. Power system protection. Stability of power systems.

Prerequisites: Electric Circuits or equivalent.

Credits: (3), Graded, Quarter Calendar

Lecture

EE 682 **Electromechanical Energy Conversion**

[Formerly EER 542B] This course is designed to introduce the student to the inside of AC electric machinery. It begins with a review of computing inductance using the integral form of Maxwell's equations. Next, the energy method for computing the forces of electrical origin is introduced. These forces are then combined with circuit equations and the equations of mechanics to obtain dynamic models of electromechanical systems. The methodology developed is applied to simple electromechanical structures and then to various types of synchronous machines; induction machines are also considered. Consideration will be given to the electronic control of electric machines.

Prerequisite: A undergraduate course in electromagnetics.

Credits: (3), Graded, Quarter Calendar

Lecture

EE 683 **Turbine Engineering**

[Cross-listed as ME 583] [Formerly EER 580B] Course on fundamentals of design, analysis, and technology of turbo machinery – jet engines, gas turbines, steam turbines, water turbines, and wind turbines. The course will provide an understanding of all aspects of system development: thermodynamic cycles, design-point and off-design performance; function and design of components (inlets, compressors, combustors, turbines, outlets), operational limits, and environmental concerns; structural analysis, lifting, and materials; rotor dynamics and blade aeromechanics; clearance analysis, sealing, and packing; heat transfer, blade and component cooling; starting and control; power and thrust generation; testing and instrumentation. The student is expected to develop a broad understanding of the state-of-the-art, challenges, and future of turbine systems.

Credits: (3), Graded, Quarter Calendar

Lecture

EE 684 **Wind Energy Engineering**

[Cross-listed with ME 588] [Formerly EER 580D] The course focuses on 'Wind Farm Project Design and Development' and 'Wind Turbine Technology.' Part I: Teams will demonstrate understanding of complete wind farm design/development process inclusive of site selection, wind resource evaluating target land area, turbine choice, location, energy projection, cost, transmission. Part 2: Focuses on technical understanding of Wind Turbine attributes such as structural, blade system, Nacelle system, electrical system, performance, and future opportunities.

Credits: (3), Graded, Quarter Calendar

Lecture

EE 685 **Solar Energy Engineering**

[Cross-listed as ME 587] [Formerly EER 580E] This course is designed to enable the student to effectively grasp the complex and quickly changing solar industry. The course will cover such topics as the economy of solar, photovoltaic devices, systems and applications. In order to cover this broad range of technical topics, the course will utilize multiple instructors. Each instructor has significant expertise and depth in the given field and the student will be able to draw from their experience. Students completing this course will develop knowledge of the solar industry, looking at the past, present and future of this technology area. Students will gain key technical background in every aspect of the industry and will be able to assess new technologies as they are developed. Understanding of the economics of solar and its future will also be obtained.

Credits: (3), Graded, Quarter Calendar

Lecture

EE 686 **Synchronous Electrical Generators**

[Cross-listed with ME 589] [Formerly EER 580G] Course on fundamentals of design and analysis of power generators, such as those used in thermal power plants and wind turbines. The course will address the basic operating principles of the synchronous machine and consider configurations such as would field, permanent magnet, and doubly fed generators. Key topics will include understanding and analysis of the magnetics within the machine, losses and efficiency, thermal performance, mechanical behavior, operation on the power system, and key IEEE and IEC standards. Further topics will include the duty imposed on the machine during service as well as the duty it imposes on the turbine. The student is expected to develop a broad functional understanding of the current engineering technology, challenges, and future of generator technology.

Credits: (3), Graded, Quarter Calendar

Lecture

EE 687 **Nuclear Engineering**

[Cross-listed with ME 575] [Formerly EER 570] The purpose of this course is provide students of various engineering disciplines a functional knowledge of nuclear engineering principles and those most important to the design of nuclear power generation systems. The course will focus both on the nuclear reactor core as well as plant systems. The intent is that students will gain a physical understanding of nuclear engineering principles as they relate to their own field of interest. Class participation will be highly encouraged and focused through the discussion of current events in the nuclear industry as well as proposed future nuclear technologies.

Credits: (3), Graded, Quarter Calendar

Lecture

EE 690 Independent Study

[Formerly EER 590] Advanced graduate course in the field of engineering sciences. Topics of special interest will be selected for current needs. A description of the course content in any particular term will be announced in advance.

Credits: (3), Graded, Quarter Calendar
Independent Study, Given When Needed

EE 691 Special Topics in Electrical Engineering

[Formerly EER 581] Topics chosen from the current literature according to faculty and student interest. Possible topics include new developments in the major areas of electrical engineering such as electromagnetic fields, communications, controls, circuits, power, devices, electronics, and computer design. Topics may include but not be limited to image processing, machine vision, speech synthesis, integrated optics, antenna systems, adaptive filtering, variational methods, stochastic processes, optical communications, space and satellite communications, and computer networks. Each of these special topics courses has a variable content addressing specific current areas of interest to students.

Credits: (3), Graded, Quarter Calendar
Lecture, Given When Needed

EE 693 Directed Study in Electrical and Computer Engineering

Investigation of topics of current interest in selected areas of electrical and computer engineering.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

EE 694 Directed Study in Electrical & Computer Engineering

Investigation of topics of current interest in selected areas of electrical and computer engineering.

Credits: (1-3), Graded, Semester Calendar
Independent Study,

EE 699 Master of Science Graduate Project in Electrical Engineering

[Formerly EER 599] This non-credit seminar project provides a capstone experience for graduate electrical engineering candidates not completing a thesis or independent study. The candidate and faculty advisor agree on project scope and evaluation process. The candidate receives a pass/fail grade which appears on the official transcript.

Credits: (0), Pass/Fail, Quarter Calendar
Seminar

EE 739 Seminar in Nonlinear Processes

Seminar in Nonlinear Processes

Credits: (1-10), P/NC, Semester Calendar
Seminar, Given When Needed

EE 999 Special Topics in Electrical Engineering

Used for graduate transfer credit for which Clarkson does not have an equivalent EE course number.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Transfer Credit Only

English**EGL 523 American Short Story**

This interdisciplinary seminar on the evolution and development of American short fiction will focus on two centuries of American

writers' depiction of their culture, country, and people. We will examine key issues, texts, concepts, and themes of American literature between 1810 and 2010. The course will establish the forms, preoccupations, and approaches to subjects of key American writers. Many of the personalities, issues, and themes that arose recur throughout the two centuries, although the forms, patterns, and structures may change. Selecting the appropriate number and quality of materials is difficult for such a rich period of expression. There is no attempt to be complete or to engage with every major literary figure. Insofar as possible, however, the materials selected for the course are symbolic representations of larger thematic elements and individual literary approaches to the social, artistic, intellectual, literary, and cultural life of the country between 1810 and 2010. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)
Credits: (3), Graded, Semester Calendar
Lecture

EGL 524 Shakespeare After 1600

We will look at Shakespeare's great tragedies and romances with particular attention to the dramatic practices of his time. In this we will be helped by performances and workshops conducted on campus by the American Shakespeare Center, so be prepared to chew (or at least nibble on) the scenery as well as paying close textual attention to the artistry of the plays. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture

EGL 531 Reading Poetry

Students will examine a broad range of poems in order to examine the sources and characteristics of the unique powers of poetry and poets claimed throughout history. Students will learn to formulate theories of how poetry operates in ways peculiar to itself and to develop personal, aesthetic, and critical approaches to reading poetry effectively. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture

EGL 575 Interdis. Connections of History & Multicultural Literature

Framed around universal concepts of humanity (change, diversity, intolerance, ethics, creativity, freedom, and legacy), this course is designed to illustrate the interdisciplinary connections between secondary social studies and English language arts. Recognition that these key concepts span time and place, and are applicable to every period in history, will help to develop a broad understanding of the human experience, and the unity of humanity, through the study of history and multicultural literature. In addition to the historic and literature specific content of the course, other goals include development of empathy and a respect for diversity, as well as learning how to guide discussions that value different points of view. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EGL 580 **MAT Project in English (Content Area)**

The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom? Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture

EGL 585 **Nonfiction in the English Classroom**

The Common Core Standards for ELA mandate a shift in the English classroom towards the use of more nonfiction/informational texts. The precise nature of this mandate and its impact on the practices of English teachers continues to be a source of controversy and confusion. In this 3-credit course, we will come to terms with this controversy, and articulate a vision for using nonfiction texts in the English classroom. Additionally, we will explore reading and writing in the literary genres that comprise the category of nonfiction, including memoir, the essay, argumentative writing, and literary journalism. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture

EGL 594 **Reading American Theater**

Reading American Theater will focus on canonical pieces with themes related to and relevant to adolescents. A critical analysis of plays and the writing will be balanced with discussion and assignments on the use of theater as a vehicle for English Language Arts instruction. Common Core Standards as well as the New York State curriculum will be considered. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture

EGL 988 **Independent Study in English**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

EGL 989 **Independent Study in English**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

Environmental Health Science**EHS 505** **Methods and Analysis**

This course covers the same topics as IH405 and includes additional material on the graduate level.

Prerequisites: two years' college chemistry and major Industrial Hygiene, IH309.

Credits: (4), Graded, Semester Calendar
Lecture, Laboratory

EHS 506 **Industrial Hygiene Control Methods**

This course covers the same topics as IH 406 and includes additional material on the graduate level.

Prerequisites: IH309 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

EHS 518 **Principles of Toxicology and Epidemiology**

[Cross-listed with BY 518] This course covers the same topics as EHS 416 and includes additional material on the graduate level.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

EHS 581 **Adv Topics in Environmental and Occupational Health**

This course covers the same topics as IH481 and includes additional material on the graduate level.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

EHS 999 **Special Graduate Topics**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Transfer Credit Only

Engineering & Management**EM 610** **Operations Management and Factory Physics**

This course introduces the principles of manufacturing and service management while taking a cursory and scientific look at the processes and operations that impact an organization. The course exposes the student to a wide range of management terms and theories as they relate to strategic and tactical decision making. As such, it provides a basis on which to assess, evaluate, and recommend corrective management actions. In addition, focus is placed on developing an understanding of the relationship between operations and other business functions, such as marketing, finance, accounting, and human resources. Another aspect of the course is Factory Dynamics. This is the study of the factory interactions between people, equipment, raw materials and operations. It is the scientific study of how best to manage these complex interactions so the factory or operations as a whole will work effectively. Restriction: This course requires admission to the Engineering Management MS program.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EM 620 **Intro to Artificial Intelligence: Principles and Techniques**

This course will explore and discuss various theories, models, techniques and practical applications revolving around the topics of Artificial Intelligence and Machine Learning. In a rapidly changing and

increasingly global economy, AI or Artificial Intelligence has become the all-powerful and an omnipresent tool/solution and is being used in some form or fashion by every industry. Artificial Intelligence is the machines which are designed and programmed in such a manner that they think and act like humans. The greatest advantage of artificial intelligence is that machines do not require sleep or breaks and are able to function without stopping. They can continuously perform the same task without getting bored or tired. When employed to carry out dangerous tasks, the risk to human health and safety is reduced. AI systems have the ability to execute tasks naturally associated with human intelligence, like speech recognition, decision-making, visual perception, and translating languages. AI would have a low error rate compared to humans, if coded properly. They would have incredible precision, accuracy, and speed. They won't be affected by hostile environments, thus able to complete dangerous tasks, explore in space, and endure problems that would injure or kill us.

This course will specifically teach the basics of the following: "Big Data"; "Expert Systems"; "Neural Networks"; "Natural Language Processing"; "Machine Learning"; "Deep Learning"; "Computer Vision and VR/AR".

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EM 630 **Law for Engineers**

This course provides engineers the legal background and introductory knowledge they need to successfully navigate the many different areas of law they will encounter throughout their careers. Students will learn critical aspects of corporate law, tort (liability/accident) law, intellectual property (IP) law, and contract law during the course. They will also become familiar with, and learn to recognize, key areas of constitutional law, comparative/international law, environmental law, administrative law, and computer network/cyber law which often affect technical work on a daily basis. Restriction: This course requires admission to the Engineering Management MS program.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EM 640 **Leading and Managing Organizations**

Success in leading people and managing performance demands that you have an understanding of how work groups operate and what motivates employees, as well as a candid assessment of your own personality and style. The purpose of this course is to help you understand the general principles and processes of effective leadership so that you can lead in a wide variety of organizational situations. Leadership development is relevant for any student pursuing a managerial career, and is particularly relevant to students who already hold leadership positions in their organizations. Topics covered in the on-campus sessions will focus on aspects of interpersonal behavior, including personality, leadership, teamwork, and conflict management. During the online sessions we will take a more macro perspective, examining firm-level issues such as power and influence, culture, and organizational congruence.

Within these broad categories, we will examine specific theories and models that have been used to describe and predict behavior in organizations, as well as examples of successful and unsuccessful behavior in organizations. We will use readings from the business and academic press as our primary resources, and I expect each of you to bring additional examples to the classroom, either from personal experience or your reading of the business press.

The course will be conducted as a seminar. This means that each of you will contribute to class discussion on a regular basis. I expect you

to prepare thoroughly for each class - read the materials, identify and analyze the issues, and think about what you want to say. We will also be engaging in a number of experiential activities including a business simulation, case analyses, and in-class exercises. Restriction: This course requires admission to the Engineering Management MS program.

Credits: (3), Graded, Semester Calendar
Seminar, Given When Needed

EM 650 **Enterprise Sustainability**

There is a growing sense of urgency around climate change and resource scarcity, and a lack of trust in the ability of global economic and political systems to solve large-scale societal environmental and social problems. Increasingly, the general public expects business to proactively contribute to solving these societal problems, striving towards making a net positive environmental and social impact on the world. Sustainability managers need to know how to lead projects, and more importantly how to help bring about a cultural change within their organizations so that ultimately sustainability is fully integrated into every function. The goal of this course is to empower managers in any function (not just sustainability managers) to lead in sustainability.

This course will provide an introduction to corporate sustainability in manufacturing companies. We will explore some of the critical issues - such as climate change, water scarcity, and forced labor in the supply chain - that corporations need to address, and dig into concrete problems that may arise within a company and their potential solutions. The course will run through the basics of sustainability management, from stakeholder engagement to materiality assessment to reporting, and discuss investor interest in sustainability and environmental, social and governance (ESG) ratings and rankings. We will also look at supply chain issues, including traceability, human rights, and environmental and reputational risk. There will be short lectures, but the course will mainly engage students in developing the business case to address real-life sustainability issues and emerging trends. Restriction: This course requires admission to the Engineering Management MS program.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EM 660 **Cost Management and Financial Analysis**

The overall course objective is to increase the student's ability to deliver a project within cost expectations and to make decisions within the corporate financial perspective. This objective is met by understanding the technical underpinning of engineering economic and simulation based costing analysis, understanding how project decisions impact the organization's profit/financial health, and understanding the role of life cycle costing.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EM 670 **Optimization Methods (Decision Analysis)**

Students will learn to develop and apply mathematical models to improve management decision making. Optimization involves the automatic consideration of decision alternatives and their ramifications in terms of goals and constraints expressed mathematically. Accordingly, a major focus of the course will be the application of nonlinear, linear, network, and integer optimization methods. The course will also cover other decision technologies such as analysis, regression, and stochastic simulation. These decision making and analysis methods are applicable for solving problems

across a wide variety of industries: manufacturing, distribution, health care, finance, marketing, etc.

Credits: (3), Graded, Semester Calendar
Lecture

EM 680 **Decision Analysis and Risk Management**

A successful manager needs to be equipped with the techniques and tools of decision analysis in today's competitive business environment. The primary goal of this course is to develop the student's ability to define business problems, construct quantitative models and effectively utilize decision making tools (such as MS Excel Solver, Analytic Solver Platform, and decision trees). This course introduces decision modeling techniques by focusing on the development and analysis of models for a variety of business management problems. Topics include supply chain network design, transshipment and logistics management, capital budgeting and fixed charge problems, and decision making under uncertainty and risk.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EM 690 **Capstone Project**

Students complete a semester-long project which applies engineering management problem-solving skills to a real-world problem. Students demonstrate the application of engineering problem-solving methodology and project management. Students must demonstrate the ability to engage with a client, define a problem, derive specifications for a successful solution, generate and evaluate appropriate solutions, generate the optimal solution, successfully complete the process and present the result professionally in both oral and written format.

Credits: (3), Graded, Semester Calendar
Lecture

Engineering Science

ES 500 **Numerical and Engineering Computing with Maple**

Advanced Maple programming course. Topical coverage includes numerical methods for solving single, nonlinear equations, matrix computations, systems of nonlinear equations, ordinary differential equations, partial differential equations, differential algebraic equations, and much more. Nonstandard graphical imagery with Maple.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

ES 505 **Design of Experiments and Analysis of Data**

Modern techniques for the analysis of data and for the planning of experiments in research and in manufacturing. Includes use of software to design factorial and response surface method experiments, interpret the results, and fit data to equations.

Prerequisites: MA232 or MA239 or MA339

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

ES 522 **Signal Processing and Applications**

This project-driven course involves qualitative and quantitative descriptions of DSP algorithms, software, and applications. The class covers applications in engineering, computing, music, and the arts, with MATLAB, Java, and mobile simulations. Prerequisites: EE321 Signals and Systems, or equivalent, or instructor approval.

Credits: (3), Graded, Semester Calendar
Lecture

ES 530 **Environmental Sustainability and Risk Analysis**

[Cross-listed with ES 531] This course will consider the general principles and practices of human health and ecological risk assessment in industrial environments. Understanding the key elements of risk assessment, risk management and risk communication allow one to consider a systems approach to addressing complex environmental issues. Concepts of sustainability, life-cycle assessment and environmental management strategies will be examined in the context of an organization's long-term goals. Sustainability is a new approach to environmental management that employs systems thinking/analysis to solve multiple problems with integrated solutions. To set sustainability as a goal for our industrial society we must identify targets and metrics to measure our progress. Using case studies we will examine liabilities and risk management approaches in manufacturing and service organizations.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

ES 531 **Environmental Sustainability and Risk Analysis**

[Cross-listed with ES 530] This course will consider the general principles and practices of human health and ecological risk assessment in industrial environments. Understanding the key elements of risk assessment, risk management and risk communication allow one to consider a systems approach to addressing complex environmental issues. Concepts of sustainability, life-cycle assessment and environmental management strategies will be examined in the context of an organization's long-term goals. Sustainability is a new approach to environmental management that employs systems thinking/analysis to solve multiple problems with integrated solutions. To set sustainability as a goal for our industrial society we must identify targets and metrics to measure our progress. Using case studies we will examine liabilities and risk management approaches in manufacturing and service organizations.

Credits: (3), Graded, Quarter Calendar
Lecture, Spring Terms

ES 533 **Human Exposure Analysis**

Human exposure analysis is an emerging science concerned with how humans come into contact with chemicals in the environment via inhalation, ingestion, and dermal contact. Human exposure analysis examines individual and population exposure to pollutants, the levels of exposure, why exposures occur, and how to quantify exposure events. The course focuses on scientific and engineering issues, including direct measurement and model constructs. Students gain an understanding of the complexities, uncertainties, and physical, chemical and biological issues relevant to human exposures resulting from the use and release of toxic compounds. Topics include human exposure analysis terminology, pollutant fate and transport, human activity patterns, occupational exposure, indoor air quality, dosimetry, statistical tools, and assessment tools for inhalation, ingestion and dermal exposure. For the final project, the students design and perform a small-scale human exposure study using monitoring instruments and/or exposure models.

Prerequisites: Senior or graduate status in engineering or IH or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Semesters

ES 534 Air Pollution Control

Coverage includes the sources, history, and the effects of air pollution; regulatory trends; measurement techniques; and the engineering control of particulate and gaseous pollutants.

Prerequisite: undergraduate fluid mechanics.

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Semesters

ES 542 Fundamentals of Research and Graduate Study

Students learn basic research and technical communication skills, including literature reviews, technical writing (research proposals and papers), technical presentations, ethics, experimental methods and an introduction to research-related career paths. Each student prepares a portfolio of written materials and gives technical presentation(s). (Undergraduates should register for ES 442).

Credits: (1), Graded, Semester Calendar

Lecture, Fall Semesters

ES 552 Biomaterials and Biomedical Engineering Applications

This course will examine the biomaterials, biotransport phenomena, biomolecular engineering and tissue engineering aspects of biomedical engineering. Topics covered will include the interactions of biomolecules with synthetic materials tissue-biomaterial interactions, the tailoring of material chemistry toward rational design of biomaterials, application of the principles of transport phenomena to physiological systems, understanding the principles governing rates of drug transport in advanced drug delivery systems, the microarray technology, and biosensors.

Prerequisites: CH560 and ME527.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

ES 564 Corrosion of Metals

Mechanisms of environmental degradation of materials. Methods for eliminating or reducing environmental degradation. Prerequisite: CM132.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

ES 575 Sustainable Nanotechnology

[Cross-listed with CM 575, and MSE 575] The goal of this course is to provide graduate students and advanced undergraduates with a modern view of current and emerging research in nanotechnology. Topics will include: fundamental nanoscale properties and applications, green manufacturing and assembly in functional devices, interaction of nanomaterials with biological systems, the physical and chemical phenomena at nano-bio interfaces, fate, transport and transformation of engineered nanomaterials, environmental and health impact, nanometrology, nanotoxicology and hazard identification of nano-based products. Development of analytical methods and characterization tools for assessing nanoscale properties and materials will also be discussed. Students will be exposed to interdisciplinary topics and an integrated training bridging material and environmental sciences with biology and analytical chemistry. Students will be able to demonstrate a basic awareness of risks and benefits of emerging technologies and evaluate overall environmental and societal impact.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

ES 580 Foundations of Teaching College Engineering Courses

The course introduces students to the foundations of engineering education. It couples pedagogical theory and best practices with practical approaches to provide a basis for teaching college level engineering courses. Topics to be covered include: theories of student learning, educational research and best practices, design of courses, delivery of course material, and developing, delivering, and assessing college level engineering courses.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

ES 581 Selected Topics in Engineering Science

An advanced graduate course in the field of engineering sciences. Topics of special interest will be selected for current needs. A description of the course content in any particular term will be announced in advance.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

ES 587 Applications of Synchrotron and Electron Based Techniques

The purpose of the course is to familiarize all students with the x-ray and electron based experimental techniques available at Brookhaven National Lab and other similar facilities. Students will be cognizant of the applications of these cutting edge facilities, and well positioned to use them in their own research. This course is suitable for graduate students, postdocs, and advanced undergrads in physical sciences and engineering, as well as students in biological, environmental, and chemical sciences who may have the interest to learn more about the techniques they may use for their research.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

ES 601 Mechanics of Fracture I

A study of the fundamentals of fracture mechanics is presented. Linear elastic fracture mechanics (LEFM): elastic solutions, energy balance approach, LEFM testing. Elastic-plastic fracture mechanics (EPFM): EPFM testing. Concepts for crack growth: fatigue crack growth, dynamic crack growth and arrest. Mechanism and mechanics of fracture in metallic materials, polymers, ice, composites.

Prerequisites: ES222, CE/ME554, CE/ME551, or consent of instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

ES 610 Engineering Science Seminar

Students, staff and visiting lecturers present research results and topics of current interest.

Credits: (1-2), P/NC, Semester Calendar

Seminar, Every Semester

ES 612 Directed Study in Engineering Science

For graduate students with baccalaureate degree in an engineering field.

Credits: (1-4), Graded, Semester Calendar

Independent Study, Given When Needed

ES 615 Thesis, Dissertation Credits

Analytical or experimental studies in interdisciplinary engineering science under the direction of a faculty adviser. Credit for this work is given when the requirements for the degree are completed including

the presentation of a thesis or dissertation as appropriate to the degree program.

Credits: (1-15), Thesis, Semester Calendar
Thesis Research, Every Semester

ES 999 **Special Topics in Engineering Science**

Used for graduate transfer credit for which Clarkson does not have an equivalent course number.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Transfer Credit Only

Environmental Science & Policy

EV 510 **Where the Wild Things Are: Env**

[Cross-listed with PHIL 510] This course takes Henry David Thoreau's claim "In Wildness is the Preservation of the World" as the philosophical starting point of the American environmental movement and its attempts to conceptualize nature as a collection of ecosystems and as an ecosphere; along with the ontological, epistemological and ethical implications that result. Authors include Thoreau, Emerson, Muir, Leopold, Stan Rowe, Wes Jackson and Stuart Kauffman. Special emphasis will be given to applications to, and issues and challenges confronting, the Adirondack Park. Graduate students are required to perform additional assignments above those required by undergraduates. Prerequisites: Must have junior or senior standing.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

EV 532 **Risk Analysis**

Risk assessment entails the evaluation of the hazardous properties of substances, the extent of human exposure to them and the characterization of resulting risk. It is a systematic approach to organizing and analyzing the scientific knowledge regarding potentially hazardous activities or substances. Variability and uncertainty are used to estimate the level of confidence in the risk assessment. The general approach to risk assessment including the use of default assumptions and uncertainty analysis will be presented along with illustrative examples.

Prerequisites: graduate standing or senior with >B average.
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

EV 535 **Groundwater Hydrology and Geochemistry**

[Cross-listed with CE 535] This class provides fundamental understanding of the key physical and chemical processes impacting groundwater resources and quality. Emphasis is on groundwater geology, physical characteristics of flow, and geochemical properties of groundwater. Groundwater contamination and contaminant transport and modeling will be introduced. The course will prepare students to qualitatively and quantitatively analyze fluid and contaminant flow in varied geologic systems.

Credits: (3), Graded, Semester Calendar
Lecture, Odd Fall Terms

EV 536 **Global Climate Change: Science, Engineering & Policy**

The primary objective of the course is to provide the necessary background that will permit students to understand and accurately describe the workings of the Earth's climate system, the interactions between the atmosphere, ocean, and climate, and human's involvement in altering these processes. The course is broken into four components covering earth science, energy, policy, and database

access/programming. This highly quantitative course will use project-based experiences to allow each student an opportunity to complete a data acquisition/modeling project of their own design to show correlations between human activities, current atmospheric concentrations, and resulting ecosystem change. For example, the global spatial and temporal distributions of greenhouse gases, clouds, aerosols, radiation, etc. Students will use computational programming tools (Matlab, Excel) in combination with mapping tools (Google Maps, API) to quantify, analyze, and display geographical variations of integrated and averaged values of quantities studied. The project will have separate expectations for graduate and undergraduate students.

Prerequisites: quantitative and modeling skills (Matlab, Excel)
Credits: (3), Graded, Semester Calendar
Lecture, Odd Spring Semesters

EV 590 **Special Topics in Environmental Science and Engineering**

Advanced study of special topics in the area of environmental science and engineering.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

EV 591 **Special Topics in Environmental Politics and Governance**

Advanced study of special topics in the area of environmental politics and governance. With approval, students may take this class up to three times as long as the topical area is substantially different and the course is not repeated in the same semester.

Credits: (1-3), Graded, Semester Calendar
Lecture, Given When Needed

EV 610 **ISE Graduate Seminar**

Seminar course for ISE graduate students in the Environmental Science and Engineering and the Environmental Politics and Governance (EPG) programs.

Credits: (1), P/NC, Semester Calendar
Seminar, Every Semester

EV 612 **Thesis, Dissertation or Special Project**

Analytical or experimental studies in civil and environmental engineering under the direction of a faculty adviser. Credit for this work is given when the requirements for the degree are completed including the presentation of a thesis, dissertation, or project report as appropriate to the degree program.

Credits: (1-15), Thesis, Semester Calendar
Thesis Research, Every Semester

EV 999 **Special Graduate Topics**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Transfer Credit Only

Finance

FN 540 **Finance for Engineers**

The goal of this course is to develop a working understanding of finance issues important to engineering managers and to apply this understanding to develop the skills necessary for a career in a business organization. The course includes the concepts of engineering economy, including the time value of money and net

present value calculations, additional capital budgeting processes and techniques, the role of short-term finance in project management as well as international corporate finance. Prerequisites: Acceptance in the Engineering and Management MS program.

Credits: (2), Graded, Semester Calendar
Lecture

FN 575 Professional Fund Management I

Professional fund management involves two principal topic areas: Portfolio management and security analysis. Portfolio management involves establishing an investment strategy and constructing a portfolio of financial assets consistent with said strategy. Security analysis on the other hand involves the evaluation of individual financial securities. While we address both areas throughout the semester, the focus of this class is security analysis. The primary structure of this course is an application of fund management with a focus on a rotating investment style. Each semester, students will be directed to follow different investment styles such as, sector rotation, growth, or quantitative analysis. Furthermore the class will be responsible for managing a designated portion of the Clarkson University endowment. This student managed investment fund (SMIF) will be primarily invested in equity securities; security selection within the equity assets class will be made by the current class members.

Credits: (1-3), Graded, Semester Calendar
Lecture, Fall Semesters

FN 576 Professional Fund Management II

Professional fund management involves two principal topic areas: Portfolio management and security analysis. Portfolio management involves establishing an investment strategy and constructing a portfolio of financial assets consistent with said strategy. Security analysis on the other hand involves the evaluation of individual financial securities. While we address both areas throughout the semester, the focus of this class is security analysis. The primary structure of this course is an application of fund management with a focus on a rotating investment style. Each semester, students will be directed to follow different investment styles such as, sector rotation, growth, or quantitative analysis. Furthermore the class will be responsible for managing a designated portion of the Clarkson University endowment. This student managed investment fund (SMIF) will be primarily invested in equity securities; security selection within the equity assets class will be made by the current class members.

Credits: (1-3), Graded, Semester Calendar
Lecture, Spring Semesters

FN 607 Financial Management (MBA Module)

[Cross-listed with FN 608, FN 610] An application of the tools and models that produce better decisions for the firm in short and long term. Asset selection, risk management, inventory management, credit and capital acquisition, and overall value enhancement are covered. Emphasis is put on the quantitative tools, the practices of existing corporations, and the international environment. Restriction: Admission to the MBA program required

Credits: (2), Graded, Semester Calendar
Lecture/Discussion, Spring Semesters

FN 608 Financial Management

[Cross-listed with FN 607, FN 610] This course introduces students to the complexities of financial valuation and decision-making while

providing a comprehensive overview of the major issues in Corporate Finance. Specific topics will include: valuation of financial instruments, capital budgeting, an introduction to capital markets, the assessment and pricing of risk, capital structure issues, dividend policy, and working capital considerations. The course will integrate concepts from Accounting (Income Statement and Balance Sheet Analysis as well as pro forma statements), Decision Sciences (Excel, modeling and sensitivity analysis), and Economics (wealth maximization, demand estimation and forecasting).

Credits: (3), Graded, Semester Calendar
Lecture

FN 618 Mergers, Acquisitions, and Corporate Restructuring

[Formerly MBA 618] Restructuring is essential to the long-term survival and prosperity of any corporation due to the ever-changing business conditions and regulatory environment. In this course, we will investigate external restructuring, known as mergers and acquisitions (M&A's), as well as internal restructuring – shifting resources from mature declining business activities to existing or new business activities with more attractive growth potential. M&A's can be broadly defined to include restructuring through divestitures or sell-offs; various changes in corporate control and ownership, including going private and leverage buyouts; and rearrangements through recapitalization or bankruptcy. We will examine restructuring transactions and learn the economic motives for undertaking restructuring, such as enhancing competitive advantage, achieving strategic diversification, improving economies of scale and scope, reducing funding and transaction costs, and increasing market power.

Credits: (3), Graded, Quarter Calendar
Lecture, Spring Terms

FN 619 Investments

[Formerly MBA 619] This course provides an in-depth analysis of modern investment strategies and portfolio management techniques. Current theory, empirical evidence, and institutional practices are considered. Topics covered include portfolio theory and asset pricing models, market efficiency, fixed-income portfolio management and immunization, equity valuation models, the valuation of options and option strategies, and portfolio management and performance evaluation.

Credits: (3), Graded, Quarter Calendar
Lecture, Winter and Summer Quarters

FN 620 Investment Management

[Formerly MBA 620] The preliminary goal of this course is to provide students with an opportunity to gain valuable hands-on experience in fiduciary management of investment assets, such as security research, valuation of risky assets, asset allocation, and portfolio management. Investment is a field of business where intuition often plays a more important role than theoretical knowledge. In this course, we discuss the rapid development in investment theory that helps us identify the factors that are responsible for price movements. We focus on how to apply theory into practice. Students will work on challenging, integrated, analytical projects using real time capital market data. This course will increase the student's knowledge in industries such as equity research, investment banking, commercial banking, and corporate finance.

Credits: (3), Graded, Quarter Calendar
Lecture, Spring Terms

FN 629 Money, Markets, and Banking

[Formerly MBA 629] The course covers the nature and functions of money and finance in the economy. Commercial and central banking, monetary theory, and monetary policy are also considered.

Credits: (3), Graded, Quarter Calendar
Lecture, Winter and Summer Quarters

FN 661 International Finance

[Formerly MBA 661] An analysis is made of international financial markets and the special problems and opportunities associated with the financial management of multinational firms. The international monetary and banking system (including the World Bank and IMF), balance of payments, and economic relationships are also examined. Foreign exchange and interest rate risk management, arbitrage, international equity and debt financing activities, derivatives, multinational capital budgeting, political risk, international taxation and accounting issues are considered. Coursework involves an intensive team research project focused on a specific country and the international financial exposures of select global corporations.

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

FN 672 Investments

This course presents the investment decision-making process based on both theory and practice. In addition to the coverage of the standard investment securities and contracts, active investment based upon market inefficiency determination is examined. Related topics may include initial public offerings, risk arbitrage, and speculation with derivatives. Prerequisites: FN607 or equivalent.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

FN 680 Strategic Financial Management

This course examines in depth (1) financing courses for entrepreneurs and business developers, as well as (2) risk management methods. Besides the capital markets, the sources for operating and fixed asset financing for firms in development or with strategic alliances include venture capital, vendor and customer financing, bank and insurance company loans, and leasing. In addition to financing topics, commodity price risk management, as achieved with forward contracting, futures contracts, over-the-counter options and swaps, is examined as means to control price uncertainty. Prerequisites: FN607 or consent of the instructor

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

FN 687 Special Project in Finance

Individual study under the guidance of a staff member. Provides an opportunity for the student to investigate a specific problem area of finance, that is acceptable and under the guidance of the faculty member and chairperson.

Prerequisites: permission of the Department of Finance Chair and faculty member involved.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

French Language**FRN 515 Teaching French in American Schools**

Students will become familiar with American public high schools through reading, discussion, school visits and observations. Over the

course of the semester students will practice the following skills in both the target language and in English: improve their reading and writing skills with a focus on interpretation, analysis, and argumentation; improve grammar and language skills related to academic reading and writing; evaluate and critique written arguments, delineate and reason one's own argument on a variety of topics; interpret words and phrases in context; use textual evidence to make inferences, analyze actions, understand ideas, and draw conclusions.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

FRN 580 MAT Project in French (Content Area)

The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom? Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture

FRN 988 Independent Study in French

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

FRN 989 Independent Study in French

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

Geology**GEO 580 MAT Project in Earth Science (Content Area)**

The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom? Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture

GEO 988 **Independent Study in Earth Science**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

GEO 989 **Independent Study in Earth Science**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

German Language**GER 580** **MAT Project in German (Content Area)**

The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom? Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture

GER 988 **Independent Study in German**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

GER 989 **Independent Study in German**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needef

Health Management**HC 600** **Introduction to Health Systems**

[Formerly HCM 500] This course examines the determinants of health, illness, and medical care utilization, institutional arrangements and settings for the delivery of acute and chronic care, the doctor-patient relationship, resource allocation and financing,

and measuring and evaluating system performance.

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

HC 601 **Swiss Healthcare Study Tour**

[Formerly HCM 601] This Study tour will give Healthcare MBA students a better understanding of the healthcare delivery system in Switzerland. Students will have an opportunity to visit research hospitals, R&D centers, and pharmaceutical companies and learn firsthand about the unique characteristics of the system. We will also have seminars where experts in the field will discuss current issues in terms of healthcare delivery.

Credits: (3), Graded, Quarter Calendar
Lecture

HC 602 **Advanced Statistics and Data Visualization**

[Formerly MBA 606] This is an applied course on advanced statistical techniques that are commonly used in health care and business settings. The course will be based on case studies that incorporate typical challenges of a real-life application: Large data sets with mixed types of variables (e.g., qualitative and quantitative), missing data, lurking variables, correlated variables and uncontrolled variation. The course objective is to enable students to become effective users of advanced statistical techniques in support of business decision making. The topics covered will include logistic regression, multivariate analysis (principal components, clustering, discriminant analysis), partitioning analysis, and time series modeling. Students will learn to identify high impact application opportunities for each technique, plan and execute their own data-based investigations, apply the appropriate statistical modeling technique, and report their findings and recommendations. The role of effective data visualization as a key element in modern data analysis and presentation will be emphasized throughout the course. Prerequisites: IS647

Credits: (3), Graded, Quarter Calendar
Lecture, Winter Terms

HC 603 **Data Architecture**

[Formerly MBA 607] Database management systems are standard tools that enable the storage and retrieval of data within modern information systems. Database concepts are now an accepted part of most computer science courses. These introductory units tend to concentrate on the use of relational database systems. This advanced module, in contrast, deals with implementation aspects of relational systems and provides students with the knowledge of the current enhancements to relational database systems, distributed database systems (e.g. Hadoop) object oriented database and XML database systems. The course will also include an introduction into SQL to query relational databases. Prerequisites: HC468 or IS606

Credits: (3), Graded, Quarter Calendar
Lecture, Winter Terms

HC 604 **Hospital Analytics**

[Formerly HCM 604] An application of principles of analytics to hospital settings, problems, and strategic issues. Students will learn the array of alternative platforms hospitals use for collecting, storing, and distributing data within the hospital-health system setting, including data displays, analytical modules, and user interfaces. Students will also work with hospital data to answer clinical and strategic questions that senior leaders pose, and understand the promise and limitations of the data. Finally, students will be exposed

to issues related to data communication and sharing among internal constituencies including owned physician practices and subsidiaries, related parties (e.g., PHO's and voluntary physicians), and Health Information Exchanges through RHIO's. Prerequisites: HC602, HC603, and HC642

Credits: (3), Graded, Quarter Calendar
Lecture, Summer Terms

HC 605 **Health Operations**

[Formerly HCM 505] This course instructs the students in quantitative methods useful for analysis, improvement, and design of efficient and effective organizational processes within a health-care organization. Operations management (OM) is concerned with evaluating the performance of operating units, understanding why they perform as they do, designing new or improved operating procedures and systems for competitive advantage, making short-run and long-run decisions that affect operations, and managing the work force. Health systems OM is the analysis, design, planning, and control of all steps necessary to provide a service for a client. The course will involve readings from a selected text, review of published studies, exercises in internal and external benchmarking, and exploration of the tools and methods promoted at the national level.

Credits: (3), Graded, Quarter Calendar
Lecture, Winter and Spring Terms

HC 606 **Payer Analytics**

[Formerly HCM 606] Health insurers and healthcare providers share a common mission of improving health however their means to achieving their mission vary materially. This course will focus on the analytics health insurers utilize to facilitate affordable, quality healthcare. We will discuss and analyze the approaches health insurers take to discover and communicate meaningful patterns in data from historical information reporting to future predictive modeling. Upon completion of this course, the student will have been exposed to key payer analytic frameworks and tool sets used to drive success within a health insurer. Prerequisites: HC602, HC603, and HC642

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

HC 607 **Healthcare Operations Research**

[Formerly HCM 607] Health Care Operations Research examines several of the Operations Research models most widely used in the Health Care industry. The primary goal is to enable students to become productive consumers of Operations Research for the support of Health Care Management decision making. Students will learn to recognize opportunities for Operations Research analyses, perform basic analyses, report their findings in non-technical terms, and direct or interact with more complex analyses. Operations Research methodologies covered will include Linear Programming, Queuing Theory, Simulation, and Decision Analysis. Applications to staffing, scheduling, capacity planning, facility layout, facility location, and inventory management will be covered. Prerequisites: IS502

Credits: (3), Graded, Quarter Calendar
Lecture, Spring Terms

HC 609 **Healthcare CRM**

[Formerly HCM 609] This course provides a practical overview of how to design and implement modern digital customer relationship marketing. Topics to include: customer insight mining, social media and search analyses, segmentation, customer database design,

promotional media selection, campaign operations, sales force automation, digital engagement analytics, and ROI measurement. Textbook and other readings will be supplemented by a small-group case study project that students develop throughout the term. Prerequisites: (IS647 or HC647), and (HC648 or IS606)

Credits: (3), Graded, Quarter Calendar
Lecture, Summer Terms

HC 610 **Healthcare Accounting and Finance**

[Formerly HCM 510] The course covers use of financial statements and financial management in a regulated environment for taxable and tax exempt healthcare entities. Topics covered include: reading, interpreting and analyzing healthcare entity financial statements, time value analysis, valuing healthcare entities and assets, financial decision making and capital budgeting.

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

HC 617 **Healthcare Finance**

[Formerly HCM 617] This course covers financial management in a regulated healthcare environment. Topics include cost-finding and third-party reimbursement, contemporary issues in healthcare financing, sources of capital, capital budgeting, financial planning and analysis, cost accounting, and managed care issues. Prerequisites: AC604

Credits: (3), Graded, Quarter Calendar
Lecture, Winter and Spring Terms

HC 620 **Health Economics**

[Formerly HCM 620] This course is intended for students entering the health field and investigates economic approaches to problems and solutions. Students obtain an understanding of how economics contributes to public and private decision-making in healthcare, and learn to properly interpret economic research results and apply them to work performed by health planners and administrators. Prerequisites: HC600 and IS647

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

HC 626 **Health Systems Marketing**

[Formerly HCM 526] This course introduces students to the principles of marketing and their application to healthcare settings. At the end of this course, students should a.) Understand what marketing can do for the healthcare organization in terms of contribution to strategic planning, building business, strengthening relationships between the organization and its constituents, and achieving competitive advantage. b.) Clearly understand how to use health data in marketing planning and implementation. c.) Appreciate the challenges of evaluating the effectiveness of marketing communications investments made by healthcare organizations. d.) Understand the relationship between patient/customer satisfaction and service quality in health organizations. e.) Understand how to judge marketing communications quality, both qualitatively and quantitatively. f.) Demonstrate effective communications skills through in-class participation, writing assignments, and class presentations. g.) Analyze marketing problems and select effective strategies for solving them. h.) Understand key marketing concepts and their applications to business and healthcare organizations.

Credits: (3), Graded, Quarter Calendar
Lecture, Fall and Winter Terms

HC 630 **LIM Introduction to Health Systems**

[Formerly LIM 500] This course examines the determinants of health, illness, and medical care utilization, institutional arrangements and settings for the delivery of acute and chronic care, the doctor-patient relationship, resource allocation and financing, and measuring and evaluating system performance. Restriction: Open to LIM students only

Credits: (3), Graded, Quarter Calendar
Lecture,

HC 633 **LIM Healthcare Leadership**

[Formerly LIM 503] This course examines managerial roles and processes within health service organizations - organization design, managerial epidemiology, governance, total quality management, human resource management, labor relations and ethics. Restriction: Open to LIM Students only

Prerequisites: HC630
Credits: (3), Graded, Quarter Calendar, Lecture

HC 634 **LIM Health and Human Values**

[Formerly LIM 544] An intensive 8 day introduction to current topics in clinical ethics and bioethics, taught seminar style, with a clinical visit to Mount Sinai School of Medicine in New York City. This overview of current issues in bioethics humanities involves four special pro-seminars, case conferences and ethics rounds. There will also be training in the computer skills (demonstrations, workshops) essential to mastering distance learning. Restriction: Open to LIM students only

Credits: (3), Graded, Quarter Calendar
Seminar,

HC 635 **LIM Health Economics**

[Formerly LIM 553] This course is intended for LIM students entering the medical profession and investigates economic approaches to problems and solutions. Students obtain an understanding of how economics contributes to public and private decision-making in healthcare, and learn to properly interpret economic research results and apply them to work performed by Physicians, health planners and administrators. Restriction: Open to LIM students only

Credits: (3), Graded, Quarter Calendar
Lecture,

HC 637 **LIM Clinical Leadership Practicum**

[Formerly LIM 571] Students will work in the field with a preceptor in a clinical leadership role. Students may be placed in a variety of healthcare settings including: hospitals, physician offices, health maintenance organizations, etc. Classes meet every other week to discuss students' field experiences and selected readings. Restriction: Open to LIM students only

Credits: (3), Graded, Quarter Calendar
Practicum, Spring Terms

HC 642 **Data Analytics and Business Intelligence**

[Formerly HCM 642] This course provide an introduction to Data Analytics and examines a set of information systems, which specifically support managerial decision makers: Decision Support Systems, Group Decision Support Systems, Executive Information Systems, Data Warehouses, Expert Systems, and Neural Networks. The focus in this course is on data and text mining, using an appropriate software application for the organization, retrieval, and

modeling of large structured and unstructured data sets.
Prerequisites: HC602 and HC603
Credits: (3), Graded, Quarter Calendar
Lecture, Spring Terms

HC 643 **Advanced Applications in Data Analytics**

The objective of this course is to introduce students to advanced data analytics applications, using a set of structured and unstructured data (historical and real-time) from various business sectors. The course will build upon concepts and methodologies, which students have learned from previous classes in the data analytics program, but extend the scope and complexity by using a combination of analytic tools (e.g. R, SPSS, RapidMiner, Tableau, and SQL). While some of the 3 day course involves lecturing and hearing guest sessions, students will spend most of their time working in a team to analyze data and prepare presentations to visualize and communicate the insights obtained from the data. This course will be focused on key-concepts in data analytics and provide students with a better understanding of how to analyze and communicate 'big data' and will provide the students in the MS Healthcare Data Analytics program a "capstone" style experience. Prerequisites: HC602, HC603, HC642, HC647, HC648
Credits: (3), Graded, Quarter Calendar
Lecture, Given When Needed

HC 647 **Statistical Foundations of Data Analytics**

[Formerly HCM 647] [Cross Listed with IS647] This course covers fundamental methods in statistical analysis and data visualization as applied in healthcare. A holistic problem-solving approach is taken covering problem formulation, data acquisition and preparation, selection of appropriate statistical methods, and effective communication of analytic results. Topics covered include data visualization, data description methods, statistical inference, and model building. Examples are drawn from a variety of healthcare applications. Data visualization and analysis will be performed using statistical software.

Credits: (3), Graded, Quarter Calendar
Lecture,

HC 648 **Health Informatics**

This course will introduce students to the concepts and practices of health informatics. Topics include: a) an introduction to information systems and specifically to the health informatics field; b) major applications and commercial vendors; c) decision support methods and technologies; d) system analysis, design, implementation, and evaluation of healthcare information systems; and e) new opportunities and emerging trends.

Credits: (3), Graded, Quarter Calendar
Lecture, Winter and Summer Terms

HC 650 **Structural Dynamics in Healthcare**

Application of organization theory to healthcare organizations and systems for the purpose of improving performance. Topics include: organizational structure and design, coordination and control, power and politics, organizational culture, organizational ethics, organizational change. Prerequisites: HC600 and HC651

Credits: (3), Graded, Quarter Calendar
Lecture, Fall and Winter Terms

HC 651 **Health Systems Management**

[Formerly HCM 501] This course examines the various aspects of managing in the modern health care environment. A variety of

methods including lectures, case studies, in-class exercises, and student presentations will be used. Topics covered include quality improvement, ethical management, managing diversity, communications, leadership, motivation, team building, and conflict resolution. Prerequisites: HC600

Credits: (3), Graded, Quarter Calendar

Lecture, Fall and Winter Quarters

HC 656 **Group Practice Administration**

The objective of this course is to introduce students to the organization and management of private group practice through seminar and practical experience. It is intended that this course will prepare students for employment in private group practices and/or other ambulatory care organizations. Prerequisites: HC600 and HC651

Credits: (3), Graded, Quarter Calendar

Lecture, Winter and Summer Terms

HC 657 **Healthcare Leadership Proseminar**

[Formerly HCM 507] This Proseminar will provide students with an introduction to the role of management and leadership in healthcare. It includes a preliminary overview of the U.S. health system and changes occurring in the healthcare environment, as well as an introduction to ethical reasoning and ethics as they apply to the healthcare industry. Students will also learn communications concepts and skills required of leaders. The course will involve an intensive three-day on-campus residency, in which students will receive classroom lectures, participate in exercises, hear guest speakers from healthcare organizations, and complete projects as assigned. After completing the 3-day on-campus residency, students will continue the course independently and online, completing an assignment by the end of the Fall term. The Proseminar is designed to provide students with a framework with which they can interpret material to be covered in successive courses. In addition, they will have a unique opportunity to meet and network with healthcare leaders, faculty members, and student colleagues. The course will require some online work beyond the 3-day intensive on-campus residence to be completed during the subsequent term.

Credits: (3), Graded, Quarter Calendar

Lecture, Fall Terms

HC 674 **Legal Aspects of Healthcare**

[Formerly HCM 674] This course is designed to familiarize students with basic legal issues involved in managing healthcare systems. Antitrust, consent, labor law, malpractice, professional rights and other problems are explored using actual and hypothetical case studies.

Credits: (3), Graded, Quarter Calendar

Lecture, Spring and Summer Terms

HC 680 **Health Policy and Managerial Epidemiology**

[Formerly HCM 680] This course covers health public policy formulation and implementation and is designed to provide an understanding of the political and regulatory environment of healthcare organizations.

Prerequisites: HC 600 and HC 651. For students in the LIM program, HC 630, and HC 633. Prerequisites: HC 600 and HC 651. For students in the LIM program, HC 630, and HC 633.

Credits: (3), Graded, Quarter Calendar

Lecture, Spring Terms

HC 681 **Strategic Issues for Healthcare Org (Health Capstone)**

[Formerly HCM 681] This course is designed to integrate the concepts and skills associated with managerial problem-solving learned throughout the MBA in Healthcare Management program. Students analyze case studies addressing the strategic realignment of health service organizations in today's healthcare environment. A variety of expert practitioners present their views on this topic. Prerequisites: HC600, HC605, HC651, and HC657.

Credits: (3), Graded, Quarter Calendar

Lecture, Spring Terms

HC 683 **MBA Internship**

[Formerly HCM 683] An Internship for the MBA or Healthcare MBA program. Provides practical, hands-on experience that focuses on an area directly related to the student's field of study.

Credits: (0), Pass/Fail, Quarter Calendar

Independent Study, Given When Needed

HC 684 **LIM Strategic Issues in Healthcare (Capstone)**

[Formerly HCM 684] A capstone course designed to integrate the concepts and skills associated with healthcare research-based managerial problem solving learned throughout the LIM program in Healthcare Management. The objective of this course is to assist students with a level of professional maturity, confidence and strategic thinking to become a successful physician leader.

Restriction: Open to LIM students only

Credits: (3), Graded, Quarter Calendar

Lecture

HC 690 **Independent Study in Health Systems**

Students pursue programs of independent study in a particular area of healthcare management, under the supervision of a faculty member. Permission of the program directory is required to enroll.

Credits: (3), Graded, Quarter Calendar

Independent Study, Given When Needed

HC 691 **Independent Study in Health Systems**

Students pursue programs of independent study in a particular area of healthcare management, under the supervision of a faculty member. Permission of the program directory is required to enroll.

Credits: (3), Graded, Quarter Calendar

Independent Study, Given When Needed

HC 999 **Special Graduate Topics**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree.

Credits: (0-10), Graded, Quarter Calendar

Independent Study, Transfer Credit Only

History

HIST 585 **Advanced Topics**

An advanced topics seminar open to students with at least 12 credit hours in the discipline or permission from the instructor. Limited to 12 students. Topics to be covered will be selected to conform to the mutual interests and needs of students and faculty. Additional prerequisites may be required depending on the topic. Graduate students will be required to perform additional work.

Credits: (3), Graded, Semester Calendar

Lecture

HIST 588 Themes and Concepts in Chinese History

[Cross Listed with HIST288] This course is an examination of themes and concepts related to the study of Chinese history. Topics include early China during the Shang, the dynastic cycle, philosophies, the Silk Road, urbanization, gender and society, revolution and change. Students will utilize a variety of source and literature to examine these topics. Note: this course will be jointly offered at the undergraduate and graduate level. Graduate students will do additional work; the syllabus will specifically delineate the course requirement at each level. Undergraduate students with a History major cannot apply HIST288 toward their required Major Concentration in History.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

Educational History**HIST 520 World History, an Economic Perspective**

This 3-credit course is designed to provide an overview of world history with a particular emphasis on economic developments and turning points. Main topics will include human prehistory, the agricultural revolution, early civilizations in Asia, Africa, Europe, and the Americas, the contributions of ancient Greece, the emergence of world belief systems, the encounter of Europe and the Americas, the scientific, American, French, and industrial revolutions, colonialism and imperialism, the two world wars, and globalization. Supplementary readings will introduce and illustrate some basic economic concepts and connect them to the disparities of modern economic development. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

HIST 525 Survey of US History

This 3-credit course is designed to address United States history from two perspectives. The first is to examine the content requirements for United States history as it is taught in New York State schools by focusing on the topics in the scope and sequence provided by New York State. The second perspective examines pedagogical approaches and best practice when teaching U.S. History. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture

HIST 529 Survey of African History

This course will provide an overview of Africa's history while analyzing and synthesizing authentic documents and outside sources. The course will examine ways African history contributes to global history taught in high schools. Emphasis will be placed on how to effectively evaluate student's learning with the content area. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

HIST 574 History of Social and Political Movements in Latin America

This 3-credit course examines the history of recent social movements in Latin America. We will explore a variety of issues including democracy, economics, racism, class structure, gender, ethnicity, human rights, globalization, and popular movements. Rather than

analyzing Latin America from a North American point of view, we will examine how Latin Americans view themselves and how their culture, economics, and politics have developed in different directions than other parts of the world, especially the United States and Europe. While social movements have at times erupted into full-fledged revolutionary upheavals, more often Latin American struggles have been ongoing, such as factory occupations, land seizures, and demonstrations for gender equality, workers' rights, indigenous autonomy, protection of the environment, and students' rights. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)
Credits: (3), Graded, Semester Calendar
Lecture

HIST 575 Interdis. Connections of History & Multicultural Literature

Framed around universal concepts of humanity (change, diversity, intolerance, ethics, creativity, freedom, and legacy), this course is designed to illustrate the interdisciplinary connections between secondary social studies and English language arts. Recognition that these key concepts span time and place, and are applicable to every period in history, will help to develop a broad understanding of the human experience, and the unity of humanity, through the study of history and multicultural literature. In addition to the historic and literature specific content of the course, other goals include development of empathy and a respect for diversity, as well as learning how to guide discussions that value different points of view. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

HIST 580 MAT Project in History (Content Area)

The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom? Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)
Credits: (3), Graded, Semester Calendar
Lecture

HIST 587 Reel History

Reel History is an examination of themes and concepts related to the study of history. A range of historical topics across the New York state 12 social studies curriculum will be examined. Students will view and research films to analyze and evaluate the historical accuracy portrayed in film. Emphasis will be placed on determining the degree to which film can be used as a source for understanding history. Student research, presentations, and the development of curricular materials related to the use of film as a documentary evidence will be the basis of course assessments. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

HST 588 **Themes and Concepts in Chinese History**

Chinese History is a 3-credit course that examines themes and concepts related to the study of Chinese history. Topics include early China during the Shang, the dynastic cycle, philosophies, the Silk Road, spread of Buddhism, gender and society, revolution & change. Students will utilize primary source documents and literature to examine these topics and develop resources and strategies for teaching Chinese history in a secondary classroom. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

HST 988 **Independent Study in History**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Independent Study, Given When Needed

HST 989 **Independent Study in History**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Independent Study, Given When Needed

Interdisciplinary Analytics**IA 501** **Calculus**

This course serves as a prerequisite course for MS Data Analytics students who do not have calculus background. Functions and graphs; derivative concept and formulas, including chain rule and implicit differentiation; integral concept; the Fundamental Theorem of Calculus; properties and applications of the derivative, including max-min problems and graph sketching; exponential, logarithmic, and inverse trigonometric functions.

Credits: (2), P/NC, Semester Calendar

Lecture, Given When Needed

IA 502 **Probability and Statistics**

Prerequisite course for MS Data Analytics students who do not have calculus-based statistics and probability background. A calculus based introduction to topics in probability and statistics. Probability content includes events and sample spaces, the basic axioms of probability, discrete and continuous random variables (definitions and basic characterizations such as the means and variances) including binomial, Poisson, normal, exponential, student-t, and uniform distributions. Topics in statistics include the central limit theorem, statistical inference including confidence intervals and hypothesis testing for one and two sample data, and linear regression. Students will use statistical software to read data and interpret software generated output.

Credits: (2), P/NC, Semester Calendar

Lecture, Given When Needed

IA 503 **Introduction to Programming**

Prerequisite course for MS Data Analytics students who do not have programming background. This course introduces students to programming fundamentals and standard components, features and practices. Main programming concepts are introduced in an applied context. Practical emphasis is on sound programming practices and development methods.

Credits: (2), P/NC, Semester Calendar

Lecture, Given When Needed

IA 505 **Applied Data Analytics**

Proper utilization of modern methods and tools for analyzing data in tabular form is a critical component of effective and timely creating and use of organizational intelligence in variety of fields of human endeavor: management in variety of organizational settings, social science, health care, engineering etc. This course focuses on critical skills and tools for using the spreadsheet software packages for the purpose of conducting a variety of analytics tasks and operations to improve gathering, generation and presentation of organizational intelligence. Focus is on proper data gathering and preparation, followed by the use of key analysis, grouping and summation tools as well as data presentation and visualization by creating spreadsheet based dashboards, charts and scorecards using advanced tools and methods.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

IA 507 **Spreadsheet Analytics**

The main purpose of this course is to enable students to acquire understanding and applicable knowledge of conducting exploratory analysis across different disciplinary fields using modern spreadsheet based tools and techniques. This course focuses on critical skills and tools for using the spreadsheet software packages for the purpose of conducting a variety of analytics tasks and operations to improve gathering, generation and presentation of organizational intelligence.

Credits: (1), Graded, Semester Calendar

Lecture, Spring Terms

IA 510 **Database Modeling, Design & Implementation**

This course is focused on key concepts of database modeling, design, and management, utilizing a variety of relational database management systems. Students will acquire understanding of proper data modeling approaches, grounded in underlying rationale for creating well-designed and efficient data repositories. They will be introduced to the variety of modeling and implementation approaches, and will gain understanding of unique advantages leading to the prevalence of the relational database model in today's systems. Students will learn to properly utilize basic methods and techniques for conceptually envisioning as well as designing databases which include Entity-Relationship (ER) modeling, relational modeling, normalization, and Structured Query Language (SQL).

Credits: (3), Graded, Semester Calendar

Lecture, Winter Terms

IA 520 **Optimization Methods for Analytics**

Optimization is a structured approach to determining the best values for a set of decision possibilities given constraints and an objective expressed as a function of these decision variables. This course focuses on the design, development, and analysis of optimization models while using canned software to solve them. The students will solve a wide variety of optimization problems applicable to a wide

variety of industries: manufacturing, distribution, health care, finance, marketing, etc. Students will develop optimization models using Microsoft Excel.

Prerequisites: An undergraduate course in probability and statistics, and an undergraduate course in introductory computer science or programming.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

IA 530 Probability & Statistics for Analytics

Probability theory is presented as a mathematical foundation for statistical inference. Axiomatic probability is introduced; standard discrete and continuous probability distributions are presented. Joint distributions and transformations are discussed. Probabilistic convergence concepts are introduced. The key objectives of this course are to formulate statistical models and find optimal solutions for statistical problems in economics, business, engineering, and science, have a global overview of the interplay between probability and statistics as well as master the art of writing statistical proofs well, consistent with the written tradition of the discipline, and have the skills to communicate statistical ideas effectively.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

IA 605 Data Warehousing

This course examines how data warehouses are used to successfully gather, structure, analyze, understand, and act on information. The components and design issues related to data warehouses and business intelligence techniques for extracting meaningful information from data warehouses are emphasized. The emphasis is on proper modeling techniques as well as the techniques for Extraction, Transformation and Loading (ETL) process. Various software tools will be used to demonstrate design, implementation, and utilization of data warehouses.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

IA 626 Big Data Processing and Cloud Services

This course will enable students to gain understanding of critical components and the processes of Big Data architecture. The course will take a hands on approach, enabling students to develop critical skills by creating data processing pipelines and procedures to transform and integrate structured, semi-structured and unstructured data. The course will provide students with understanding of web service based systems architecture and best practices for deployment of scalable applications for data analytics.

This class will also teach students practical fundamentals of Cloud Computing and how it relates to Big Data. The class will cover both Apache Hadoop implementation as well as usage of leading industry solutions such as Elastic MapReduce. Throughout the class students will be taught how to recognize opportunities in big data analytics and how to match those opportunities with the most appropriate big data software. Students will learn the various data formats and be taught when to utilize each one. The course will take an applied approach but also relate this application to general design theories of abstraction and architecture. Prerequisites: IA 503, or IS 237, or CS 141, or equivalent

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

IA 628 Introduction to Big Data Architecture and Applications

The objective for this course is to provide an in-depth discussion of the big data architecture and its applications. The following topics will be covered: big data architecture from a data pipeline perspective; distributed file systems; massively scalable processing of big data, using the map and reduce model; access to big data via SQL-like interface; running search engines over big data; scripting over big data; and real-time access to big data. The course will be taught using the Hadoop ecosystem as a reference platform. The course will use a projects-driven approach where students will have ample opportunities to practice essential skills needed by a big data analyst, from cluster planning, through the development of data analytics, to the designing and building of big data applications. Prerequisites: IA 503, IA 510, and IA 626 (or equivalent)

Credits: (3), Graded, Semester Calendar

Lecture, Summer Terms

IA 630 Modeling for Insight

Although mathematical models have a long and compelling history of application in science and engineering, they are becoming increasingly important in the world of business. Some problems are well described by statistical (curve fitting models), but analyzing a business problem generates significant complexities that are often not well described by simply analyzing the historical data. In particular, to be able to answer questions of 'what if...?' often requires an understanding of system behaviors when we specifically to depart from previous (historical) practices. The critical contribution of these models is that they may allow the analyst to arrive at compelling insights to contribute to development of a reasoned action plan. This class will enable students to develop familiarity and facility in generating insightful models via modeling in realistic situations. Key skills to be developed include recognizing the key problem, developing a model structure for an unstructured problem, and intelligent analysis and interpretation of model results. Additionally, students will gain experience in the iterative process that is required to develop useful models for unstructured problems. This course will make extensive use of Excel for building and analysis of models and will leverage skills developed in prerequisite courses in spreadsheet modeling. Students will be expected to use Excel and Risk Solver Platform. This course will be delivered primarily in the style of a studio with minimal theory, but with repeated practical exercises. Each exercise will require a written report, and every second exercise will require a presentation. Prerequisites: IA 505, IA 510, IA 520, and IA 530 (or equivalents)

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

IA 640 Information Visualization

The science of Information Visualization (InfoVis) seeks to understand the best way to achieve synergistic interaction of the human visual perception system and data. Data visualizations focus on two general application areas: (1) Enhancing the ability of the visual system to discover structure in the data leading to new insight and knowledge, and (2) Taking advantage of the visual display to support rapid diffusion of complex information throughout the organization achievable by the visualization applications. This class will study the techniques, systems, software, algorithms, and design principles that allow for maximal information transmission and knowledge discovery when working with complex data sets. Students will learn the key principles involved in information visualization through a project

driven course, with students gaining background skills in design and application of innovative visualizations.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

IA 650 **Data Mining**

Recent advances in information technology, together with the growth of the Internet have resulted in an explosion of data collected, stored, and disseminated. Because of its massive size, it is difficult for analysts to sift through the data even though it may contain useful information. Data mining holds great promise to address this problem by providing efficient techniques to uncover useful information hidden in large data repositories. Awareness of the importance of data mining is becoming widespread. Industry is creating more job opportunities for people who have interdisciplinary data analytic skills. They key objectives of this course are to teach the fundamental concepts of data mining and provide extensive hands-on experience in apply the concepts to real-world applications.

Students will have opportunities to learn both domain and technical knowledge to face the big data challenges in industry. The core topics to be covered include classification, clustering, association analysis, and anomaly/novelty detection. This course consists of about 13 weeks of lecture, followed by 2 weeks of project presentations by students who will be responsible for developing and/or apply data mining techniques to applications such as intrusion detection, Web usage analysis, financial data analysis, text mining, bioinformatics, systems management, Earth Science, and other scientific and engineering areas. At the end of this course, students are expected to possess the fundamental skills needed to conduct their own research in data mining or to apply data mining techniques to their own research fields. Prerequisite: IA 530 or equivalent

Credits: (3), Graded, Semester Calendar

Lecture, Summer Terms

IA 651 **Applied Machine Learning**

The objective of this course is to provide in-depth coverage of major supervised machine learning algorithms from an applied perspective, using a case studies approach. The following topics will be covered: machine learning paradigms; process and measurement of supervised learning; support vector machines; neural networks; other selected machine learning algorithms; feature engineering; case studies selected from different domains, such as text and natural language processing, electrical engineering, business, and vision and image processing. The course will be taught using an industry accepted language, such as Python or R, and associated machine learning packages. The course will use a projects-driven approach where students will have ample opportunities to practice essential skills needed by a machine learning practitioner, from the preparation and planning of data for training and testing, through feature selection, to the deployment of machine learning based applications. Prerequisite: IA 530

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

IA 690 **Analytics Capstone Project**

This course is based on a semester-long sponsored project that utilizes a variety of expertise areas, methods, and skills in data analytics. Students participating in this course will be divided into inter-disciplinary teams charged with planning, designing, and implementing an analytics solution for the organization that sponsors the project. In addition to the continuous interaction with the

sponsoring organization representatives, students will be required to report and consult with the faculty project supervisor on a regular basis. Depending on the nature of the capstone and its sponsorship, projects could be on-site fieldwork intensive. Final deliverables include written reports and oral presentations.

Credits: (6), Graded, Semester Calendar

Independent Study, Summer Terms

Information Systems

IS 501 **Mathematics of Management**

[Formerly MBA 1] This course focuses on mathematics useful in modeling management processes. Fundamental concepts of differential and integral calculus and their applications to management are addressed.

Credits: (0), Pass/Fail, Quarter Calendar

Lecture, Given When Needed

IS 502 **Introduction to Probability**

[Formerly MBA 2] This course covers marginal, joint and conditional probability; random variables, expected value and variance; selected probability distributions and their uses in management; and sampling distributions and the Central Limit Theorem.

Credits: (0), Pass/Fail, Quarter Calendar

Lecture, Given When Needed

IS 605 **Information Systems (MBA Module)**

[Cross-listed with IS 606] In this course the role of information systems and information technology in managing modern information age enterprises is explored. The focus of the course is on (a) establishing the basic knowledge of information systems (b) strategic significance of information systems to various businesses and industries (c) role of information systems as a strategic weapon to compete in the global marketplace and (d) role of information systems in transforming modern business organizations. Advanced topics of enterprise resources planning and emergent visions and practices such as electronic commerce, web-based information systems, and corporate intranets and extranets are reviewed in a framework of strategic information planning. Real life cases of information systems are analyzed and discussed to reinforce the understanding of concepts introduced in the course.

Prerequisites: completion of all CUSB MBA foundation requirements admission to the MBA program.

Credits: (2), Graded, Semester Calendar

Lecture, Fall Semesters

IS 606 **Business Information Systems**

[Cross-listed with IS 605] This course explores the role of information technology and systems (IT/IS) in today's organizations. The focus of this course is on the fundamentals of information systems and investigating the strategic importance of information systems to various businesses and industries as well as the role of information systems in transforming modern business organizations. Topics will include: Planning an IT application portfolio, system implementation, IT driven process redesign, IT governance and IT/IS as a source of competitive advantage. We will examine specific information technologies and applications such as: enterprise systems, cloud computing, social media, and business intelligence. The structure of the course will include readings, group work / discussions and case studies highlighting the IT/IS related issues faced by organizations.

Credits: (3), Graded, Quarter Calendar

Lecture, Winter Terms

IS 647 Statistical Methods for Data Analytics

[Formerly MBA 506] [Cross Listed with HC647] This course covers the analytic process that supports data-driven decision-making in business. Emphasis is placed on problem formulation, data acquisition, selection of appropriate statistical approaches, and effective communication of analytic results. Topics covered include data visualization, data description methods, statistical inference, and model building. Examples are drawn from quality management, finance, operations, supply chain management, marketing and healthcare. Data visualization and analysis will be performed using statistical software.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

IS 686 Independent Project in Information Systems

Practical application of information systems concepts in an independent research or development project conducted under the guidance of a Clarkson School of Business faculty member.

Credits: (1-3), Graded, Quarter Calendar
Independent Study, Given When Needed

IS 687 Independent Project in Information Systems

Practical application of information systems concepts in an independent research or development project conducted under the guidance of a CUSB faculty member.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

Information Technology**IT 501 Software Systems**

This course is an introduction to software design and implementation. After a review of basic programming concepts, students will be introduced to procedural and data abstraction, object-oriented design, recursion and dynamic data structures. Abstract data types such as lists, stacks, queues, and trees will be studied. Algorithms for searching and sorting will be explored along with methods for comparative analysis. Programming concepts will be demonstrated in a language like C++. The course will also include an introduction to the Unix operating system.

Prerequisite: programming experience.
Credits: (3), Graded, Semester Calendar
Lecture, Every Term

IT 502 Computing and Telecommunications Systems

A study of the concepts of computer system design and organization needed for effective information system implementation and management. Topics in computer hardware design, processor design, computer peripherals and interfacing techniques, networking components, and survey of commercially available computers. Also included are the basic concepts of telecommunications including data communication protocols and related topics.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

IT 520 Information Technology Independent Project

Independent project under the direction of a Clarkson professor.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Every Term

IT 521 Information Technology Independent Project

Independent project under the direction of a Clarkson professor.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Given When Needed

IT 522 Information Technology Independent Project

Independent project under the direction of a Clarkson professor.

Credits: (1-4), Graded, Semester Calendar
Independent Study, Given When Needed

IT 523 Information Technology Independent Project

Independent project under the direction of a Clarkson professor.

Credits: (1-4), Graded, Semester Calendar
Independent Study, Given When Needed

IT 620 Information Technology Project

Independent project work in IT under the supervision of a Clarkson professor.

Credits: (1-9), Graded, Semester Calendar
Independent Study, Every Term

IT 621 Information Technology Project

Independent project work in IT under the supervision of a Clarkson professor.

Credits: (1-9), Graded, Semester Calendar
Independent Study, Spring Terms

IT 699 IT Project Consultant

For students who have filled all unit requirements for the IT MS degree, but are staying to oversee an ongoing project.

Credits: (1), Graded, Semester Calendar
Independent Study, Given When Needed

IT 999 Special Graduate Topics

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree.

Credits: (1-10), Graded, Semester Calendar
Independent Study, Transfer Credit Only

Latin Language**LAT 538 Lyrics & Elegiac Poetry**

Extensive readings from poems of Catullus, Horace, Propertius, Tibullus, and Ovid. May be repeated with change in author.

Requisites: Two years of high school Latin or Latin 1. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture, Fall Terms

LAT 543 Latin Drama

This course includes readings in Plautus and Terence along with selections from Seneca. Additional readings may be repeated with change in author or texts. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture, Summer Terms

LAT 580 **MAT Project in Latin (Content Area)**

The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom? Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture

LAT 988 **Independent Study in Latin**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

LAT 989 **Independent Study in Latin**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

Law**LW 620** **Environmental Law and Policy**

This course considers the principal legal approaches used to deal with environmental problems, including, common-law, statutory, regulatory, and economic-incentive systems. This course addresses procedural and substantive issues of law and regulation affecting environmental and natural resources. Further, the course will review and consider the policy implications of actions (or inaction) that impact the environment and to see environmental issues from multiple perspectives.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

Mathematics**MA 511** **Algebraic Structures**

Properties of the integers. Rings, fields and polynomials. Abstract groups. Vector spaces. Linear groups.

Prerequisite: linear algebra.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

MA 513 **Abstract Linear Algebra**

A proof-oriented introduction to linear algebra. Vector spaces, linear transformations, determinants, eigenvalues, canonical forms, and inner-product spaces. Notions of null spaces, spectral decomposition theorem, positive definiteness, and also Penrose pseudo-inverse and

singular value decomposition will be included. Students will be expected to independently investigate some aspects of the course material.

Prerequisite: Linear Algebra
Credits: (3), Graded, Semester Calendar
Lecture

MA 514 **Sets and Topology**

Sets and set operations. Construction of the number system. Axiom of choice and its equivalents. Transfinite numbers. Topological spaces. Separation and connectedness. Product and quotients. Compactness. Topological groups.

Prerequisite: linear algebra.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

MA 521 **Classical Complex Analysis**

Complex series and power series. Analytic functions and basic mapping properties. Cauchy's theorem and its consequences. Residue theorem and applications.

Prerequisite: advanced calculus.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

MA 522 **Classical Real Analysis**

Metric spaces and metric topology. Continuity, connectedness and compactness. Contraction mapping theorem and applications. Lebesgue measure and integral on euclidean spaces. Fourier series.

Prerequisite: advanced calculus.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

MA 525 **Functional Analysis**

This course introduces the students to the fundamental aspects of applied functional analysis. This field builds upon the concepts of real and complex analysis, developing the general theories of Banach spaces, bounded linear operators, and linear functionals. The primary focus of the course will be applications of functional analysis to other fields of mathematics, including such topics as dual spaces, weak topologies and weak convergence, approximation theory, and the applications of operator theory to the solutions of partial differential equations. Recommended prerequisites: courses in Real Analysis and Complex Analysis or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

MA 526 **Convex Optimization and Analysis**

Convex sets, functions, and optimization problems. Basics of convex analysis. Least-squares, linear and quadratic programs, semidefinite programming, minimax and extremal volume problems. Optimality conditions, Lagrange multipliers and KKT conditions, duality theory, primal and dual decomposition theorems of alternative interior point methods. Possible applications to come from signal processing, physics, control theory, mechanical engineering, image processing, manifold learning. Other topics may include epigraphs, subdifferentials and cone convexity, and multiobjective optimization.

Prerequisites: MA578; MA513 or MA573; and MA522
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

MA 531 Initial & Boundary Value Problems & Partial Diff Equations

Solution techniques for ordinary differential equations. Series solutions. Boundary value problems and special functions. Classification of partial differential equations. Linear problems shall include heat equation, wave equation, and Laplace's equation. Separation of variables and boundary value problems will be presented. Nonlinear equations shall be discussed, including reaction diffusion and reaction diffusion advection. Method of characteristics will be presented and shocks and singularities shall be included, and so will Burger's equation be included.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

MA 533 Ordinary Differential Equations

Please check with the math department for a course description

Credits: (3), Graded, Semester Calendar

Lecture

MA 550 Nonlinear Partial Differential Equations

This course introduces the analysis of Partial Differential Equations, (PDE's). Topics include linear PDE's such as transport, Laplace, heat and wave equations. Necessary functional analysis such as L^p spaces, Hilbert spaces, linear operator theory, dual spaces and weak convergence and the theory of Sobolev spaces will be included. Methods will include classical maximum principles, Galerkin truncation methods for global existence of weak solutions, and finite time blow up. The application of Sobolev spaces for existence theory of elliptic and parabolic PDE, and certain nonlinear reaction diffusion equations, such as models for population dynamics may be covered as time allows.

Prerequisites: Basic PDE, Advanced Calculus. Real and/or functional analysis is recommended but not required.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

MA 562 Complex Analysis with Applications

Complex numbers and functions, conformal mapping and applications, derivative, Cauchy-Riemann equations, real and complex line integrals, Fundamental Theorem, Cauchy and Poisson formulas, Taylor series, analytic continuation, special functions, Laurent series, residues. Applications to partial differential equations.

Prerequisite: MA231.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

MA 563 Applied Dynamical Systems

This course will emphasize applied dynamical systems, nonlinear science, and chaos theory. The dynamical systems approach emphasizes the study of long-term evolution through geometrical and topological considerations. We will emphasize applications from mechanics, engineering, physics, biology, medicine and chemistry.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

MA 571 Numerical Solution of Differential Equations

Numerical solution of initial and boundary value problems in ordinary differential equations, finite difference methods for elliptic, parabolic, and hyperbolic partial differential equations. Additional topics may include introduction to finite element and spectral methods.

Prerequisites: MA377 or consent of the instructor and the ability to program.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

MA 572 Finite-Element Methods

[Cross-listed with CE 538, ME 515] This course is an introduction to the finite element method, from a mathematical as well as a modeling and applications point of view. The basic theory and implementation will be discussed in the context of continuum problems in linear elasticity, potential flow and plate modeling. If time permits, additional applications such as structures, electromagnetics, fluid mechanics, ground water and geotechnics will also be discussed. Topics include: weak formulations and the principle of virtual work, discretization and interpolation-function selection, assembly and solution of the system equations, error estimates and accuracy assessment. When taught in conjunction with CE 438/ME 453 the course requires additional independent work for those registered for the graduate course.

Prerequisites: MA232, MA339 or MA330, ES222, ES330, and the ability to program. Consent of the instructor may be used to replace some prerequisites.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

MA 573 Matrix Theory and Computations

This course presents topics in matrix theory that are useful in applications to engineering, science and other branches of mathematics. Review of linear algebra, including vector and matrix norms and canonical forms, numerical methods for linear systems (direct and iterative methods), eigenvalue problems, singular value decomposition, orthogonal projections, matrix decompositions, generalized inverses. Additional topics may include applications to least squares and optimization.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

MA 578 Numerical Analysis

Review of linear algebra and systems, solution of nonlinear equations and systems, interpolation, approximation of functions, orthogonal polynomials, numerical differentiation and integration. Additional topics may include eigenvalue problems, iterative methods for linear systems and topics from optimization.

Prerequisites: linear algebra.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

MA 579 Introduction to Applied Optimization

The motivation for this course is that optimization problems arise routinely in most applications -- from designing an airline schedule to minimize cost to designing a remediation strategy for a contaminated ground water site. In this course we will focus on numerical techniques to solve applied optimization problems of various formulations. Topics will include solutions to linear and nonlinear equations, nonlinear programming, unconstrained and constrained optimization, black-box formulations and a glance at sampling methods, as time allows, extra topics may include multi-objective optimization, mixed integer programming methods, and evolutionary algorithms. This course will include a computing component with MATLAB and possibly some off-the-shelf optimization packages. The objectives are (a) to become familiar with a range of optimal design

formulations and techniques appropriate for those formulations, (b) to motivate the need for efficient numerical methods for optimization problems, (c) to study these methods through implementation and analysis, (d) to become familiar with some existing software for optimization as well as write our own codes, and (e) to obtain a better understanding and appreciation for scientific computing in optimization.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

MA 581 **Probability**

[Cross-listed with STAT 581] Sample spaces; axioms of probability; basic theorems; random variables (discrete and continuous); combinatorial methods; Bayes' Theorem and conditional probability; expected values and variances; distribution functions, including: binomial and multinomial, Poisson, normal and bivariate normal distributions, and others such as geometric, hypergeometric, negative binomial, exponential, gamma and beta; joint distributions; covariance and correlation; central limit theorem; geometric probability; method of transformations; introduction to stochastic processes.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

MA 582 **Mathematical Statistics I**

[Cross-listed with STAT 582] A rigorous course in statistics. Topics include random variables and their distributions, data reduction, estimation, sampling distributions, testing, optimal tests, analysis of variance and nonparametric statistics. A large project is required.

Prerequisites: MA381.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

MA 601 **Topics in Mathematics**

Prerequisites: consent of the instructor.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Given When Needed

MA 701 **Directed Study in Mathematics**

Prerequisites: consent of the instructor.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Given When Needed

MA 705 **Directed Study in Applied Mathematics**

Directed Study in Applied Mathematics

Credits: (1-10), Graded, Semester Calendar

Independent Study, Given When Needed

MA 707 **Directed Study in Numerical Analysis**

A directed study in Numerical Analysis, intended to give a student the opportunity to further explore an area of interest to them under the supervision of a faculty member.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Given When Needed

MA 719 **Directed Study in Nonlinear Processes**

A directed study in Nonlinear Processes, intended to give a student the opportunity to further explore an area of interest to them under the supervision of a faculty member.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Given When Needed

MA 725 **Seminar in Applied Mathematics**

Prerequisites: consent of the instructor.

Credits: (1-10), P/NC, Semester Calendar

Seminar, Given When Needed

MA 727 **Seminar in Numerical Analysis**

Prerequisites: consent of the instructor.

Credits: (1-10), P/NC, Semester Calendar

Seminar, Given When Needed

MA 739 **Seminar in Nonlinear Processes**

[Cross-Listed with EE739] Prerequisites: consent of the instructor.

Credits: (1-10), P/NC, Semester Calendar

Seminar, Given When Needed

MA 810 **Thesis Dissertation or Special Projects**

Credits: (1-15), Thesis, Semester Calendar

Thesis Research, Given When Needed

MA 999 **Special Graduate Topics**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Transfer Credit Only

Mechanical Engineering

ME 500 **Elasticity**

[Formerly MER 500] The behavior of substances that possess the property of recovering their size and shape when forces producing deformation are removed. Review of stress and strain; study of two-dimensional problems in rectangular, polar, and curvilinear coordinates; introduction to three-dimensional problems; torsion and bending.

Prerequisites: Calculus IV, Linear Algebra and Differential Equations, and Mechanics of Materials or equivalent

Credits: (3), Graded, Quarter Calendar

Lecture, Winter Quarters

ME 501 **Transport Phenomena**

[Formerly MER 501] The fundamentals of momentum, energy, and mass transfer and their analogous transport mechanisms. One-dimensional transport, transport properties, transport with internal generation, transfer coefficients, convective and turbulent transport.

Prerequisites: Linear Algebra and Differential Equations, Heat Transfer Analysis and Design or equivalents

Credits: (3), Graded, Quarter Calendar

Lecture, Spring Terms

ME 502 **Engineering Analysis**

[Formerly MER 502] Topics in applied mathematics needed to analyze and model engineering problems by constructing mathematical models for a physical situation and the reduction of the ensuing mathematical problems to numerical procedures. Matrices, linear algebra, vector and tensor calculus, partial differential equations, calculus of variations, finite element and difference techniques, Fourier series and integrals.

Prerequisites: Calculus, Linear Algebra and Differential Equations or

equivalents

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

ME 503 Additive Manufacturing

Brief introduction to the traditional manufacturing processes such as bulk deformation, extrusion, forging/forming, cold & hot working, and joining/welding. Emphasis will be on advanced near net shape forming/processes of engineering materials known as Additive Manufacturing/3D Materials Processing, including 3D processing for Polymers as well as metals.

Credits: (3), Graded, Semester Calendar
Lecture,

ME 506 Mechanical Behavior of Materials

[Formerly MER 506] Strain relationships in elastic and plastic behavior. Metallurgical fundamentals of plastic deformation. Dislocation theory. Materials testing. Creep and metal fatigue.

Prerequisites: Calculus, Linear Algebra, Differential Equations, and Mechanics of Materials or equivalents
Credits: (3), Graded, Quarter Calendar
Lecture

ME 507 Design for Manufacturing

[Formerly MER 507] This course will introduce the student to the principles of design for manufacturing. The course will begin by examining modern manufacturing operations including machining, casting, forging, welding, brazing, soldering, finishing, heat treating, assembly, plastic materials processing, powder metallurgy, and specialized manufacturing processes. This section will also include electronics manufacturing, covering both through-hole technology and surface mount devices. For each manufacturing process, capabilities and limitations will be discussed and how they relate to part design and cost. Design for manufacturing principles will be examined, including how the designer affects manufacturing cost, lean manufacturing, six sigma, value stream analysis, manufacturing rate, the cost of quality, process flexibility, process simulation, and process economics.

Prerequisites: Strength of Materials, Mechanics or equivalent
Credits: (3), Graded, Quarter Calendar
Lecture

ME 508 Fracture Mechanics

[Formerly MER 508] Modern theory of fracture in design. The ability to apply fracture mechanics principles to the design and analysis of engineering structures. Subjects treated include occurrence of fracture, fracture toughness, fracture resistance, and fatigue.

Prerequisites: Mechanics of Materials or equivalent
Credits: (3), Graded, Quarter Calendar
Lecture

ME 509 Current Approaches to Fatigue in Design

[Formerly MER 509] To provide engineering students with an understanding of fatigue mechanisms, design criteria and realistic examples to avoid and predict fatigue/durability failures in structures and components. The major emphasis of the course is fatigue of metals as applied to a variety of engineering structures and components, including both fatigue mechanisms and design applications. The course material is applicable to ground vehicles, buildings/bridges, aerospace vehicles, ships, nuclear pressure vessels,

metal implants/prostheses and others. Both constant amplitude and variable amplitude fatigue life situations are considered.

Prerequisites: Calculus, Differential Equations, Strengths of Materials
Credits: (3), Graded, Quarter Calendar
Lecture

ME 510 Advanced Dynamics

[Formerly MER 510] Analytical dynamics with engineering applications to particles and rigid bodies. Topics include three-dimensional kinematics and dynamics, Lagrangian dynamics.

Prerequisites: Advanced Mechanics, Rigid Body Mechanics or equivalent
Credits: (3), Graded, Quarter Calendar
Lecture

ME 511 Introduction to Acoustics

This course covers the basic concepts of acoustical analysis for engineers. Topics covered included wave propagation, and sound radiation, absorption, and transmission. Treatment of the material is considered from the viewpoint of harmonic oscillators, and builds upon the foundation of frequency domain analysis. Prerequisites: ME455 or Instructor Permission

Credits: (3), Graded, Semester Calendar
Independent Study, Spring Terms

ME 512 Vibrations of Discrete Systems

[Formerly MER 512] Response of single and multi-degree-of-freedom systems to harmonic, periodic and impulsive excitation. Fourier series and transforms; ideal impulse and impulse response; convolution in the time and frequency domains; matrix and modal methods; system eigenvalues and vectors; impulse testing with a spectrum analyzer.

Prerequisites: Dynamics and Kinematics or equivalent, Calculus, Differential Equations, Mat Lab helpful
Credits: (3), Graded, Quarter Calendar
Lecture

ME 513 Processing and Selection of Engineering Materials

[Formerly MER 515] A comprehensive examination of processing technologies for engineering materials, and the effects of selected processing routes and materials to meet and satisfy design and applications criteria.

Prerequisites: Mechanics of Materials or equivalent
Credits: (3), Graded, Quarter Calendar
Lecture

ME 515 Finite Element Methods

[Cross-listed with CE 538, MA 572] This course is an introduction to the finite element method, from a mathematical as well as a modeling and applications point of view. The basic theory and implementation will be discussed in the context of continuum problems in linear elasticity, potential flow and plate modeling. If time permits, additional applications such as structures, electromagnetics, fluid mechanics, ground water and geotechnics will also be discussed. Topics include: weak formulations and the principle of virtual work, discretization and interpolation-function selection, assembly and solution of the system equations, error estimates and accuracy assessment. When taught in conjunction with CE 438/ME 453 the course requires additional independent work for those registered for the graduate course.

Prerequisites: MA232, MA339 or MA330, ES222, ES330, and the ability to program. Consent of the instructor may be used to replace some prerequisites.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

ME 516 Finite Element Methods in Engineering

[Formerly MER 516] This course provides an introduction to the finite element method with an emphasis for solving structural engineering problems. It will cover a review of matrix algebra and the solution to simultaneous linear equations. It will then lead to an introduction of the stiffness method, which will include a review of the equations from elasticity. The method will then be applied to bar and beam equations, followed by 2D plane strain equations. Modeling guidelines will then be covered, along with axisymmetric analysis and isoparametric formulations; finishing up with three dimensional analysis. Prerequisites: Calculus, Differential Equations, Strength of Materials or Equivalent

Credits: (3), Graded, Quarter Calendar
Lecture

ME 517 Advanced Thermal Systems

Advanced treatment of steady and transient conduction, convection and radiation heat transfer with applications to various thermal systems such as electronic circuits and HVAC.

Credits: (3), Graded, Quarter Calendar
Lecture, Given When Needed

ME 527 Advanced Fluid Mechanics

An introductory level graduate course in fluid mechanics. Spatial and material coordinates, kinematics of fluid motion, continuity and momentum equations, constitutive relations, simple solutions, potential flows, boundary layer theory, creeping flow, flow through porous media, particle motion, interfacial phenomena, turbulence.

Prerequisites: CH301 or ES330 or equivalent.

Credits: (3), Graded, Quarter Calendar
Lecture, Laboratory, Fall Terms

ME 529 Stochastic Processes in Engineering

Review of the theory of probability. Single and multiple random variables topics, such as distributions, moments, conditioning, central limit theorem, and Laws of Large Numbers. Stochastic processes. Stationary and nonstationary processes. Time averaging and ergodicity. Correlation and power spectrum. Langevin's equation and Markov processes. Poisson and Gaussian processes. Response of linear systems. Approximate methods for analysis of nonlinear stochastic equations Application to engineering problems, such as random vibrations, turbulence, estimation theory, signal detection, and others.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

ME 530 Holistic Structural Integrity Process (HoSIP)

This course discusses a Holistic Structural Integrity Process (HoSIP) founded upon the primary idea that all failure mechanisms involved in the degradation of the structure are interconnected and should not be analyzed as merely the sum of individual mechanisms. In reality many failure mechanisms interact synergistically and are much more complex and challenging to understand, and thus the requirement for a holistic physics based analysis and design approach to structural integrity problems. The final goal of this holistic approach is to more

accurately assess the reliability and structural integrity of aerospace and wind energy structures while maintaining and achieving higher safety conditions.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

ME 531 Computational Fluid Dynamics

The course will present advanced computational methods for solutions of transient and steady-state problems in fluid mechanics and in transport phenomena, including incompressible flows, compressible flows, heat transfer, transport of suspended particles, etc. The course will require programming in Fortran or other languages. Post processing of data will include the use of computer graphics. Special projects in application of the course material to research-oriented problems in engineering will be emphasized.

Credits: (3), Graded, Semester Calendar, Lecture, Spring Semesters

ME 537 Fluid Mechanics of Aerosol Dispersion

Review of viscous flow theory. Creeping flows around a sphere. Drag and lift forces acting on particles. Wall effects and nonspherical particles. Diffusion of aerosols in laminar flows. Brownian motion and Langevin equation. Mass diffusion in pipe and boundary layer flows. Dispersion of particles in turbulent flows. Turbulent diffusion and wall deposition of aerosols. Effects of electrostatics, van der Waals and other surface forces. Computational aspects of aerosol dispersion in laminar and turbulent flows. Particle removal and resuspension from surfaces. Coagulation of aerosols due to Brownian movement, presence of a shear field and turbulence. Applications to microcontamination control, air pollution, and particle deposition in human lung.

Prerequisites: Consent of the instructor

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Given When Needed

ME 538 Experimental Aerosol Mechanics and Instrumentation

Introduction to the mechanics and transport of aerosols. Review of elementary particle mechanics. Brownian motion and diffusion. Particle statistics. Inertial separation of particles. Impactors - design and theory. Periodic motion and sonic agglomeration. Coagulation. Evaporation and condensation. Condensation nuclei counters. Filtration. Electrical properties. Electrical aerosol analyzers. Differential mobility analyzers - theory and experiments. Aerosol sampling and transport - theory and experiments. Optical properties of aerosols - theory and experiments. Experimentation including aerosol generation, sampling, classification, and measurement.

Prerequisites: consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

ME 543 Advanced Optimal Design

The optimal design of mechanical systems is studied. The optimization methods discussed in the course include: unconstrained optimization in several variables (e.g. gradient search, random search), constrained optimization in several variables (e.g. linear programming, nonlinear programming, Lagrange multipliers, geometric programming) and problems structured for multistage decision (e.g. dynamic programming). Emphasis is placed on the formulation of problems which can be solved by these techniques. A project involving the application of the methods introduced is required.

Prerequisites: ES222.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

ME 544 **Advanced CAD (Computer Aided Design)**

This course deals with the use of commercially available CAD hardware and software for product development and design. Lectures cover the underlying theories upon which such software is based, the ways in which these theories are implemented and software limitations. Hands-on experience is emphasized. Students entering the course are assumed to have some knowledge of general computer usage and computer graphics.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

ME 551 **Theory of Elasticity**

[Cross-listed with CE 551] A study of the mathematical theory of elasticity and its application to engineering problems; development of general stress-strain relationships, equations of equilibrium and compatibility; plane stress and plane strain; stress functions; applications to beam bending and torsion.

Prerequisites: ES222 or equivalent, ME554 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

ME 554 **Continuum Mechanics**

[Cross-listed with CE 554] The course involves the analysis of stress and deformation at a point, and the derivation of the fundamental equations by applying the basic laws of conservation of mass, energy and momentum and those of thermodynamics. Vector and cartesian tensors are reviewed. Relationships are then developed between stress, strain and strain rate and constitutive laws affecting stress-strain relationships. These are used to formulate the basic equations governing the behavior of any continuum with applications to solids and fluids.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

ME 555 **Advanced Mechanical Vibrations**

A review of discrete multiple degree-of-freedom systems is presented. The equations of motion of continuous systems such as strings, rods, beams and torsion bars are studied using both classical and approximate solution methods. Hamilton's principle and nonlinear vibrating systems are also covered.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

ME 557 **Advanced Mechanics of Composite Materials**

Nature of composite materials. Classification and characteristics of composite materials, mechanical behavior of composite materials. Macromechanical and micromechanical elastic behavior of unidirectional lamina. Constitutive and transformation relations. Strength of unidirectional lamina. Composite failure theory. Mechanics of multidirectional structural laminates. Lamination theory. Strength and failure analysis of multidirectional laminates. Effect of temperature and moisture.

Prerequisites: ES222 and ES260.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

ME 560 **Linear Control Systems**

[Cross-listed as EE 657] [Formerly MER 522] This course addresses practical control system design primarily from a classical perspective. Beginning with transfer function modeling of dynamic systems, the course moves through transient, root locus, and frequency response analysis to end with frequency domain techniques for controller design.

Prerequisites: System Modeling and Analysis (Circuits and Systems or Dynamics of Physical Systems), Mat Lab/Simulink helpful

Credits: (3), Graded, Quarter Calendar

Lecture

ME 561 **Engineering Optimization**

[Formerly MER 525] This course in engineering optimization studies techniques with applications in various aspects of engineering design and other disciplines including: concepts of design variables, constraints, objective functions, penalty functions, and Lagrange multipliers. Techniques for solving constrained and unconstrained optimization problems: classical approaches steepest descent, conjugate gradient, modified Newton, controlled random searches, etc. Applications and examples in the design of engineering components and systems will be presented.

Prerequisites: Calculus, Differential Equations, Mat Lab helpful

Credits: (3), Graded, Quarter Calendar

Lecture

ME 562 **Composites**

[Formerly MER 532] This course provides a comprehensive introduction to composite materials and motivation for their use in modern applications. Topics include selection and availability of composite materials, manufacturing processes, usable theoretical concepts, testing and characterization of composites, and strength theories.

Prerequisites: Materials Science, Strength of Materials, or equivalent

Credits: (3), Graded, Quarter Calendar

Lecture

ME 563 **Dynamics of a Viscous Fluid**

[Formerly MER 534] Analysis of laminar and turbulent flow fields. Approximate solutions of the Navier-Stokes equations according to boundary layer theory. Prerequisites: Fluid Mechanics, Thermodynamics or equivalent, Calculus, Differential Equations

Credits: (3), Graded, Quarter Calendar

Lecture

ME 564 **Compressible Fluid Flow**

[Formerly MER 536] Analysis of internal and external compressible flow fields. Supersonic airfoil analysis according to shock-expansion theory.

Prerequisites: Fluid Mechanics, Thermodynamics or equivalent, Calculus, Differential Equations

Credits: (3), Graded, Quarter Calendar

Lecture

ME 565 **Combustion Fundamentals**

[Formerly MER 537] The study of the chemical and physical processes in combustion. Analysis of thermochemistry and fuel oxidation, premixed and diffusion flame phenomena, combustion of condensed phases, detonation, combustion in practical systems, and combustion

generated air pollution. Prerequisites: Thermodynamics or equivalent
Credits: (3), Graded, Quarter Calendar
Lecture

ME 566 Fluid Dynamics of Turbo Machinery

[Formerly MER 538] Analysis of the energy exchange between a continuously-flowing fluid and a turbomachinery rotor. Study of the design and operating principles of axial and radialflow turbines, compressors, and pumps. Prerequisites: Thermodynamics, Fluid Mechanics or equivalent
Credits: (3), Graded, Quarter Calendar
Lecture

ME 567 Thermodynamic Analysis

[Formerly MER 540] Consideration of various particulate and continuum bases for structuring thermodynamic principles and their application to the solution of current and prospective engineering problems.
Prerequisites: Basic Thermodynamics, Heat Transfer or equivalent
Credits: (3), Graded, Quarter Calendar
Lecture

ME 568 Thermal Energy Processes

[Formerly MER 541] This course focuses on the analysis of thermal processes relevant to the renewable energy priorities of today's green economy. The underlying engineering principles of thermal processes, which make the best use of sustainable energy sources through proper acquisition, storage and conversion, will be considered. The course incorporates the fundamentals of thermodynamics and heat exchange necessary to understand the components and cycles that enable these thermal energy processes.
Prerequisites: Fluid Mechanics, Thermodynamics, Heat Transfer
Credits: (3), Graded, Quarter Calendar
Lecture

ME 570 Superconductivity

[Cross-listed with EE 645] [Formerly MER 551] Superconductivity is a complex physical phenomenon still at the forefront of research. This course is designed to provide a fundamental working knowledge of this technology, the importance and integration of material properties, and a broad understanding/appreciation of the applications in the areas of power equipment and electronics. The course will also focus on active research and technological barriers for future applications.
Prerequisites: Calculus, Electromagnetics (basics), Quantum Mechanics helpful
Credits: (3), Graded, Quarter Calendar
Lecture

ME 571 Convection Heat Transfer

[Formerly MER 552] Analysis of laminar and turbulent heat transfer processes. Approximate solutions of the energy equation according to boundary layer theory.
Prerequisites: Fluid Mechanics, Heat Transfer
Credits: (3), Graded, Quarter Calendar
Lecture

ME 572 Advanced Fluid Dynamics

[Formerly MER 553] This course examines the Derivation and Analysis of Laminar and Turbulent flow fields. Approximate solutions to the Navier-Stokes Equations as related to Boundary Layer Theory.

Application of Complex Variable conformal mapping techniques to Inviscid Flow.
Credits: (3), Graded, Quarter Calendar
Lecture

ME 573 Flow and Heat Transfer in Multiphase Systems

[Formerly MER 554] Analytical and empirical methods for evaluation of flow characteristics, particularly in liquid vapor systems and boiling and condensing of heat transfer.
Prerequisites: Fluid Mechanics, Heat Transfer
Credits: (3), Graded, Quarter Calendar
Lecture

ME 574 Computational Fluid Dynamics

[Formerly MER 555] Computational Fluid Dynamics (CFD) employs a combination of Fluid Mechanics, Heat Transfer, and Numerical Methods to solve problems of practical "applied" engineering. CFD allows for a rapid (as opposed to exact solution, if possible, experimental testing) investigation of the thermos-fluid topics covered in previous courses with an emphasis on numerical solutions to those problems. Numerical solution theory and methods will be covered and students will be expected to program in any code/package with which they are comfortable. Upon completion of the course the student will be expected to be able to 1) describe the physics of a given problem in mathematical terms describing the conservation equations, initial and boundary conditions, 2) choose an appropriate numerical solution technique to apply, and 3) be able to write their own code or employ a commercial CFD code in the solution of the problem. This course will emphasize the STAR-CCM+ commercial code. Having achieved a solution, via visualization/calculation techniques of key parameters and student will be able to assess its validity.
Credits: (3), Graded, Quarter Calendar
Lecture

ME 575 Nuclear Engineering & Technology

[Cross-listed with EE 687] [Formerly MER 560] The purpose of this course is provide students of various engineering disciplines a functional knowledge of nuclear engineering principles and those most important to the design of nuclear power generation systems. The course will focus both on the nuclear reactor core as well as plant systems. The intent is that students will gain a physical understanding of nuclear engineering principles as they relate to their own field of interest. Class participation will be highly encouraged and focused through the discussion of current events in the nuclear industry as well as proposed future nuclear technologies.
Credits: (3), Graded, Quarter Calendar
Lecture

ME 577 Engineering Statistics

[Cross-listed with EE 602, CS 506] [Formerly MER 572] Modern engineering practice makes extensive use of statistical methods for the efficient collection and analysis of engineering data, and to support data-based decision making. This course will introduce the statistical tools that are of greatest importance for practicing engineers. Core topics to be covered will include probability and distribution theory, the construction and interpretation of statistical intervals, statistical hypothesis testing, regression analysis and empirical modeling, statistical experimental design, and statistical quality/process control. Additional specialized topics may also be covered, depending upon the interests of the class; possible topics

include system reliability analysis, measurement system analysis, process capability analysis (and “six-sigma”), accelerated life testing, and acceptance sampling.

Credits: (3), Graded, Quarter Calendar

Lecture

ME 579 Motor Acoustics

[Cross-Listed as EE 606] [Formerly MER 576] Development of the fundamental principles and equations for motor noise and vibration. Focus on development of analytical methods for predicting the acoustic performance of motors, along with an overview of numerical methods. Develop an understanding of the key principles and governing equations of motor acoustics. This covers noise generation by the motor, its structural dynamics response, and its sound radiation. Apply those equations to the analytical prediction of the noise sources and acoustic responses of motors. Understand the bounds of applicability of the analytical formulas, and the numerical methods which are available to predict the response of complex motors.

Prerequisites: Applied Calculus and Differential Equations

Credits: (3), Graded, Quarter Calendar

Lecture

ME 580 Advanced Modeling and Simulation of Dynamic Systems

This course will incorporate techniques of bond graph theory in the energy-based lumped parameter modeling of electrical, mechanical, hydraulic, magnetic, and thermal energy domains. Bond graph theory offers a unified approach to modeling dynamic energy systems and provides the tools necessary for the analysis of complex systems involving a variety of energy domains. Rather than attempt to cover all of the available analysis techniques, this course will serve to provide an underlying foundation on which to develop a thorough understanding of the interactions of energetic systems. Emphasis of the course will focus on multi-domain interaction.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

ME 581 Fuel Cell Science and Hydrogen Engineering

[Cross-listed with EE 640] [Formerly MER 580] Introduce the student to the science and engineering of fuel cell technology. Emphasis will be on developing an understanding of different types of fuel cells, their applications, and the engineering of complete fuel cell systems. Elements of that class will include: electrochemistry; polymer materials science for proton exchange membrane (PEM) based systems; ceramics for solid oxide fuel cells; liquid-electrolytes for phosphoric acid and alkaline fuel cells; and other methods of generating power directly from a fuel and an oxidant. The system requirements of the fuel cell stack will be introduced to provide a complete picture of the technology. Other elements addressed during the course will include thermochemistry; electrochemistry; fuel processing or reforming; electrical & power management; and polymer science and systems engineering. Developing an understanding of the proton exchange membrane fuel cell will be the primary objective. After completing this course, the student is expected to have an understanding of the technical needs, challenges, and opportunities of fuel cell systems. The overall essence of the class will be to address the essentials of fuel cells and fuel cell systems and related electrochemical systems. Elements of the entrepreneurial aspects of the industry will also be covered. Hydrogen will be discussed throughout the semester as it relates to

fuel cells and the emerging changes in power generation models.

Credits: (3), Graded, Quarter Calendar

Lecture

ME 582 Photovoltaic Engineering

[Cross-listed with EE 643] [Formerly MER 580A] The course focuses on the physical principles, technology, and design of efficient semiconductor photovoltaics. Course goals equip students with the concepts and analytical skills to understand efficiency limitations, to assess the viability of various solar and thermophotovoltaic technologies, and to introduce the physics required for understanding photovoltaic energy conversion. The course will focus on three primary aspects of photovoltaic energy conversion, (i) the transfer and conversion of solar (i.e. thermal) radiation to electronic energy, (ii) the theory and design of the semiconductor photovoltaic cell and (iii) photovoltaic systems and applications.

Credits: (3), Graded, Quarter Calendar

Lecture

ME 583 Turbine Engineering

[Cross-listed with EE 683] [Formerly MER 580B] Course on fundamentals of design, analysis, and technology of turbo machinery – jet engines, gas turbines, steam turbines, water turbines, and wind turbines. The course will provide an understanding of all aspects of system development: thermodynamic cycles, design-point and off-design performance; function and design of components (inlets, compressors, combustors, turbines, outlets), operational limits, and environmental concerns; structural analysis, lifting, and materials; rotor dynamics and blade aeromechanics; clearance analysis, sealing, and packing; heat transfer, blade and component cooling; starting and control; power and thrust generation; testing and instrumentation. The student is expected to develop a broad understanding of the state-of-the-art, challenges, and future of turbine systems.

Prerequisites: Basic Structures, Thermodynamics, Fluids.

Credits: (3), Graded, Quarter Calendar

Lecture

ME 586 Welding

[Formerly MER 580D] Welding metallurgy is a technologically important field that covers a wide range of scientific disciplines. This course uses welding metallurgy as a vehicle to introduce basic and broadly applicable concepts in solid state physics, chemistry, materials science, fluid mechanics, and solid mechanics. Topics covered include welding processes, heat and fluid flow, chemical reactions, residual stresses, solidification phenomena, phase transformations, and welding defects. Special emphasis will be placed on applied engineering problems and on the behavior of structural engineering materials. Real life examples will be used to illustrate the fundamental concepts of the course. Homework assignments and a final project are required.

Prerequisites: Materials Science, Strength of Materials or equivalent.

Credits: (3), Graded, Quarter Calendar

Lecture

ME 587 Solar Energy Engineering

[Cross-listed with EE 685] [Formerly MER 580E] This course is designed to enable the student to effectively grasp the complex and quickly changing solar industry. The course will cover such topics as the economy of solar, photovoltaic devices, systems and applications. In order to cover this broad range of technical topics, the course will

utilize multiple instructors. Each instructor has significant expertise and depth in the given field and the student will be able to draw from their experience. Students completing this course will develop knowledge of the solar industry, looking at the past, present and future of this technology area. Students will gain key technical background in every aspect of the industry and will be able to assess new technologies as they are developed. Understanding of the economics of solar and its future will also be obtained.

Credits: (3), Graded, Quarter Calendar

Lecture

ME 588 **Wind Energy Engineering**

[Cross-listed with EE 684] [Formerly MER 580F] The course focuses on 'Wind Farm Project Design and Development' and 'Wind Turbine Technology.' Part 1: Teams will demonstrate understanding of complete wind farm design/development process inclusive of site selection, wind resource evaluating target land area, turbine choice, location, energy projection, cost and transmission. Part 2: Focuses on technical understanding of Wind Turbine attributes such as structural, blade system, Uacelle system, electrical system, performance, and future opportunities.

Credits: (3), Graded, Quarter Calendar

Lecture

ME 589 **Synchronous Electrical Generators**

[Cross Listed EE686][Formerly MER 580G] This course covers fundamentals of design and analysis of power generators, such as those used in thermal power plants and wind turbines. The course will address the basic operating principles of the synchronous machine and consider configurations such as would field, permanent magnet, and doubly fed generators. Key topics will include understanding and analysis of the magnetics within the machine, losses and efficiency, thermal performance, mechanical behavior, operation on the power system, and key IEEE and IEC standards. Further topics will include the duty imposed on the machine during service, as well as the duty it imposes on the turbine. The student is expected to develop a broad functional understanding of the current engineering technology, challenges, and future of generator technology. Cross Listed EE686

Credits: (3), Graded, Quarter Calendar

Lecture

ME 590 **Advanced Welding Metallurgy**

Introduction to various aspects of welding processes. Weldability problems in ferrous, non-ferrous and metal-matrix composite materials will be discussed in detail. Solidification modes and their effects on the mechanical properties of austenitic and duplex stainless steel weldments will be examined.

Prerequisites: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Laboratory, Given When Needed

ME 591 **Selected Topics in Materials Engineering**

An advanced graduate course in the field of materials engineering. Topics to be covered will be selected to conform to the mutual interests and needs of students and faculty.

Prerequisites: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

ME 594 **Selected Topics in Manufacturing**

An advanced graduate course in the field of manufacturing. Topics to be covered will be selected to conform to the mutual interests and needs of students and faculty.

Prerequisites: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Independent Study, Every Semester

ME 599 **Master of Science Graduate Project in Mechanical Eng**

[Formerly MER 599] This non-credit Seminar project provides a capstone experience for graduate mechanical engineering candidates not completing a thesis or independent study (i.e. all course work). The candidate and faculty advisor agree on project scope and evaluation process. The candidate receives a pass/fail grade which appears on the official transcript.

Credits: (0), Pass/Fail, Quarter Calendar

Seminar

ME 600 **Disruptive Technology**

[Cross-listed with EE 600] [Formerly MER 600] This course is designed to prepare the student to be able to efficiently evaluate potential disruptive technologies and their potential for application/commercialization. The course will cover such topics as the CO2 Mitigation, Solid state Energy Systems, Bio Energy and Fusion that have potential to impact the future. In order to cover this broad range of technical topics, the course will utilize multiple instructors that have technical depths as well as experience in the field.

Credits: (3), Graded, Quarter Calendar

Lecture

ME 601 **Sustainability**

[Cross-listed with EE 601] [Formerly MER 601] The focus of this course is to build an understanding of what is meant by Sustainable Energy and to be able to analyze a range of different opportunities. The intent is to perform a value analysis on each opportunity in order to determine which are practical, on a variety of scales, while considering all aspects of the opportunity. Attention will be placed on efficiency, scale, and impact of each opportunity as well as what limitations may exist.

Credits: (3), Graded, Quarter Calendar

Lecture

ME 610 **Mechanical Engineering Seminar**

Students, staff and visiting lecturers present research results and topics of current interest.

Credits: (1-2), P/NC, Semester Calendar

Seminar, Every Semester

ME 614 **Thesis, Dissertation Credits**

Analytical or experimental studies in mechanical and aeronautical engineering under the direction of a faculty adviser. Credit for this work is given when the requirements for the degree are completed including the presentation of a thesis or dissertation as appropriate to the degree program.

Credits: (1-15), Thesis, Semester Calendar

Thesis Research, Every Semester

ME 616 **Special Project Credits**

Engineering project credits associated with a Masters of Engineering degree under the direction of a faculty advisor.

Credits: (1-7), Pass/Fail, Semester Calendar
Project Team, Every Semester

ME 618 **Selected Topics in Heat Transfer**

An upper level graduate course in the field of heat transfer. Areas of coverage will be selected to conform to the mutual interests and needs of students and faculty.

Prerequisites: consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Every Semester

ME 621 **Computational Mechanics of Materials**

The objective of this class is to teach the nonlinear finite element analysis for modeling various advanced solid mechanics problems. Both geometric and material nonlinearities will be covered. A wide range of constitutive models, hyper-/hypo-elasticity, viscoelasticity, classical plasticity, crystal plasticity and piezoelectricity will be introduced. Variational formulation will be developed under both the Lagrangian and Eulerian description. Explicit and implicit integration schemes will be covered, and the stability will be discussed. Students will then learn to implement finite element models that can capture geometric and material nonlinearities that represent a wide range of material behavior. The course is expected to make a student comfortable using Abaqus package for advanced problems including developing their own constitutive models and linking these models to the Abaqus package. Prerequisites: ME554 or CE554, and ME515 or MA572, or by instructor consent

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

ME 628 **Selected Topics in Fluid Mechanics**

An advanced graduate course in fluid mechanics. Topics of special interest will be chosen to coincide with current needs. Description of the course content in any particular term will be announced in advance.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

ME 633 **Plasticity**

This course provides an introduction to the subject of plasticity. The physical background of inelastic deformation in metals and geological materials is discussed. Continuum constitutive theory is presented including yield criteria, flow rules, and plastic hardening. Extension to the rate-dependent (viscoplastic) material is discussed. Uniqueness and extremum theorems are derived and discussed and field equations for general, two-dimensional and axisymmetric problems are presented. Selected problems from metal and soil/rock plasticity are presented and solved using various techniques, including slip-line theory, limit analysis and exact methods. Other topics such as localization and diffuse instability in plastic deformation and application of FEM in plasticity are presented as time allows.

Prerequisite: CE554 or ME554; recommended CE551 or ME551.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

ME 637 **Particle Transport, Deposition and Removal II**

Introduction to turbulent flows and turbulent modelings. One and several equation models. Drag, lift, virtual mass, and Basset forces acting on particles. Wall effects and nonspherical particles. Aerosol transport and dispersion in turbulent flows. Turbulent diffusion and wall deposition of aerosols. Particle charging mechanics and electrostatics forces. Thermophoretic and electrophoretic effects. Introduction to colloids and electrokinetic phenomena. Computational aspects of aerosol dispersion and deposition in turbulent flows. Sublayer model approach. Approximate simulation of turbulence and turbulence transport. DNS simulation methods. Nonspherical particle transport in turbulent flows. Coagulation of aerosols due to shear and turbulence. Experimental techniques for turbulent flow measurements. Hot-wire anemometry, isokinetic sampling. Particle concentration and velocity measurements with phase-doppler, and PIV. Applications to microcontamination control, air pollution, combustor, spray, and particle deposition in human lung. Prerequisite: ME537

Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Spring Semesters

ME 639 **Advanced Turbulence**

Recent developments in turbulence modeling, stress transport models, multipoint closure methods, and thermodynamical formulation. Turbulent diffusion, isotropic turbulence and Karman-Howarth equation. Kraichnan's direct interaction approximation. Wiener-Hermite expansion approach. Characteristic functional formulation and Hopf's theory. Lundgren's probabilistic formulation and Chung's kinetic theory of turbulence. Direct and Large-Eddy simulation techniques. Proper orthogonal decomposition Techniques. Chaos and dynamical systems, stochastic Estimation, Lagrangian mean approaches.

Prerequisite: ME527 and ME629 or consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Laboratory, Given When Needed

ME 654 **Elastic Waves in Solids**

The course concerns with stress propagation problems in elastic solids and waveguides. Following the derivation of governing elastodynamics equations, formal mathematical issues, such as uniqueness, reciprocal identity, and completeness theorem, are addressed. The most commonly used solution techniques (e.g. Green's functions, integral transforms, normal mode expansions, and series analysis) with examples are provided. Problems considered include propagation in half spaces (reflections and transmissions), approximate rod and plate theories, and classes of composite materials (e.g. laminated bars, and plates). Well-known experimental techniques are also covered. Assignments consist of mathematical derivations, computer simulations and presentations.

Prerequisites: ME551/CE551 and ME554/CE554 or consent of the instructor.
Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

ME 657 **Selected Topics in Solid Mechanics**

An advanced graduate course in solid mechanics. Topics of special interest will be selected to conform to the mutual interests and needs of students and faculty.

Prerequisite: consent of the instructor.
Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

ME 690 Independent Study

[Formerly MER 590] Advance graduate course in the field of engineering sciences. Topics of special interest will be selected for current needs. A description of the course content in any particular term will be announced in advance.

Credits: (3), Graded, Quarter Calendar

Independent Study, Given When Needed

ME 696 Structural Dynamics

Analysis of elastic and inelastic single and multiple degree-of-freedom structural systems under time-dependent loads including harmonic, impulse, earthquake, and other general dynamic loads. Development of equations of motion. Analytical and numerical evaluation of free and forced vibration response. Identification of dynamic system properties. Modal analysis. Vibration isolation and force transmissibility. Dynamic measurement sensors. Shock loading spectrum Frequency-domain analysis.

Prerequisites: Knowledgeable background in Dynamics, Linear/Matric Algebra, Ordinary and Partial Differential Equations. MATLAB Experience useful

Credits: (3), Graded, Quarter Calendar

Lecture, Given When Needed

ME 999 Special Topics in Mechanical Engineering

Used for graduate transfer credit for which Clarkson does not have an equivalent ME course number.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Transfer Credit Only

Marketing**MK 609 Marketing Management (MBA Module)**

[Cross-listed with MK 610] The problems, decisions and decision-making processes of marketing managers as they seek to increase the effectiveness of performing marketing activities. The objectives are: to update the discussion of marketing principles and practices in the light of recent national and international events; to deepen the discussion of business environmental factors of increased importance, such as energy, inflation, changing consumer life style, government regulation, consumerism and environmentalism; and to aid students in experiencing real-life business situations through the discussion of marketing cases.

Prerequisites: completion of all CUSB MBA foundation requirements and admission to the MBA program.

Credits: (2), Graded, Semester Calendar

Lecture, Discussion, Spring Semesters

MK 610 Marketing Management

[Cross-listed with MK 609] This course provides graduate students with a fundamental command of marketing concepts, processes, and management, as well as creating an understanding of the critical strategic role marketing plays in the management of organizations. The objectives are two-fold. The first objective is to provide the student with an introduction to the fundamental concepts of marketing and their role in effective marketing management. Thus students will explore central topics including product, price, place, and promotion decisions, examine the roles of consumer behavior and market research, and investigate how organizations blend these inter-related components to create and sustain value. The second objective is to allow students to apply that knowledge in the context of strategic marketing management. Here, strategic elements associated with marketing are integrated into strategic marketing

framework to understand and develop marketing strategy and to illustrate how marketing can assist the firm in arriving at a competitive advantage.

Credits: (3), Graded, Semester Calendar

Lecture

MK 625 Marketing Communications

[Formerly MBA 625] Given today's rapidly changing media environment, it is essential for managers to understand how marketing communications operate in the marketing mix of contemporary firms. In this course, we will spend the majority of the time talking about what lies behind the marketing messages people see every day. When most people think about advertising, they think about the creative side—the clever slogans and attention getting pictures and illustrations. However, it requires a lot of research, strategic thinking, and a thorough understanding of the consumer behavior for these clever slogans and graphics to be effective. In addition, we will learn about analytical methods and data sources to allow managers to choose media for reaching customers in the most cost-effective manner. Finally, the marketing applications of new media, internet communications, and social networking will be explored.

Credits: (3), Graded, Quarter Calendar, Lecture

MK 626 Marketing Research Techniques

[Formerly MBA 626] Marketing research is primarily conducted to reduce the amount of uncertainty managers would otherwise face in their decision-making. This course is designed to develop students' knowledge of marketing research by both exposing them to many major important issues involved with marketing research and requiring them to complete a marketing research report from start to finish. Topics discussed include research designs, data collection methods, survey development, measurement, sampling methods and sample size determination, descriptive statistics, parameter estimation, independent samples t-test analysis, correlation analysis, chi-square analysis, code sheet development, non-sampling errors, and ethics in marketing research.

Credits: (3), Graded, Quarter Calendar

Lecture, Fall and Spring Quarters

MK 627 Marketing High Technology Products

[Formerly MBA 627] This course will develop an understanding of strategies and practices involved in marketing technologically oriented products and services and to see how and why these

strategies differ from marketing of non-technical products/services. In general, this course will focus on honing market analysis skills to leverage decision-making in the high-tech context. This course will enhance skills in analyzing industry trends, identifying threats and opportunities, designing suitable products and marketing strategies to best suit market/environmental conditions, market segmentation and analysis, and in assessing/monitoring a firm's relative advantage via competitive intelligence. Specific additional topics will include pricing, new product introduction, e-business, selling and sales management.

Credits: (3), Graded, Quarter Calendar

Lecture, Summer Terms

MK 629 Consumer Behavior

[Formerly MBA 628] This course is designed to enhance students' understanding of consumers. Topics explored involve the many, many

influences that may shape an individual's behaviors in the marketplace, including the impact of these influences on managerial decision-making situations. Observational research methods are also covered.

Credits: (3), Graded, Quarter Calendar
Lecture, Winter Quarters

MK 640 Marketing Management for Innovation

This course introduces students to the fundamentals of marketing management including consumer behavior, market research, professional selling, and marketing strategy all with a focus on managing the innovation process. The course is designed for graduate students who have undergraduate training in a technical field, most likely engineering and need exposure to the theory and practice of marketing and thus, integrates the concept and practice of innovation throughout the topics covered.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

MK 665 International Marketing Management

[Formerly MBA 665] This course examines development of international marketing strategies, from determining objectives and evaluating international market opportunities through coordinating strategies in world markets. Particular emphasis is placed on application of marketing principles in the multinational environment.

Credits: (3), Graded, Quarter Calendar
Lecture, Spring Terms

MK 687 Independent Project in Marketing

Practical application of marketing theory in an independent research project conducted under the guidance of a Marketing faculty member.

Credits: (1-3), Graded, Semester Calendar
Independent Study, Every Semester

MK 689 New Product Marketing

Accepted analytical models are used to analyze current data obtained from major companies regarding new products which have been test marketed. The objective is to introduce students to a new and crucial aspect of product management: the ability to use computers and analytical tools in brand decisions. Prerequisite: MK609 (Marketing Management)

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

MK 694 Supply Chain Distribution Management

Effective management of the distributive networks that constitute a key component of supply chain networks is increasingly being recognized as a critical corporate activity. This is especially true in contemporary supply chain networks as firms strive to survive in today's competitive marketplace that demands quality product and service offerings at minimal transaction costs. Moreover, technological advances like the internet have significantly altered the rules of the game, and hence the practices associated with distribution management. This course will identify the chief decision areas associated with supply chain distribution management, and subsequently examine the latest distribution network design models and activities based on the principles of agency theory, transaction cost economics, and relational exchange theory. Other topics to be covered include crafting and coordinating strategic alliances with distributive intermediaries, conflict management, role of customer

service audits in channel design decisions, performance appraisal systems, strategic sourcing, and benchmarking.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

MK 696

Marketing Methods

Intended to equip the student with a thorough knowledge of an arsenal of research methods, including the assumptions, methodology, and limitations of these methods. Enhances students' ability to conceptualize and operationalize a research question. Some statistical content is included as an introduction to data analysis. Applications of these methods are discussed within the context of research problems faced by both academic researchers and practitioners (e.g., managers, engineers, economists, marketing researchers, information system designers). A research project will be an integral part of the course.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

Multidisciplinary

MP 518

Project-Based Learning Program

See MP 318 for course description.

Prerequisite: consent of the instructor.

Credits: (3), Graded, Semester Calendar, Lecture, Every Semester

MP 525 Multidisciplinary Course - Sustainable Housing Solution

[Cross-listed with MP425] A team of Clarkson students from multiple majors will collaborate to design, optimize, and build a prototype of a housing solution. Principles of sustainable design, alternatives assessment, resource management, multidisciplinary teamwork, and communication will be emphasized.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

MP 551

Open Source Software Projects

Student teams will engage in projects in the following areas: administer, create, modify, test, or document Open Source Software (OSS); analyze business and policy issues involving OSS; and create and run outreach/tutorial programs that introduce interested persons to OSS or enhance the skill of persons already using OSS. Project status will be reported during regularly scheduled weekly meetings. Students will document projects on the Clarkson Open Source Institute (COSI) web site and will construct individual, web-based portfolios of their work. Students are expected to have some experience or course preparation in their project areas. Given Pass/No Credit.

Credits: (0-3), P/NC, Semester Calendar
Project Team, Given When Needed

MP 552

Internet Teaching Laboratory Projects Course

In conjunction with Clarkson's Internet Teaching Laboratory, students will participate in projects related to computer networking such as implementing network software, configuring networking hardware, simulating large-scale networks, evaluating and testing computer security, administering the Internet Teaching Laboratory, deploying networked solutions for community members or developing network tutorials for other students. Students will construct web-based portfolios and give oral presentations of their work. Given Pass/No Credit. By permission of instructor.

Credits: (0-3), P/NC, Semester Calendar
Project Team, Every Semester

Materials Science & Engineering

MSE 551 **Advanced Materials Characterization**

Advanced methods for characterizing materials, such as scattering methods, including laser light scattering and x-ray diffraction (powder patterns & Laue patterns); microscopy, including optical microscopy; scanning electron microscopy (including EDX), transmission electron microscopy, and atomic force microscopy; and spectroscopy, including nuclear magnetic resonance, surface plasmon resonance, and scanning confocal Raman microscopy.

The following undergraduate courses should be completed prior to taking this course: CM371 (Physical Chemistry I); PH132 (Physics II); and ES260 (Materials Science and Engineering I)

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

MSE 560 **Advanced Materials Science and Engineering I**

Atomic and molecular structure of solids (crystalline and glassy); atomic and molecular bonding; thermodynamics of materials (condensed matter); kinetics, diffusion and phase transformation; properties of bulk solids compared to thin films, and nano-sized materials; methods for forming solids and thin films (solidification, crystallization, precipitation, evaporation, physical vapor deposition, chemical vapor deposition, etc.); materials chemistry; defects (point, line, surface); mechanical, thermal, electrical, and optical properties; relationship between materials processing and materials properties.

The following undergraduate courses should be completed prior to taking this course: CM371 (Physical Chemistry I); PH132 (Physics II); and ES260 (Materials Science and Engineering I)

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

MSE 575 **Sustainable Nanotechnology**

[Cross-listed with CM 575, and ES 575] The goal of this course is to provide graduate students and advanced undergraduates with a modern view of current and emerging research in nanotechnology. Topics will include: fundamental nanoscale properties and applications, green manufacturing and assembly in functional devices, interaction of nanomaterials with biological systems, the physical and chemical phenomena at nano-bio interfaces, fate, transport and transformation of engineered nanomaterials, environmental and health impact, nanometrology, nanotoxicology and hazard identification of nano-based products. Development of analytical methods and characterization tools for assessing nanoscale properties and materials will also be discussed. Students will be exposed to interdisciplinary topics and an integrated training bridging material and environmental sciences with biology and analytical chemistry. Students will be able to demonstrate a basic awareness of risks and benefits of emerging technologies and evaluate overall environmental and societal impact.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

MSE 587 **Applications of Synchrotron & Electron Based Techniques**

The purpose of the course is to familiarize all students with the x-ray and electron based experimental techniques available at Brookhaven National Lab and other similar facilities. Students will be cognizant of the applications of these cutting edge facilities, and well positioned to use them in their own research. This course is suitable for graduate students, postdocs, and advanced undergrads in physical sciences and engineering, as well as students in biological, environmental, and

chemical sciences who may have the interest to learn more about the techniques they may use for their research.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

MSE 614 **Thesis, Dissertation**

Analytic or experimental studies in materials science & engineering under the direction of a faculty adviser. Credit for this work is given when the requirements for the degree are completed including the presentation of a thesis or dissertation as appropriate to the degree program.

Credits: (1-15), Thesis, Semester Calendar

Thesis Research, Given When Needed

MSE 999 **Material Science and Engineering Elective**

Used for awarding transfer credits for graduate courses completed elsewhere for which no equivalent Clarkson University graduate course can be identified. (Not offered at Clarkson, for transfer credit only).

Credits: (1-4), Transfer, Semester Calendar

Lecture, Transfer Credit Only

Educational Mathematics

MTH 509 **Probability and Statistics**

An introductory course in probability and statistics. Probability content includes events and sample spaces, the basic axioms of probability, discrete and continuous random variables, including binomial, Poisson, normal, exponential, student-t, and uniform distributions. Topics in statistics include the central limit theorem, statistical inference including confidence intervals and hypothesis testing, and linear regression. Students will use statistical software to read data and interpret software generated output. The key objectives are to understand and explain connections between 'uncertainty' and 'data analysis' as applied across a broad spectrum of application settings, along with development of skills necessary to communicate statistical ideas effectively.

Prerequisite: Multivariate Calculus or permission of instructor. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

MTH 524 **Geometry for Math Teachers**

This geometry course will focus primarily on content in the new high school Common Core geometry course. The main domains in this course are congruency, similarity, circle properties, measurement and modeling, and coordinate geometry. Emphasis will be on changes in the high school course especially in the areas of transformations, geometric constructions, trigonometric concepts, and modeling with geometry. Students will develop strong proof and reasoning skills throughout this course.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

MTH 560 **Common Core Math Standards for Teachers**

Common Core Mathematics is a 3-credit course that focuses on the changes in teaching mathematics in the present day classroom. Teachers in the Common Core classroom faces changes in curriculum, modeling, assessments and APPR. This class prepares teachers by analyzing pedagogical shifts, discussing the eight mathematical practices, and examining the new rigorous curriculum. Students will

be able to demonstrate models in class and will show the progression from concrete, pictorial and finally abstract representations. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)
Credits: (3), Graded, Semester Calendar
Lecture

MTH 580 **MAT Project in Mathematics (Content Area)**

The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom? Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)
Credits: (3), Graded, Semester Calendar
Lecture

MTH 988 **Independent Study in Mathematics**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)
Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

MTH 989 **Independent Study in Mathematics**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)
Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

Operations Management

OM 602 Decision Analysis & Supply Chain Modeling (MBA Module)

In today's fast-paced competitive environment, successful managers need the ability to define business problems, construct quantitative models and effectively utilize decision making tools. This course will introduce students to decision analysis techniques by focusing on the development and analysis of models for a variety of business management problems. Topics include supply chain network design, project management, decision making under uncertainty and risk, business process management, and simulation modeling of supply chain systems. Microsoft Excel will be used as a modeling and analysis environment to investigate a variety of analytic techniques. Prerequisites: completion of all CUSB MBA foundation requirements and admission to the MBA program.
Credits: (2), Graded, Semester Calendar
Lecture, Fall Semesters

OM 603 **Decision Analysis & Supply Chain Modeling**

This course introduces students to different approaches, support tools, and analytical methods for decision making in various business management situations. The objective is to develop the students'

ability to define business problems, construct quantitative models and effectively utilize decision making application software. Topics such as linear programming, network modeling, project management, decision making under uncertainty and risk, queueing theory, business process simulation, and Monte Carlo simulation will be explored. Special attention will be given to supply chain modeling and applications. Microsoft Excel will be used as a spreadsheet modeling and analysis environment to investigate a variety of analytic techniques. Prerequisite: OM607
Credits: (3), Graded, Quarter Calendar
Lecture, Spring Terms

OM 606 **Supply Chain Management (MBA Module)**

[Cross-listed with OM 607] Global supply chains are networks of facilities around the globe that procure raw materials, transform them into intermediate and final products, and subsequently deliver the products to customers worldwide through distribution systems. Rapid advances in information technology are accelerating productivity by providing a multitude of new, lower-cost options for integrating supply chains. In this course we review and discuss state-of-the-art concepts and practical tools to effectively design and management the supply chain. Topics covered include a strategic framework for supply chain management, supply chain design and operation, logistics strategies and design for logistics, inventory management and risk pooling, warehousing and material handling systems, supplier relations, and new and future trends in supply chain management.

Prerequisites: completion of all CUSB MBA foundation requirements and admission to the MBA program.

Credits: (2), Graded, Semester Calendar

Lecture, Fall Semesters

OM 607 **Global Supply Chain Management**

[Cross-listed with OM 606] Intense global competition has forced business enterprises to redesign and integrate their supply chains to effectively meet rising customer expectations at a reasonable cost. This course will start with selected introductory topics before covering the state-of-the-art concepts and practical tools to effectively design and manage the supply chain. Topics covered include a strategic framework for supply chain management, supply chain design, managing inventories in the supply chain, global logistics and distribution strategies, design for logistics, global sourcing, managing supply chain risk/disruptions, and new and future trends in supply chain management. Some combination of team projects, case studies, simulation games, and consulting experiences will be utilized to demonstrate real world issues, challenges and applications.

Credits: (3), Graded, Quarter Calendar

Lecture, Winter Terms

OM 650 **Operations Strategy and International Competitiveness**

The emphasis of the course is the operations and logistics function in firms that source, produce, distribute and market in multiple nations. The management of logistics in such firms differs from its domestic counterpart along several key dimensions. First, there is the need to be able to identify and analyze factors that differ across nations that influence the effectiveness of this function. These include worker productivity, process adaptability, governmental concerns, transportation availability, culture, and so on. In addition, because of the distances involved, transportation and distribution are of greater significance. Finally, these geographically dispersed set of facilities

and markets must be integrated and managed to enhance the strategy of the business unity.

Credits: (3), Graded, Semester Calendar
Lecture

OM 671 Supply Chain Environmental Management

Manufacturing organizations have increased their interest in environmental management through activities such as green purchasing, reverse logistics, product stewardship and design-for-the environment. These activities, usually involving several organizations, are often part of what is known as supply chain environment management. This course aims to gain a greater understanding of supply chain environmental management by examining: (i) the advantages and business risks of adopting and implementing environmental practices and technologies in the supply chain, (ii) the role of suppliers and customers to facilitate the adoption/implementation of environmental practices and technologies, and (iii) the implications of such supply chain activities on an organization's operations strategy. This course consists of a mix of lectures and class discussion and relies primarily on a set of readings and a series of cases that will be analyzed in class. Prerequisite: OM606 (Supply Chain Management)

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

OM 676 Developing and Managing Technology

This course covers the creation, design, development, implementation, diffusion and transfer of product and process innovation. The course covers the full range of activities from laying a foundation of technical knowledge in research, through the creation of new products and processes, to the integration of marketing, manufacturing and engineering, to commercialization. Topics include innovation management, managing r&d, product and process development, concurrent engineering, project selection, initiating new ventures, and technology transfer. Lectures, cases, reading, and projects focus on managing technology in companies. Corequisite: OS610 (or equivalent)

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

OM 680 Strategic Project Management

[Cross-listed with ES 510, OM 681] A project is a one-time or infrequently occurring operation with a unique goal, a limited lifespan and limited resources. This course will focus on project management from a decision-making perspective and how projects can be used to implement organizational strategy. The course follows the project life cycle model from project initiation to implementation to termination. Topics covered include such things as project scope development, project selection, organizational strategy, leadership, team building, planning, conflict resolution, budgeting, resource allocation, information management, control, auditing, and termination procedures. Computer applications such as MS Project, case studies, project simulations and student project teams will be an integral part of the course. This course satisfies the educational prerequisite for the Project Management Institute's (PMI) Certified Associate in Project Management (CAPM) and Project Management Professional (PMP) certifications.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

OM 681 Strategic Project Management

[Cross-listed with ES 510, OM 680] A project is a one-time or infrequently occurring operation with a unique goal, a limited lifespan and limited resources. This course will focus on project management from a decision-making perspective and how projects can be used to implement organizational strategy. The course follows the project life cycle model from project initiation to implementation to termination. Topics covered include such things as project scope development, project selection, organizational strategy, leadership, team building, planning, conflict resolution, budgeting, resource allocation, information management, control, auditing, and termination procedures. Computer applications such as MS Project, case studies, project simulations and student project teams will be an integral part of the course. This course satisfies the educational prerequisite for the Project Management Institute's (PMI) Certified Associate in Project Management (CAPM) and Project Management Professional (PMP) certifications.

Credits: (3), Graded, Quarter Calendar
Lecture, Summer Terms

OM 685 Quality Management and Process Improvement

[Cross-listed with ES 572, OM 686] This course will introduce the students to both the managerial and technical aspects of quality improvement techniques. The discussion of statistical topics will be tied to the Six Sigma methodology for the improvement of quality, productivity, and competitive position. A systemic and strategic approach to quality management will be provided, with emphasis on process improvement tools and methodologies. The course is designed to expose students to the integral elements of a total quality management system within both manufacturing and service organizations. Several individual and team projects involving class presentations, discussion of supplemental articles and case studies are utilized to demonstrate real world issues and applications.

Prerequisites: SB284 or consent of the instructor.

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

OM 686 Quality Management and Process Improvement

[Cross-listed with ES 572, OM 685] This course will introduce the students to both the managerial and technical aspects of quality improvement techniques. The discussion of statistical topics will be tied to the Six Sigma methodology for the improvement of quality, productivity, and competitive position. A systemic and strategic approach to quality management will be provided, with emphasis on process improvement tools and methodologies. The course is designed to expose students to the integral elements of a total quality management system within both manufacturing and service organizations. Several individual and team projects involving class presentations, discussion of supplemental articles and case studies are utilized to demonstrate real world issues and applications.

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

OM 687 Independent Project in Management

[Cross-listed with OM 688] An investigation of a problem undertaken by the student under the guidance of an individual faculty member. The course provides an opportunity for the student to explore an area of management research in depth on an independent study basis. To register students must receive approval of the faculty member.

Prerequisites: consent of the instructor.
Credits: (1-6), Graded, Semester Calendar
Independent Study, Every Semester

OM 688 Independent Project in Management

[Cross-listed with OM 687] An investigation of a problem undertaken by the student under the guidance of an individual faculty member. The course provides an opportunity for the student to explore an area of management research in depth on an independent study basis. To register students must receive approval of the faculty member.
Prerequisites: consent of the instructor.
Credits: (1-6), Graded, Quarter Calendar
Independent Study, Given When Needed

Organizational Studies

OS 602 Leadership Development I

The purpose of this course is to help students understand the general principles and processes of organizational behavior and effective leadership so that they can lead in a wide variety of situations. Course concepts include personality, motivation, decision making, power, team dynamics, and leadership styles. This course proceeds from the premise that leadership skills supplement the technical and diagnostic skills learned in other Clarkson MBA courses. Students in this course will develop an understanding of the course topics through hands-on experience, using a business simulation and a number of team exercises.
Credits: (1.5), Graded, Quarter Calendar
Lecture, Summer Terms

OS 603 Leadership and Organizational Behavior

[Cross-listed with OS 608] This course builds upon the lessons learned in OS602 and other MBA classes to allow students to further develop their leadership skills and understanding of behavior within an organizational setting. Specific topics to be covered include organizational culture and structure, influencing others through formal and informal means, negotiations, and analysis of organizational congruence. The course uses business cases, videos, articles from the academic and popular press, as well as in-class exercises.
Credits: (3), Graded, Quarter Calendar
Lecture, Fall and Spring Terms

OS 608 Organizational Behavior and Performance Management

[Cross-listed with OS 603] The purpose of this module is to prepare students for leadership responsibilities in the organization. The module may focus around one or more of several topics: managing your own performance and that of subordinates; managing organizational change; managing power, politics and conflicts; working in and managing groups effectively; managing technology to enhance productivity. Other topics will be covered as appropriate.
Prerequisites: completion of all CUSB MBA foundation requirements and admission to the MBA program.
Credits: (2), Graded, Semester Calendar
Lecture, Fall Semesters

OS 610 Strategic Planning

[Cross-listed with OS 611] This course provides an integrative approach to recognition, analysis and solution of strategic issues or challenges facing business executives in their quest to gain and sustain strategic advantage in the world marketplace. Through case

analyses, as well as other instructional methods, students will develop the synthetic, critical thinking, and communication skills necessary for effectively managing in a global context. Students will also develop an ethical/moral understanding of the dynamics involved in the creation and distribution of value among organizational stakeholders.

Prerequisites: completion of all CUSB MBA foundation requirements and admission to the MBA program. Prerequisites: AC603, EC604, FN607, MK609, OM606, OS608, and SB609.

Credits: (2), Graded, Semester Calendar
Lecture, Every Semester

OS 611 Strategic Planning

[Cross-listed with OS 610] This course provides an integrative approach to recognition, analysis, and solution of strategic issues or challenges facing business executives in their quest to gain and sustain strategic advantage in the world marketplace. Students will develop the synthetic, critical thinking, and communication skills necessary for effectively managing in a global context. Students will perform detailed strategic assessment of market opportunities and risks, and create detailed strategic plans that integrate and apply supply chain, financial, marketing, human resource, legal, economic, and technological concepts and analyses. Emphasis will be placed on global, technological, and innovation-oriented issues. Finally, students will learn how to align supply chain strategies with competitive and corporate level strategies. Prerequisites: AC604, EC605, FN608, MK610, OM603, and OM607
Credits: (3), Graded, Quarter Calendar
Lecture, Given When Needed

OS 650 Competing By Design

[Formerly MBA 650] Design often signals a shift in strategic emphasis and patterns of organizational performance. Design can also be used to shape an organization's tone or operating style. Dramatic and lasting restructuring or re-engineering plans often fail without the mindset of change architects who share the new strategic vision and corporate values. The ultimate goal of design is to use organizational structures, systems, and processes creatively as a sustainable source of competitive advantage. This course focuses on examining how successful corporations leverage competitive advantages through restructuring and external alliances. Students will apply theoretical knowledge and conceptual models to analyze organizational structures, diagnose organizational design, and evaluate a range of design options and implementation strategies available for transitioning organizations.
Credits: (3), Graded, Quarter Calendar
Lecture, Summer Terms

OS 651 High Performance Leadership

[Formerly MBA 652] This course emphasizes cognitive skills and experiential practicum learning applied to ongoing leadership and organizational problems. Students learn about leadership roles and competencies essential for building and supporting organizational capabilities and business strategies in global markets. The course also enables students to learn a method to diagnose their strengths and weaknesses in leadership capacities and measure their proficiency against bench-marked models of high performance leadership.
Credits: (3), Graded, Quarter Calendar
Lecture, Spring Terms

OS 654 Labor Relations

[Formerly MBA 654] This comprehensive course ties together the history of modern labor movements in the United States with issues facing workers in the Twenty-First Century, including the impact of globalization and international outsourcing. Subtopics include negotiation, conflict resolution, and workforce diversity. In addition, a comparative study on international unions will be examined. Each week, current events and their implications for labor relations will be discussed.

Credits: (3), Graded, Semester Calendar
Lecture

OS 656 Leading Organizational Change

[Cross-listed with OS 657] This course examines the processes of organizational change in dynamic technological and global business environments to enhance organizational quality, productivity, and overall operation. The course focuses on leadership approaches that facilitate stakeholder acceptance of change and employee contribution to the management of change. Topics include: change models and theories, the various types of organizational change, planned organizational change, resistance to change, the role of change management consultants, and human resource management practices that facilitate change. The types of change considered range from minor change interventions to transformational change, including technological, cultural, and work design changes. The course utilizes case studies, skills development exercises, and group projects in the study of organizational change. Prerequisite: OS 608 (Organizational Behavior and Performance Management), or OS 603 (Leadership Development II)

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

OS 657 Leading Organizational Change

[Cross-listed with OS 656] This course examines the processes of organizational change in dynamic technological and global business environments to enhance organizational quality, productivity, and overall operation. The course focuses on leadership approaches that facilitate stakeholder acceptance of change and employee contribution to the management of change. Topics include: change models and theories, the various types of organizational change, planned organizational change, resistance to change, the role of change management consultants, and human resource management practices that facilitate change. The types of change considered range from minor change interventions to transformational change, including technological, cultural, and work design changes. The course utilizes case studies, skills development exercises, and group projects in the study of organizational change. Prerequisite: OS 608 (Organizational Behavior and Performance Management), or OS 603 (Leadership Development II)

Credits: (3), Graded, Semester Calendar
Lecture, Summer Semesters

OS 659 Women and Management

[Formerly MBA 658] Several scholars on organizational behavior have acknowledged that organizational cultures are "gendered." For example, although women and men have reached numerical parity in management overall, fewer women than men lead organizations, including the powerful Fortune 500 organizations. This course will examine the status of women in management and discuss issues that women managers face, including differences in leadership styles, obstacles to advancement, and pay, benefit and resource inequity.

This course also addresses themes of ethical decision-making, authority, power and leadership and conflict in organizational life. We also discuss interconnections among equality issues: sex, race, class, age, sexual orientation and disability. Women managers in the Capital District will discuss their personal experiences with gendered organizations and apply the theories and empirical research presented in the readings to their personal experiences.

Credits: (3), Graded, Quarter Calendar
Lecture

OS 660 Executive Decision Making Processes

[Formerly MBA 660] Making decisions is the most important job of any executive. It is also the toughest and riskiest. This course explores decision making from multiple perspectives. The process of executive decision making is emphasized: How do executives make decisions? How do they sift through the information without drowning in the sea of strategic options? What are the factors that lead them in a certain direction? Content covered includes structured information gathering (e.g. industry economic traits, competitive conditions, and future profit estimates), environmental scanning (e.g. changing customer needs, new technologies), and the role of managerial intuition in making strategic decisions. This course also explores the streams of unconscious routines, called heuristics, used to cope with the complexity inherent in most decisions. These are related to psychological traps in executive decision-making and cognitive biases, which lead to failures in decision making. These failures often undermine everything from new product development to acquisition and divestiture strategy to promotion and succession planning. This course helps students understand how decision processes work and emphasizes important lessons of how to make better decisions under conditions of change and uncertainty.

Credits: (3), Graded, Quarter Calendar
Lecture, Fall Terms

OS 666 Negotiations and Relationship Management

[Cross-listed with OS 667] This course examines the complex problems associated with the management of stakeholder relationships under conditions of rapid economic change and intense global competition. The course emphasis is on the establishing, negotiating, building, sustaining, and repairing of both workplace and external relationships, including relationships with employees, management, customers, suppliers, manufacturers, shareholders, society, and other key stakeholders. This course provides an in-depth understanding of the theories of negotiation, conflict, complaint handling, and norms and ethics of fairness. The course also provides a foundation on labor relations, collective bargaining, and U.S. labor and employment laws, with an emphasis on the corresponding implications for union and nonunion workplaces. The course is intended to be applicable to a broad spectrum of work- or business-related relationship issues faces by managers and professionals. Prerequisites: OS608 (Organizational Behavior & Performance Management) or OS602 (Leadership Development I).

Credits: (3), Graded, Semester Calendar
Lecture, Fall Semesters

OS 667 Negotiations and Relationship Management

[Cross-listed with OS 666] This course examines the complex problems associated with the management of stakeholder relationships under conditions of rapid economic change and intense global competition. The course emphasis is on the establishing, negotiating, building, sustaining, and repairing of both workplace and

external relationships, including relationships with employees, management, customers, suppliers, manufacturers, shareholders, society, and other key stakeholders. This course provides an in-depth understanding of the theories of negotiation, conflict, complaint handling, and norms and ethics of fairness. The course also provides a foundation on labor relations, collective bargaining, and U.S. labor and employment laws, with an emphasis on the corresponding implications for union and nonunion workplaces. The course is intended to be applicable to a broad spectrum of work- or business-related relationship issues faced by managers and professionals.

Prerequisites: OS603 or OS602

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

OS 675 Human Resource Management Systems

[Formerly MBA 675] This course covers theories, empirical research and practical applications relevant to strategic human resource management from three major perspectives: legal, management and social science. The course will provide foundational knowledge in human resource and anti-discrimination law, job analysis, and strategic human resource planning processes. Four functional areas of human resource management will be addressed: recruitment/selection, training/development, motivation (e.g., performance management, compensation/benefits) and maintenance (e.g., communications, health and safety, labor relations, corrective action/discipline).

Credits: (3), Graded, Quarter Calendar

Lecture, Winter Quarters

OS 676 Current Issues in Human Resource Management

[Formerly MBA 676] This course addresses the strategic practice of human resource management from the perspective of an organizational leader striving to work strategically, ethically, and effectively with people. Current topics of importance in human resources (such as employee engagement, diversity/inclusion, work-life integration strategies, shifting employment relationships) will be addressed, discussing ways to manage human resources effectively in organizations' dynamic legal, social and economic environments. Course topics will be examined using a problem solving approach, through analyses of case studies and court cases, social science research, and federal/state/local legislation.

Credits: (3), Graded, Quarter Calendar

Lecture, Spring Terms

OS 677 International Human Resources

[Formerly MBA 677] International Human Resource Management will focus on how effective human resource policy and practice contributes to a global company's competitiveness. This course will be considered within the context of strategic business objectives, culture, and resource management constraints given by the various national entities. Special focus will be placed on understanding the unifying human resource policies that support the strategic objectives of a global organization. This course will draw on practical examples from companies that have experienced challenges of international human resource management.

Credits: (3), Graded, Quarter Calendar

Lecture, Summer Terms

OS 681 Strategic Management

[Formerly MBA 681] This capstone course provides an integrative approach to the recognition, analysis, and action that managers need

as part of the effective strategic management process. Critical thinking, creative thinking, and analytical skills applicable to strategy formulation and implementation are developed across a variety of organizational contexts. Concepts including multiple strategic frameworks, competitor analysis, and competitive advantage are applied to real organizations. Enhanced written and oral communications skills are developed to persuasively and credibly present strategic conclusions and recommendations. Different types of data are analyzed and tools and models from core MBA coursework are integrated. A strategic assessment is conducted, including relevant recommendations that consider ethical practices and corporate social responsibilities. Prerequisites: AC 604, EC 605, FN 608, MK 610, OM 607, OS 603, and SB 610

Credits: (3), Graded, Quarter Calendar

Lecture, Winter and Spring Terms

OS 687 Project in Organizational Studies

An investigation of a problem undertaken by the student under the guidance of an individual faculty member. The course provides an opportunity for the student to explore an area of organizational research in depth on an independent study basis. To register students must receive approval of the faculty member.

Prerequisites: consent of the instructor.

Credits: (1-6), Graded, Semester Calendar

Independent Study, Every Semester

OS 688 Project in Organizational Studies

An investigation of a problem undertaken by the student under the guidance of an individual faculty member. The course provides an opportunity for the student to explore an area of organizational research in depth on an independent study basis. To register students must receive approval of the faculty member.

Prerequisites: consent of the instructor.

Credits: (1-6), Graded, Quarter Calendar

Independent Study, Given When Needed

Occupational Therapy

OT 501

Gross Anatomy

This course will provide students with a sound working knowledge of the structure of the human body with a strong emphasis on the musculoskeletal and nervous systems through the study of clinical anatomy. The relationship between structure and function will be addressed and the integration of these body systems during normal and abnormal function will be reviewed. Course structure will focus on regional anatomy and therefore will emphasize the relationship between various structures including muscles, nerves and arteries. The laboratory is designed to facilitate the study of human anatomy through the dissection of human cadavers and examination of skeletal materials and anatomical models. In addition, dissection provides students a unique opportunity to consider and discuss issues of professionalism, team-building, ethics, and death and dying.

Prerequisite: Students must be admitted into the OT-MS program

Credits: (4), Graded, Semester Calendar

Lecture, Odd Fall Terms

OT 503

Neuroscience

This course will focus on the application of neuroscience theory and clinical principles of nervous system function to behavioral outcomes in sensation, movement, perception and cognition as typically seen by rehabilitation professionals. Anatomy and function of the human nervous systems will be taught with emphasis placed on their role in

development, movement and motor learning, the sensory system, cognition, perception and behavior for the purpose of understanding rehabilitation principles and intervention. Components of normal function and dysfunction of the peripheral and central nervous systems will be reviewed from the perspective of the rehabilitation specialist. Nervous system components including the spinal cord, brainstem, cerebrum and the auditory, visual and vestibular systems will be reviewed. Primary roles and functions, knowledge of the physical structures involved and the neural pathways that link systems will be reviewed. Examination of human brain specimens and anatomical models will be used both in this course and the experiential learning component of this course.

Prerequisites: Successful completion of all previous semester courses.

Credits: (4), Graded, Semester Calendar

Lecture, Odd Spring Terms

OT 507 Basic Science: Cognition and Occupational Performance

In this basic science course, students are introduced to the tenets of cognitive and perceptual rehabilitation in occupational therapy. Students will explore how cognitive and perceptual deficits impact occupational performance and health related quality of life. Neurocognitive disorders will be reviewed, along with current assessments, evidence-based interventions, and practice models. Competency will be assessed with two simulation practical examinations. Prerequisite: Students must be admitted into the OT-MS program

Credits: (4), Graded, Semester Calendar

Lecture, Even Spring Terms

OT 511 Devel & Occupational Performance Across the Lifespan

In this course, students will explore motor, cognitive and psychosocial development and age-related changes that occur from birth through older adulthood in typical individuals. Students will gain an appreciation for, and understanding of, individual and contextual factors that influence development and aging, including but not limited to biologic, social, environmental and health-related factors. They will examine the relationship between development and aging on performance skills, and apply this knowledge to gain a deeper understanding of activity demands. Students will be able to recognize the challenges that are presented when typical development does not occur or when age-related conditions negatively impact occupational performance. Prerequisite: Students must be admitted into the OT-MS program

Credits: (2), Graded, Semester Calendar

Lecture, Fall Terms

OT 517 Foundations in Evidence Based Practice: Applied Research II

This experiential learning course is the final course in the occupational therapy research sequence. The course provides an in-depth examination of research and its relationship to multiple areas of practice and practice assumptions. Students will obtain an advanced understanding of theory-based research, selecting appropriate methodology and units of analysis in the design of research, ways of evaluating practice, and approaches to analyzing data. They will learn how to carry out and complete a scholarly activity. At the conclusion of this course, students will produce a scholarly report and participate in the dissemination of their work.

Prerequisites: Successful completion of all previous semester courses.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Terms

OT 521 Basic Science: Mental Health & Occupational Performance

This basic science course provides students the opportunity to revisit the roots of occupational therapy, as students explore the role of the profession as it relates to mental health issues. Students will compare the traditional role of OT practice in this field with current trends and emerging practice as they explore the impact of mental health and psychosocial issues on occupational performance across a lifespan. Additionally, students will explore how mental health and psychosocial issues can impact all areas of practice, from pediatrics, to adult physical dysfunction, to non-traditional practice areas.

Credits: (2), Graded, Semester Calendar

Lecture, Odd Fall Terms

OT 525 Experiential Learning Lab 3

This is the third of four experiential learning labs. The focus of the course is to allow students the opportunity to critically evaluate ecological perspective for occupational therapy intervention as we move through crises and transitions across our lifespans. Students will use evaluation data and experiential learning to explore the interrelatedness of the individual, the environment and the engagement in occupation and examine the ways multiple contextual influences impact intervention and health outcomes. Students will critically assess the concept of 'thinking locally and globally' as they analyze theoretical approaches from a literature and a variety of intervention techniques.

Prerequisites: Successful completion of all previous semester courses.

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Terms

OT 527 Experiential Learning Lab 4

What is OT the unique solution for? How can occupational engagement and participation be core components to an abundant world? This course begins with an exploration of theories related to management and leadership and ends investigating the concept of social entrepreneurs and change agents. Students will explore emerging areas as identified by AOTA. They will also learn to use research as a valuable tool for their professional lives. Prerequisites: OT 505, OT 515, OT 525, OT 545, and (OT 630, or OT 631, or OT 632)

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Terms

OT 531 Foundations in Occupation Based Practice

In this foundational course, students are introduced to the profession of occupational therapy through history, theory, and current practice and professional affiliations. Overview of the value of occupational therapy in society is presented as students examine professional terminology, historical constructs of occupation, and the use of activities as therapeutic and healing practices. Students will be introduced to professional behaviors, ethical codes of behavior, professional documentation and the global community of the profession. Restriction: Students must be admitted into the OT-MS program

Credits: (3), Graded, Semester Calendar

Lecture, Odd Fall Terms

OT 533 Basic Science: Applied Kinesiology for OT's

Kinesiology is the study of human motion. Students will demonstrate knowledge and understanding of the structure and function of the human body as it relates to human movement and occupation. This course is designed to establish a basis of general biomechanical principles as it relates to Occupational Therapy practice. The course

consists of both lecture and laboratory sessions. Laboratory sessions will provide the student with practical applications of principles discussed in lectures. In addition, the laboratory sessions will allow the student to become proficient in the areas of surface anatomy and palpation, manual muscle testing, and goniometry. The student will study normal and pathological movements. Students will employ logical thinking, critical analysis, problem solving, and creativity throughout this course. The influence of the environment on occupational performance will be explored. Cases will invite the exploration of the learned concepts to subjective experiences of meaningful engagement in work and play.

The focus will included but not be limited to, level of arousal, orientation, recognition, attention span, initiation of activity, termination of activity, memory, sequencing, categorization, concept formation, spatial operations, problem solving, learning, and generalization, as they are manifested across the lifespan, or resultant from disease process/effects. Students will develop entry level skills of the student occupational therapist sufficient for treatment planning, note writing, patient safety, and student safety in clinical practice.

Prerequisites: Successful completion of all previous semester courses.
Credits: (2), Graded, Semester Calendar

Lecture, Odd Spring Terms

OT 537 Bridging Science to Pediatric Assessment

In this course, students will develop skills in obtaining, interpreting and reporting evaluative information and data through both standardized and non-standardized methods. They will gain the ability to utilize comprehensive evaluation results to identify meaningful and realistic intervention goals that are relevant to the practice setting, and reflect client/family needs and priorities. Students will gain an ability to accurately and professionally report the results of an evaluation both orally and in a formal evaluation report.

Prerequisites: Successful completion of all semester 3 courses.

Credits: (2), Graded, Semester Calendar

Lecture, Summer Terms

OT 541 Foundations in Research

Students will refine their ability to locate, evaluate, and incorporate research evidence into the practice of occupational therapy. Students will build upon research analysis and information literacy skills from prior coursework as they develop clinical questions, conduct database searches to obtain evidence, critically analyze available evidence, and determine relevancy to clinical practice. Students will review quantitative and qualitative research methodologies and designs, analyze scholarly works and assess both role established and role emergent concerns in occupational therapy profession. Students will identify an over-arching research question derived from their own area of interest and begin to examine the current body of knowledge related to their variables of interest, identify appropriate methodologies for the question. Students will work with faculty to develop a proposal from which their scholarly activity and propose a plan for their scholarly study will evolve. This course will include the development of a Critically Appraised Paper (CAP). Restriction: Students must be admitted into the OT-MS program

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Terms

OT 547 Seminar D: Guided Practice in Scholarly Activity

This course will provide students with the opportunity to work closely with their mentor and complete a graduate level scholarly activity. Students will be required to disseminate their projects in a scholarly forum. This course supports students as they develop the ability to synthesize student learning and prepare to enter their fieldwork experience. To that end, the students will have the opportunity to deeply reflect on the role of occupational therapy in promoting the health and well-being for the individual, family and society, embody habits of health professionals and create plan for entry into the field of occupational therapy. Students will work with instructor to successfully complete the NBCOT practice exam. Prerequisites: OT 505, OT 515, OT 525, OT 545, and (OT 630, or OT 631, or OT 632)

Credits: (2), Graded, Semester Calendar

Seminar, Even Spring Terms

OT 551 Defining & Understating Occupational Performance

This course will incorporate a combination of lecture, video, guest lectures and collaborative group learning activities to reinforce the connection between the Occupational Therapy Practice Framework and real-life. Students will apply knowledge of human development, behavior, and newly acquired knowledge of occupational performance to observations of humans engaged in daily routines and activities. They will employ critical thinking skills to explore the relationships between client factors, context and environment, and occupation, and how this impacts health and disability. Through active learning assignments, students will apply concepts of occupation and activity to therapeutic intervention, and become familiar with various service delivery models. Throughout the course, core competencies of interpersonal skills, oral and written communication, critical thinking and scientific reasoning will be reinforced. Students can expect to gain an understanding of the role and process of occupational therapy in promoting health among individuals with and without disabilities. This class is delivered in a flipped format; students will be expected to complete preparatory activities (posted on Moodle) prior to class so that they can participate fully in the hands-on application activities during class time. Restriction: Students must be admitted into the OT-MS program

Credits: (3), Graded, Semester Calendar

Lecture, Odd Fall Terms

OT 553 Basic Science: Cognition and Occupational Performance

In this basic science course, students are introduced to the tenets of cognitive and perceptual rehabilitation in occupational therapy. Students will explore how cognitive and perceptual deficits impact occupational performance and health related quality of life. Neurocognitive disorders will be reviewed, along with current assessments, evidence-based interventions, and practice models. Competency will be assessed with two simulation practical examinations.

Prerequisites: Successful completion of all previous semester courses.

Credits: (2), Graded, Semester Calendar

Lecture, Odd Spring Terms

OT 557 Bridging Science to Upper Extremity Rehabilitation

In this hands-on, highly interactive course, students will link learned science concepts from anatomy, neuroanatomy, kinesiology, and occupational science to the art and science of upper extremity rehabilitation. Upper extremity assessment and intervention, and the link to meaningful occupational engagement, will be explored

through cases. The importance of the hand in everyday functioning will be explored through an anthropology, biological, and occupational science perspective. Experiential learning component of the course will require students to create orthotic devices aimed toward the client's social and cultural adaptation to disabilities and to maximize health and participation.

Prerequisites: Successful completion of all semester 3 courses.

Credits: (2), Graded, Semester Calendar

Lecture, Even Fall Terms

OT 563 Bridging Science to Adult Conditions and Assessment

This course links concepts learned in gross anatomy (OT 500) to the first experiential learning lab (OT 583). Clinical correlations covered in lectures as well as laboratory will present the fundamentals of human anatomy in a clinical context. Material covered will provide students with a rich foundation in which they will develop clinical reasoning that guides occupational therapy practice, professional inquiry and evidence based decision-making. Corequisite: OT583

Credits: (2), Graded, Semester Calendar

Lecture

OT 567 Bridging Science to Adult Neuro Conditions and Assessment

This course links concepts learned in Neuroscience (OT 503) to the second experiential learning (OT 587). Clinical correlations covered in lectures as well as laboratory will present the fundamentals of understanding and identifying neuroscience related health conditions in a clinical context. Material covered will provide students with a rich foundation in which they will develop clinical reasoning that guides occupational therapy practice, professional inquiry and evidence based decision-making.

Credits: (2), Graded, Semester Calendar

Lecture, Given When Needed

OT 583 Experiential Learning Lab I

This course serves as the experiential lab for common conditions and ailments seen by OTs in the adult population. Students integrate knowledge of gross anatomy, the impact of disease and disability throughout the lifespan and related pathological conditions to explore the impact of life style choice, health and disability on occupational performance and participation. Students begin to become competent in administering, interpreting and documenting the evaluation process and the related impact on client factors, performance skills and patterns, occupational performance, and the interconnectedness of cultural, contextual and environmental factors. The use of evaluation data to design and implement interventions with those who are at risk for, or who have acquired, disabilities due to disease or trauma will be explored in this course. Case studies are woven throughout this course to provide a platform for students to develop critical thinking skills, design and implement theoretically sound, evidence based interventions through goal setting, treatment planning termination of services and the use of a variety of intervention techniques incorporating innovation and technology to allow the client to engage in meaningful occupations.

Prerequisites: Successful completion of all previous semester courses.

Credits: (3), Graded, Semester Calendar

Laboratory, Spring Terms

OT 587 ELL II: Applied Neuroscience and Human Occupation

This course serves as the experiential lab for OT 503 Case Base Reasoning II: Gross Anatomy, Neuro-Rehabilitation and Human Occupation. Students integrate knowledge focused on the

neurological concepts and related pathological conditions to explore the impact on occupational performance and participation with the adult population. Students will become competent in identifying, administering, interpreting and documenting the evaluation process and the related impact on client factors, performance skills and patterns, occupational performance, the impact of contextual and environmental factors. Students will develop critical thinking skills to provide sound rationale for, design and implement evidence based interventions through goal setting, treatment planning and the use of a variety of intervention techniques incorporating innovation and technology to allow the client to engage in meaningful occupations. Students must achieve competence in assessment, intervention and documentation of the OT process for all conditions covered in this course. Prerequisite: OT583.

Credits: (3), Graded, Semester Calendar

Laboratory, Odd Spring Terms

OT 591 Professional Seminar A

In this highly interactive, advanced seminar, students will explore their own strengths and challenges, and explore how to utilize that information to optimize the learning experience, work in a cohort, and work as an occupational therapist. Professional behaviors, group cohesion and interprofessional communication will be examined as a means of developing oneself as a professional and agent of change. Entry-level concepts such as ethical practice and medical documentation will also be explored. This class is the first of four professional seminar classes. Restriction: Students must be admitted into the OT-MS program

Credits: (2), Graded, Semester Calendar

Seminar, Odd Fall Terms

OT 595 Professional Seminar B

Students will explore inter-professional practice, emerging practice, and understand the crucial, unique, and vital role occupational therapists play in a variety of teams. Through the exploration of different practice areas, students will understand how occupational performance plays a key role in health and wellness, despite practice setting. Health literacy and advocacy are addressed, as students start exploring clinical questions, critically analyze available evidence, and begin learning how to convey this knowledge to clients, colleagues, and other stakeholders. This class is the second of four professional seminar classes.

Prerequisites: Successful completion of all semester 2 courses.

Credits: (2), Graded, Semester Calendar

Seminar, Odd Spring Terms

OT 597 Professional Seminar C: Clinical Scholarship

This seminar provides students the opportunity to examine and discuss specialty topics related to practice. Topics are taught in modules, allowing students to explore each topic in depth. During each module, students will explore research as it applies to occupation based practice, understand ways to collect evidence in the clinic and incorporate that evidence into occupational therapy best practice, learn ways to disseminate this information to peers, colleagues, and clients, and advocate for change. Examples of concepts covered in this class may include, death and dying, cancer, social determinants of health, and driving. The course will remain fluid to allow for educational changes as the profession changes. This class is the third of four professional seminar classes.

Prerequisites: Successful completion of all semester 3 courses.

Credits: (2), Graded, Semester Calendar

Seminar, Even Fall Terms

OT 603 Eng Health through Creativity, Craft & Anal of Occupation

Students will explore both historic and present-day relevance of Mary Reilly's quote: "Man, through the use of his hands as they are energized by mind and will, can influence the state of his own health." Students will examine the relationship between creativity, activity, and occupation through personal involvement in creative endeavors and analysis. This course explores how creative expression plays a vital role in health and personal transformations. Students will learn to gather occupational history, analyze tasks and skills, identify necessary performance skills, and explore current and innovative adaptations and modifications to foster participation.

Prerequisites: Successful completion of all previous semester courses.

Credits: (3), Graded, Semester Calendar

Lecture,

OT 605 Engineering Pathways to Participation through Technology

In this course, students will explore the role that modifications and adaptations have in maximizing independence, functional capabilities, and occupational performance and engagement for individuals with a variety of health conditions. They will gain an understanding of concepts of Universal Design as a proactive means of supporting participation among all individuals. They will also acquire an understanding of the no-tech, low-tech, mid-tech and high-tech interventions that can be implemented to address specific functional areas. Students will gain an understanding of the process of selecting appropriate strategies, adaptive equipment or assistive technologies, while ensuring a good fit between client needs and intervention/tool characteristics.

Prerequisites: Successful completion of all semester 2 courses.

Credits: (2), Graded, Semester Calendar

Lecture, Summer Terms

OT 630 Eng Pathway: Tech for Health-Related Quality of Life II

In this second application course, the student will continue to integrate didactic material, concepts of occupation based practice, clinical reasoning, reflection, and evidence based decision-making. Students will investigate theoretical constructs relevant to their selected practice interests and articulate the theory of change relevant to their scholarly pursuit. At the end of the course, students will create a professional development learning plan with the help of a faculty mentor. This faculty can be in or outside the occupational therapy department. The practice interests are as follows: In this Technology for Health-Related Quality of Life specialty track, students will gain an in-depth understanding of how technology can be utilized by occupational therapists to promote occupational performance, quality of life and access to healthcare. Didactic presentation of material will be supplemented by hands-on exploration of technology devices and active practice of task/tool adaptations and modifications. Over the course of the semester, students will also have the opportunity to meet with at least three technology mentors from the fields of assistive technology, robotics, rehabilitation engineering, telehealth, or other related areas to gain an understanding of the practical application of course material. This course will culminate with a creative student project focusing on the use of technology to address an unmet individual, community or societal need.

Prerequisites: Successful completion of all previous semester courses.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

OT 631 Eng Pathway: Occupational Therapist as an Educator II

In this second application course of this course, the student will continue to integrate didactic material, concepts of occupation based practice, clinical reasoning, reflection, and evidence based decision-making. Students will investigate theoretical constructs relevant to their selected practice interests and articulate the theory of change relevant to their scholarly pursuit. At the end of the course, students will create a professional development learning plan with the help of a faculty mentor. Students will locate and apply for a grant in support of individualized scholarly activity. Students will be provided the opportunity to immerse him or herself in their specialty area of interest, expand their knowledge and skills, and to apply those knowledge and skills to forge an innovative solution to an identified need. Faculty mentor can be in or outside the occupational therapy department. The practice interests are as follows: Occupational Therapist as an Educator Academia, [the role of occupational therapist as educator and member of an educational team], will be conceptualized as a unique practice setting. The occupation of teaching and learning will be viewed along the continuum of intervention and outcome. Students will examine best practices in teaching and learning, creating and assessing learning outcomes and application of learning theory. Methods of quantitative and qualitative clinical research will be presented emphasizing how clinicians apply evidence to learning experiences and use the scientific method to resolve learner problems. Students will explore cultural attributes of learners, evaluate performance patterns of learners, and explore techniques and strategies that optimize teaching and learning.

Prerequisites: Successful completion of all previous semester courses.

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Terms

OT 632 Eng Pathway to Clinical Practice: Innovative Practitioner II

In this second application course of this course, the student will continue to integrate didactic material, concepts of occupation based practice, clinical reasoning, reflection, and evidence based decision-making. Students will investigate theoretical constructs relevant to their selected practice interests and articulate the theory of change relevant to their scholarly pursuit. At the end of the course, students will create a professional development learning plan with the help of a faculty mentor. Students will locate and apply for a grant in support of individualized scholarly activity. Students will be provided the opportunity to immerse him or herself in their specialty area of interest, expand their knowledge and skills, and to apply those knowledge and skills to forge an innovative solution to an identified need. Faculty mentor can be in or outside the occupational therapy department. The practice interests are as follows: Innovative Practitioner

Methods of quantitative and qualitative clinical research will be presented emphasizing how clinicians apply evidence to learning experiences and use the scientific method to resolve learner problems. Students who elect to participate in the Innovative Practitioner track will have the opportunity to capitalize on the entrepreneurial spirit that is inherent in a Clarkson education and leverage Clarkson's expertise through cross-disciplinary collaborations. Students will identify a need, formulate a plan to action, form teams around their ideas and work with the team and instructor to develop a well thought-out solution. Lectures and

course material will be designed to support individual student learning needs.

Prerequisites: Successful completion of all previous semester courses.
Credits: (3), Graded, Semester Calendar
Lecture, Even Fall Terms

OT 640 Eng Pathway: Tech for Health-Related Quality of Life II

In the second track courses, students will develop their own learning project or research under the tutelage of the course instructor and/or a mentor advisor. Students remain in their chosen track course, and by doing so, have an opportunity to immerse themselves in their specialty area of interest, expand their knowledge and skills, and apply their knowledge and skills to produce a scholarly project that contributes to the profession. Throughout this process students will be encouraged to engage in activities to promote personal and professional growth while developing the critical skills of a life-long learner.

Prerequisites: Successful completion of all semester 3 courses.
Credits: (2), Graded, Semester Calendar
Lecture, Even Spring Terms

OT 641 Eng Pathway: Occupational Therapist as a Researcher II

In the second track courses, students will develop their own learning project or research under the tutelage of the course instructor and/or a mentor advisor. Students remain in their chosen track course, and by doing so, have an opportunity to immerse themselves in their specialty area of interest, expand their knowledge and skills, and apply their knowledge and skills to produce a scholarly project that contributes to the profession. Throughout this process students will be encouraged to engage in activities to promote personal and professional growth while developing the critical skills of a life-long learner.

Prerequisites: Successful completion of all semester 3 courses.
Credits: (2), Graded, Semester Calendar
Lecture,

OT 642 Eng Pathway to Clinical Practice: Innovative Practitioner II

In the second track courses, students will develop their own learning project or research under the tutelage of the course instructor and/or a mentor advisor. Students remain in their chosen track course, and by doing so, have an opportunity to immerse themselves in their specialty area of interest, expand their knowledge and skills, and apply their knowledge and skills to produce a scholarly project that contributes to the profession. Throughout this process students will be encouraged to engage in activities to promote personal and professional growth while developing the critical skills of a life-long learner.

Prerequisites: Successful completion of all semester 3 courses.
Credits: (2), Graded, Semester Calendar
Lecture, Even Spring Terms

OT 700A Fieldwork Level I

OT 700 provides the student with an introduction to the fieldwork experience and the opportunity to develop a basic comfort level with and understanding of client needs. Students will develop professional and ethical behaviors while exploring current and emerging roles of occupational therapy with a variety of populations across the lifespan, in a variety of settings. While assisting in service delivery and intervention, students engage in an exploration of efficacy, therapeutic use of self, empathy and mindfulness and the development of self-awareness to support the art, craft and skill of

effective therapeutic relationships. Students will reflect on the role of innovation and technology in meeting the needs of clients in a rural context. Students will begin to develop a deeper understanding of how psycho-social factors influence engagement in occupation. Students also participate in an accompanying seminar that offers the opportunity for peer interaction, mentoring and feedback as professional competence begins to emerge.

Level IA fieldwork experiences begin following the students first full academic year with a 2 week full-time rotation. Level IB Fieldwork is embedded during the fall or spring semester of the second academic year to allow simultaneous classroom and clinical education opportunities. This fieldwork experience runs 1 day per week for 12 weeks. Level I fieldwork cannot be substituted for any part of the Level II fieldwork requirement.

Prerequisites: Successful completion of all previous semester courses.
Credits: (2), Graded, Semester Calendar
Field Studies, Fall and Spring Terms

OT 700B Fieldwork Level I

OT 700 provides the student with an introduction to the fieldwork experience and the opportunity to develop a basic comfort level with and understanding of client needs. Students will develop professional and ethical behaviors while exploring current and emerging roles of occupational therapy with a variety of populations across the lifespan, in a variety of settings. While assisting in service delivery and intervention, students engage in an exploration of efficacy, therapeutic use of self, empathy and mindfulness and the development of self-awareness to support the art, craft and skill of effective therapeutic relationships. Students will reflect on the role of innovation and technology in meeting the needs of clients in a rural context. Students will begin to develop a deeper understanding of how psycho-social factors influence engagement in occupation. Students also participate in an accompanying seminar that offers the opportunity for peer interaction, mentoring and feedback as professional competence begins to emerge.

Level IB fieldwork is embedded during the fall or spring semester of the second academic year to allow simultaneous classroom and clinical education opportunities. This fieldwork experience runs 1 day per week for 12 weeks. Level I fieldwork cannot be substituted for any part of the Level II fieldwork requirement.

Prerequisite: Successful completion of all previous semester courses.
Credits: (2), Graded, Semester Calendar
Field Studies, Fall and Spring Terms

OT 705 Fieldwork Level II A

This is the first 12-week placement which will allow the student to begin their transition from an OT academic role to that of entry-level therapist. Potential placements will encompass the lifespan, a variety of client populations and service delivery models, and will allow the

student to apply skills in their area of specialty interest. Fieldwork is highly individualized and may span from local to global, traditional to emerging and innovative roles. Students will have opportunities to utilize critical thinking and clinical reasoning to apply curricular theories and concepts to practice in the evaluation process, intervention planning, and the use of occupation as intervention and outcome. Prerequisites: OT 507, OT 517, OT 527, OT 547, and (OT 640 or OT 641 or OT 642)

Credits: (9), Pass/Fail, Semester Calendar
Field Studies, Summer Terms

OT 710 **Fieldwork Level II B**

This second 12-week placement will allow the student to complete their transition from an OT academic role to that of entry-level therapist. Potential placements will encompass the lifespan, a variety of client populations and service delivery models, and will allow the student to apply skills in their area of specialty interest. Fieldwork is highly individualized and may span from local to global, traditional to emerging and innovative roles. Students will have opportunities to utilize critical thinking and clinical reasoning to apply curricular theories and concepts to practice in the evaluation process, intervention planning, and the use of occupation as intervention and outcome.

Prerequisites: Successful completion of all previous semester courses.
Credits: (9), Pass/Fail, Semester Calendar
Field Studies, Fall Terms

Physician Assistant Studies**PA 501** **Clinical Medicine I**

This is the first in a series of courses designed to provide an intensive study of human diseases and disorders, using a lifespan approach from pediatrics to geriatrics, in the areas of clinical medicine including epidemiology, etiology, historical data, clinical manifestations, progression, therapeutic management, prevention, laboratory medicine, imaging, and prognosis. Emphasis will be on disease processes common to primary care practices and the emergency department following the NCCPA Blueprint, and the development of differential diagnoses and plans based upon the patient's clinical presentation. This course will be facilitated through lecture and problem-based learning.

Prerequisite: Admission to the PA program
Credits: (6), Graded, Semester Calendar
Lecture, Spring Semesters

PA 502 **Clinical Medicine II**

This is the second in a series of courses designed to provide an intensive study of human diseases and disorders, using a lifespan approach from pediatrics to geriatrics, in the areas of clinical medicine including epidemiology, etiology, historical data, clinical manifestations, progression, therapeutic management, prevention, laboratory medicine, imaging and prognosis. Emphasis will be on disease processes common to primary care practices and the emergency department following the NCCPA Blueprint, and the development of differential diagnoses and plans based upon the patient's clinical presentation. This course will be facilitated through lecture and problem-based learning.

Prerequisite: Successful completion of prior semester of PA course work or program permission
Credits: (6), Graded, Semester Calendar
Lecture, Summer Semesters

PA 503 **Clinical Medicine III**

This is the third in a series of courses designed to provide an intensive study of human diseases and disorders, using a lifespan approach from pediatrics to geriatrics, in the areas of clinical medicine including epidemiology, etiology, historical data, clinical manifestations, progression, therapeutic management, prevention, laboratory medicine, imaging, and prognosis. Emphasis will be on disease processes common to primary care practices and the emergency department following the NCCPA Blueprint, and the development of differential diagnoses and plans based upon the patient's clinical

presentation. This course will be facilitated through lecture and problem-based learning.

Prerequisite: Successful completion of prior semester of PA course work or program permission

Credits: (6), Graded, Semester Calendar
Lecture, Fall Semesters

PA 504 **Basic Science I**

This is the first in a series of courses designed to develop an understanding of normal physiology, genetics, pathologic, and pathophysiologic concepts of diseases per organ system, and clinical anatomy with an emphasis on important anatomical landmarks required in physical evaluation of patients, anatomical relationships of structures to each other, and anatomical components of body systems.

Prerequisite: Admission to the PA program
Credits: (2), Graded, Semester Calendar
Lecture, Spring Semesters

PA 505 **Basic Science II**

This is the first in a series of courses designed to develop an understanding of normal physiology, genetics, pathologic, and pathophysiologic concepts of diseases per organ system, and clinical anatomy with an emphasis on important anatomical landmarks required in physical evaluation of patients, anatomical relationships of structures to each other, and anatomical components of body systems. Prerequisite: Successful completion of previous semester of PA course work or program permission

Credits: (2), Graded, Semester Calendar
Lecture, Summer Semesters

PA 506 **Basic Science III**

This is the third in a series of courses designed to develop an understanding of normal physiology, genetics, pathologic, and pathophysiologic concepts of diseases per organ system, and clinical anatomy with an emphasis on important anatomical landmarks required in physical evaluation of patients, anatomical relationships of structures to each other, and anatomical components of body systems.

Prerequisite: Successful completion of prior semester of PA course work or program permission
Credits: (2), Graded, Semester Calendar
Lecture, Fall Semesters

PA 507 **Pharmacotherapeutics I**

This is the first in a series of courses designed to develop skills related to the principles of pharmacology as they pertain to therapeutic agents, prescription, and non-prescription medications. Discussion will include the principal mechanisms of action of the major classes of therapeutic agents, understanding of pharmacodynamics, uses, side effects, and toxicities.

Prerequisite: Admission to the PA program
Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

PA 508 **Pharmacotherapeutics II**

This is the second in a series of courses designed to develop skills related to the principles of pharmacology as they pertain to therapeutic agents, prescription, and non-prescription medications. Discussion will include the principal mechanisms of action of the

major classes of therapeutic agents, understanding of pharmacodynamics, uses, side effects, and toxicities.

Prerequisite: Successful completion of prior semester of PA course work or program permission

Credits: (3), Graded, Semester Calendar

Lecture, Summer Semesters

PA 509 **Pharmacotherapeutics III**

This is the third in a series of courses designed to develop skills related to the principles of pharmacology as they pertain to therapeutic agents, prescription, and non-prescription medications. Discussion will include the principal mechanisms of action of the major classes of therapeutic agents, understanding of pharmacodynamics, uses, side effects, and toxicities.

Prerequisite: Successful completion of prior semester of PA course work or program permission

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

PA 510 **Patient Assessment I**

This is the first in a series of courses designed to develop the knowledge and skills required to obtain and record the complete medical history, use of appropriate equipment, proper techniques, and accurate medical terminology to document findings. This course will provide an overview of the medical record as well as development of writing and organizational skills for medical record keeping and oral presentation skills. Skills will be developed through lecture and structured laboratory exercises.

Prerequisite: Admission to the PA program

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

PA 511 **Patient Assessment II**

This is the second in a series of courses designed to develop the knowledge and skills required to obtain and record the complete medical history, use of appropriate equipment, proper techniques, and accurate medical terminology to document findings. This course will provide an overview of the medical record as well as development of writing and organizational skills for medical record keeping and oral presentation skills. Skills will be developed through lecture and structured laboratory exercises.

Prerequisite: Successful completion of prior semester of PA course work or program permission

Credits: (3), Graded, Semester Calendar

Lecture, Summer Semesters

PA 512 **Patient Assessment III**

This is the third in a series of courses designed to develop the knowledge and skills required to obtain and record the complete medical history, use of appropriate equipment, proper techniques, and accurate medical terminology to document findings. This course will provide an overview of the medical record as well as development of writing and organizational skills for medical record keeping and oral presentation skills. Skills will be developed through lecture and structured laboratory exercises.

Prerequisite: Successful completion of prior semester of PA course work or program permission

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

PA 513 **The Patient and the PA I**

This is the first in a series of courses designed to develop skills in the area of patient communication, patient counseling, patient education, and cultural diversity and how they influence all aspects of medical practice. Instruction is focused on the detection and application of preventive measures and treatment of health risk behaviors including stress, abuse and violence, substance abuse, sexuality, end of life issues, and reaction to illness. The course will also include discussions on medical ethics.

Prerequisite: Admission to the PA program

Credits: (1), Graded, Semester Calendar

Lecture, Spring Semesters

PA 514 **The Patient and the PA II**

This is the second in a series of courses designed to develop skills in the area of patient communication, patient counseling, patient education, and cultural diversity and how they influence all aspects of medical practice. Instruction is focused on the detection and application of preventive measures and treatment of health risk behaviors including stress, abuse and violence, substance abuse, sexuality, end of life issues, and reaction to illness. The course will also include discussions on medical ethics.

Prerequisite: Successful completion of prior semester of PA course work or program permission

Credits: (1), Graded, Semester Calendar

Lecture, Summer Semesters

PA 515 **The Patient and the PA III**

This is the third in a series of courses designed to develop skills in the area of patient communication, patient counseling, patient education, and cultural diversity and how they influence all aspects of medical practice. Instruction is focused on the detection and application of preventive measures and treatment of health risk behaviors including stress, abuse and violence, substance abuse, sexuality, end of life issues, and reaction to illness. The course will also include discussions on medical ethics.

Prerequisite: Successful completion of prior semester of PA course work or program permission

Credits: (1), Graded, Semester Calendar

Lecture, Fall Semesters

PA 516 **Medical Informatics**

This course will cover the importance of evidence-based medicine and review basic statistics, research methods, and ethical standards in research. It will also cover the interpretation of medical literature and application of various types of clinical articles in answering clinical questions. It will also include the basics of medical writing to provide added guidance for upcoming projects.

Prerequisite: Successful completion of prior semester of PA course work or program permission

Credits: (1), Graded, Semester Calendar

Lecture, Summer Semesters

PA 517 **Clinical Procedures**

This course will prepare the student for the upcoming clinical year. The focus will be on procedures, such as bedside and surgical procedures including aseptic technique, air and blood-borne pathogen transmission prevention, phlebotomy, IV placement, foley catheter insertion, lumbar puncture, injections, surgical techniques, and casting.

Prerequisite: Successful completion of prior semester of PA course work or program permission

Credits: (2), Graded, Semester Calendar
Clinical, Fall Semesters

PA 518 Laboratory and Diagnostics I

Introduction to basic laboratory and diagnostic testing/studies as it applies to physician assistant studies. PA 518 Prerequisites as required for entry into the didactic phase of Clarkson PA education

Credits: (1), Graded, Semester Calendar
Laboratory, Spring Terms

PA 600 Supervised Practice - Ambulatory Medicine

This 4 week clinical course will be within a Family Medicine clinic setting. This course provides the PA student with experience in the outpatient evaluation and treatment of pediatric and adult patients, including preventive medicine, acute and chronic illness, and patient education.

Prerequisite: Completion of the preclinical year of the physician assistant program or program permission.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

PA 601 Supervised Practice - Internal Medicine

This 4 week clinical course will be within an Internal Medicine practice. It will include a substantial inpatient experience for the PA student to gain knowledge of the evaluation and treatment of the multiple diseases and conditions of the adult population requiring hospitalization.

Prerequisite: Completion of the preclinical year of the physician assistant program or program permission.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

PA 602 Supervised Practice - General Surgery

This 4 week clinical course will be within a surgical practice. PA students will participate in Operating Room (OR) cases and hospital consultations as well as clinic based cases and visits in caring for conditions that require surgical management. This will include pre-operative, intra-operative, and post-operative care.

Prerequisite: Completion of the preclinical year of the physician assistant program or program permission.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

PA 603 Supervised Practice - Emergency Medicine

This 4 week clinical course will be within a hospital Emergency Department. PA students will gain knowledge and learn skills relevant to the triage, stabilization, diagnosis, and management of acute, life-threatening injuries and illnesses as well as the care of less threatening conditions.

Prerequisite: Completion of the preclinical year of the physician assistant program or program permission.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

PA 604 Supervised Practice - Pediatrics

This four-week clinical course will provide the PA student with experience in outpatient and/or in-patient management of pediatric patients. The student will have the opportunity to perform well child

exams, problem oriented exams, evaluate common pediatric illnesses, and the care of the newborn and children.

Prerequisite: Completion of the preclinical year of the physician assistant program or program permission.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

PA 605 Supervised Practice - Women's Health

This four-week clinical course provides the PA student with experience in managing common gynecologic disorders. The obstetric experience will include routine prenatal and postpartum care. It will include labor & delivery when possible.

Prerequisite: Completion of the preclinical year of the physician assistant program or program permission.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

PA 606 Supervised Practice - Behavioral Health

This four-week clinical course will provide the PA student with a behavioral medicine experience in caring for ambulatory and/or hospitalized patients with psychiatric disorders. The student will perform basic psychiatric evaluations, monitor medications, and support the clinical management plan for patients after psychiatric evaluation and treatment.

Prerequisite: Completion of the preclinical year of the physician assistant program or program permission.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

PA 607 Supervised Practice - Elective I

This 4 week clinical course will provide the PA student the opportunity to practice in any available medical setting of the student's choice. This may be used to augment a previous clinical experience or explore an area of interest or potential future employment.

Prerequisite: Completion of the preclinical year of the physician assistant program or program permission

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

PA 608 Supervised Practice - Elective II

This 4 week clinical course will provide the PA student the opportunity to practice in any available medical setting of the student's choice. This may be used to augment a previous clinical experience or explore an area of interest or potential future employment.

Prerequisite: Completion of the preclinical year of the physician assistant program or program permission.

Credits: (3), Graded, Semester Calendar
Independent Study, Every Semester

PA 609 Clinical Research Elective

This 4 week course allows the PA student to participate in research in any medical area of interest in preparation for the student's Master's Project. The student may engage the multiple academic departments of Clarkson University outside of PA Studies for this research. Topics for research must be approved by the Department Chair and must be approved by the appropriate university review board. As an alternative, the student may perform a service learning project during this time as part of the Master's Project.

Prerequisite: Completion of the preclinical year of the physician assistant program or program permission.

Credits: (3), Graded, Semester Calendar
Independent Study, Spring Semesters

PA 610 **Summative Review**

This course, presented near the end of the clinical year, will include intensive board review in preparation for the PANCE, review for clinical skills testing, CV preparation, and interviewing skills. It also include a final clinical skills exam as well as a cumulative written test, both of which must be successfully passed to graduate from the program.

Prerequisite: Successful completion of the preclinical year and all supervised practice rotations

Credits: (1), Graded, Semester Calendar

Lecture, Spring Semesters

PA 611 **Master Project**

This course is a follow up to Medical Informatics and the Research elective. It is designed to allow the PA student to complete a master's degree project under the guidance of Clarkson faculty or a community advisor. Students may identify an area of medicine, disease process or condition, conduct research, and produce a paper worthy of publication. The student may also perform a learning service project resulting in a publishable paper or product for use in the community. The student will prepare and present an oral presentation on their topic at the conclusion of the year.

Prerequisite: Completion of the preclinical year of the physician assistant program or program permission.

Credits: (2), Graded, Semester Calendar

Research, Spring Terms

PA 900 **PA Clinical Placeholder**

This course is a clinical rotation placeholder until final clinical assignments have been finalized. Once finalized, students will be placed into the correct clinical assignment course number.

Credits: (1-12), Graded, Semester Calendar

Independent Study

Physics**PH 520** **Physical Models of Living Systems**

This course focuses on modeling essential processes in living systems using the tools and techniques of physics, including computer modeling. Using case studies in virus dynamics, bacterial genetics and naturally evolved cellular circuits, the course will explore how living organisms use physical mechanisms to gain information about their surroundings, process information and make decisions. It will also examine some of the cutting edge techniques used by scientists at the forefront of biophysical and life sciences research to study living organisms and understand their behavior. This course is broadly aimed at students studying in physics, chemistry, mathematics, computer science, chemical engineering, and biomedical engineering, in addition to biology majors with advanced math classes.

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Terms

PH 523 **Optics**

Geometrical optics: reflection and refraction at plane and spherical surfaces, lenses, lens aberrations. Physical optics: interference, diffraction, polarization, photons, absorption, scattering, electrooptics.

Prerequisite: PH132 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Even Fall Semesters

PH 525 **Thermal Physics**

Temperature, heat, thermodynamics and applications. Introduction to kinetic theory and classical and quantum statistical mechanics.

Prerequisites: PH231 and MA231 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

PH 526 **Introduction to Biophysics**

[Cross-listed by BY 526] This course concentrates on the fundamental physical processes that occur within living organisms, particularly the cell. Topics include the structure and physics of macromolecules, biological membranes, the thermodynamics of living systems, muscle contraction and the propagation of signals in nerve cells.

Prerequisite: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture

PH 531 **Quantum Physics I**

Basic principles of quantum mechanics, Schrödinger equation for simple potentials including harmonic oscillator and hydrogen atom. Selected application to atomic, molecular and nuclear structure.

Prerequisites: PH231 and MA232, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

PH 532 **Quantum Physics II**

Continuation of PH 531. Transformation theory and matrix formulation of quantum mechanics; angular momentum, spin, perturbation theory, variational methods, scattering theory.

Prerequisites: PH331 or PH531, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

PH 541 **Solid State Physics I**

This course focuses on the fundamental physical processes that occur in solid state materials. Topics include crystal structure of solids, point defects and dislocations, crystal bonding, X-ray diffraction, lattice vibrations, thermal properties, specific heat, thermal conductivity, free electron gas theory of metals, energy bands, theory of semiconductors, band gaps, doping, and a brief introduction to device physics. Graduate students will do additional course work.

Prerequisites: PH231 or ES260, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

PH 542 **Solid State Physics II**

Continuation of PH 541. Band structure of solids, electrical and thermal transport properties, magnetism, optical properties, superconductivity, semiconductors, magnetic resonance.

Prerequisites: PH 541 (or equivalent), or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

PH 547 **Nuclear Physics**

An introduction to nuclear structure, nuclear radiation and elementary particle physics. Topics include properties of nuclei, the two-nucleon forces, complex nuclei, interaction of radiation with matter, accelerators, nuclear reactions, elementary particles and their classification.

Prerequisites: PH331 or PH531, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

PH 551 **Statistical Mechanics I**

Review of thermodynamics and classical ensembles. Modern theories of phase transitions, critical phenomena, liquid structure. Introduction to Monte Carlo methods, nonequilibrium phenomena.

Prerequisites: PH325 or PH525, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

PH 553 **Relativity**

Review of the special and general theories of relativity. Topics include: tensor analysis, Riemann geometries, Minkowski geometries, unified field theories.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

PH 555 **Mathematical Methods in Physics**

Mathematics methods used in theoretical physics. Topics covered include complex variables, Fourier transforms, special functions, eigenfunction expansions, Green's functions, differential equations, linear algebra and linear spaces, with physical applications.

Prerequisite: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

PH 557 **Introduction to Astrophysics**

Radiation from astrophysical sources and measurement of position, mass, temperature, velocity, density, composition and age. Emphasis will be on recent discoveries and interpretations.

Prerequisite: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

PH 560 **Physics of Fluids**

Discussion of the mechanics of fluids based on the Navier-Stokes equation. Laminar and turbulent flows, dimensional analysis. Special topics with applications.

Prerequisite: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

PH 570 **Directed Study Experimental**

A course of study of subjects not otherwise available in formal courses may be undertaken under the supervision of a faculty member.

Prerequisite: consent of the instructor.

Credits: (1-3), Graded, Semester Calendar

Lecture, Given When Needed

PH 574 **Directed Study Theoretical**

A course of study of subjects not otherwise available in formal courses may be undertaken under the supervision of a faculty member.

Prerequisite: consent of the instructor.

Credits: (1-3), Graded, Semester Calendar

Independent Study, Given When Needed

PH 580 **Electromagnetic Theory I**

Fundamental properties of electric and magnetic fields. Gauss law, Poisson equation, dielectrics, boundary value problems, vector potential, inductance, Maxwell equations, electromagnetic waves.

Prerequisites: PH132 and MA231, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Semesters

PH 581 **Electromagnetic Theory II**

Continuation of PH 580. Detailed discussion of electromagnetic waves and their applications: filters, transmission lines, waveguides. Atomic theory of diamagnetism, paramagnetism, ferro- and anti-ferromagnetism. Theory of conduction in solids, magnetic resonance.

Prerequisites: PH380 or PH580, or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

PH 587 Applications of Synchrotron and Electron Based Techniques

The purpose of the course is to familiarize all students with the x-ray and electron based experimental techniques available at Brookhaven National Lab and other similar facilities. Students will be cognizant of the applications of these cutting edge facilities, and well positioned to use them in their own research. This course is suitable for graduate students, postdocs, and advanced undergrads in physical sciences and engineering, as well as students in biological, environmental, and chemical sciences who may have the interest to learn more about the techniques they may use for their research.

Credits: (3), Graded, Quarter Calendar

Lecture, Spring Terms

PH 589 **Physics of Semiconductor Devices**

Principles of quantum mechanics, elements of statistical physics, the energy band theory of solids, semiconductor physics, recombination mechanisms, current transport, contact phenomena, surface phenomena in semiconductors, advanced concepts in quantum and spintronic device technology.

Prerequisite: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

PH 624 **Advanced Topics in Statistical Mechanics I**

Selected topics in statistical and many-body physics, both equilibrium and nonequilibrium.

Credits: (1-3), Graded, Semester Calendar

Lecture

PH 625 **Computer Modeling in Physics**

Physical concepts using computer simulations: Euler method and its applications in classical mechanics and thermodynamics (cooling of coffee, Styrofoam ball fall, motion of planets, pendulum), random walks (Brownian dynamics), percolation, Monte Carlo method.

Pre-requisites: PH325, MA232 and knowledge of any programming language (Java, Fortran, C, C++, Matlab, etc.) or consent of the instructor. (Optional PH231/PH331 and PH380/PH381.)

Credits: (1-3), Graded, Semester Calendar

Independent Study

PH 628 **Field-Theoretical Methods in Solid State Physics**

Selected topics in applications of field-theoretical techniques to problems in solid state and condensed matter physics.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

PH 661 **Classical Mechanics**

Basic concepts of classical mechanics. The two body central force problem, Lagrange's equations, kinematics and dynamics of a rigid body, many particle systems, variational principles, Hamilton's equations, canonical transformations, Hamilton-Jacobi theory, perturbation theory, small oscillations, and continuous systems and fields.

Prerequisite: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

PH 663 **Electromagnetic Theory I**

This course includes theoretical treatment of static electric and magnetic fields, time-dependent fields, electromagnetic waves in a vacuum, in homogeneous isotropic media, and at boundaries. Also included are selected topics from special relativity, wave guides and resonant cavities, radiation and magnetohydrodynamics.

Prerequisite: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

PH 664 **Electromagnetic Theory II**

Continuation of PH 663. Prerequisites: PH 663 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

PH 669 **Quantum Mechanics I**

General formulation of quantum mechanics and its interpretation, matrix formulation, advanced perturbation and variational methods, scattering theory, atomic structure, radiative transitions and applications to atoms, nuclei, molecules and solids.

Prerequisite: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

PH 670 **Quantum Mechanics II**

Continuation of PH 669. Prerequisites: PH669 or consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Even Spring Semesters

PH 681 **Selected Topics in Physics I**

An advanced treatment of selected topics in fields of current interest not presently covered in other courses.

Prerequisite: consent of the instructor.

Credits: (1-3), Graded, Semester Calendar

Independent Study, Given When Needed

PH 682 **Selected Topics in Physics II**

An advanced treatment of selected topics in fields of current interest not presently covered in other courses.

Prerequisite: consent of the instructor.

Credits: (1-3), Graded, Semester Calendar

Independent Study, Given When Needed

PH 683 **Graduate Seminar I**

Faculty, distinguished visiting speakers, and graduate students report on current research. An important objective is to encourage the graduate students to keep informed of current developments in

physics and closely related fields, and practice presentation techniques of research results.

Prerequisite: consent of the instructor.

Credits: (1), P/NC, Semester Calendar

Seminar, Given When Needed

PH 684 **Graduate Seminar II**

Continuation of PH 683.

Prerequisite: consent of the instructor.

Credits: (1), P/NC, Semester Calendar

Seminar, Given When Needed

PH 699 **Thesis, Dissertation or Special Project**

An investigation of a problem undertaken by the student under the guidance of a faculty member.

Prerequisite: consent of the instructor.

Credits: (1-15), Thesis, Semester Calendar

Thesis Research, Every Semester

PH 999 **Special Graduate Topics**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Transfer Credit Only

Philosophy**PHIL 505 Sustainability Theory and Practice: A Critical Assessment**

This course will offer an overview and critical assessment of some of the founders, fundamental assumptions and contributions of the environmental sustainability movement in an effort to evaluate its effectiveness as an inside-the-paradigm response to the most critical challenges of our time. Graduate Students are required to perform additional assignments above those required by undergraduates.

Credits: (3), Graded, Semester Calendar

Lecture

PHIL 510 **Where the Wild Things Are: Env**

[Cross-listed with EV 510] This course takes Henry David Thoreau's claim "In Wildness is the Preservation of the World" as the philosophical starting point of the American environmental movement and its attempts to conceptualize nature as a collection of ecosystems and as an ecosphere; along with the ontological, epistemological and ethical implications that result. Authors include Thoreau, Emerson, Muir, Leopold, Stan Rowe, Wes Jackson and Stuart Kauffman. Special emphasis will be given to applications to, and issues and challenges confronting, the Adirondack Park. Graduate students are required to perform additional assignments above those required by undergraduates. Prerequisites: Must have junior or senior standing.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

PHIL 590 **Independent Study**

Working under the direction of a faculty member, this course allows a graduate student to pursue topics of interest in philosophy.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Given When Needed

Educational Physics

PHY 580 **MAT Project in Physics (Content Area)**

The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom? Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture

PHY 590 **Physics Demonstrations**

Physics Demonstrations are an important part of helping students experience events that illustrate the concepts that are studied. They can appear to be magic tricks to students who are first studying the principles they illustrate. The purpose of this course is to have prospective teachers identify appropriate demonstrations for all parts of the curriculum in an introductory physics survey course. The identification of an appropriate demonstration where the teacher fully understands the physics behind the event and that has physics that the students can understand or learn is an important skill for teachers to learn. This is a very detailed task. In order for introductory physics students to not see the event as a magic trick certain principles must first be understood. The teacher who chooses a demonstration has to understand all the principles that allow the event to take place, which ones the students have already studied and what new principles it is illustrating. The teacher also has to determine if the students understand the underlying principles necessary to have a learning experience that have already been studied. Activities need to be developed to determine this. If the principles are not understood activities need to be prepared, and ready to use, to reinforce these principles. Students will be required to identify 12 demonstrations for an introductory physics course. Each one will be done in class with the student teachers in the class acting as the 'students.' The 'students' and the professor will evaluate the demonstration and a class discussion will take place about the visibility, the teacher presentation, the relationship of the demonstration to the curriculum and the effectiveness of illustrating the physics principle it is targeting. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture

PHY 988 **Independent Study in Physics**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

PHY 989 **Independent Study in Physics**

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a

graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Independent Study, Given When Needed

Political Science

POL 550 **Development and Public-Private Partnerships**

This course introduces students to the challenges and opportunities of economic liberalization and public-private partnerships in the delivery of public goods and services. We will study public procurement, or the mechanisms through which governments buy goods and services from private vendors to fulfill their public mission. We frame procurement politics within the literature on development economics and political accountability. We study the interactions between four actors: government, law, private vendors, and civil society. We survey the linkages and tensions between economic, social, and political goals.

Credits: (3), Graded, Semester Calendar
Lecture, Even Spring Semesters

POL 570 **Environmental Policy**

A course description has not been provided for this course. Please check with the Humanities & Social Science department for a description.

Credits: (3), Graded, Semester Calendar
Lecture

POL 571 **Energy Policy**

Energy policy is a critical component of state and national public policy. Issues surrounding the reliability and security of energy supplies directly affect national domestic and foreign policy, as well as state level environmental, economic development, and land use concerns. Via emphasis on specific issues unique to North American energy policy (US and Canada), the class will introduce students to the major theoretical frameworks used by political scientists, sociologists, economists, and other intellectual disciplines to understand how societies design and implement public policies related to energy, and how the energy industry responds. Topics covered will include theories of the state, monopoly and regulation, public choice, organizational behavior, international agreements, and innovation. The class will apply these theories to major current and historical issues in energy policy, such as ethanol, climate change, and renewable energy systems, nuclear power, energy efficiency, energy security, the world oil market, and OPEC, electricity production and markets and the California electricity crisis. Graduate students will do additional coursework.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

POL 580 **The Law and Bioethics**

This course explores the relation between law, ethics, and new technologies. In particular, we will be exploring issues of the right to privacy, abortion, state sterilization programs, cloning, rights of surrogate parents, doctor/patient confidentiality, the right to die, new definitions of death, the human genome project and intellectual property rights, and organ transplantation. This inquiry will be guided by the question: 'Who Owns Life?' There is no definitive answer to this question offered by the American court system. Through readings and discussions students will gain political and ethical perspective on how legal standards are formed in response to new

demands by the public and government, and how new ethical questions are inspired by innovations in germline bioengineering, medical and rehabilitative technology, robotics, virtual reality, and nanotechnology. The material for the course will be case law and articles by leading scientists, physicians, ethicists, and legal scholars in this young field. Additional materials at the graduate level will be expected of those who register under this catalog number.

Credits: (3), Graded, Semester Calendar

Lecture

Physical Therapy

PT 505 **Foundation Sciences for Physical Therapy**

Using a Problem-Based Learning (PBL) format in small tutorial groups, clinical lab, gross anatomy lab, inquiry seminars, and self-directed learning students will develop the early cognitive, psychomotor, and affective skills necessary to be physical therapists. Cases related to the foundation sciences of anatomy (musculoskeletal and neurological) and kinesiology are covered in the different learning environments. Students will gain an appreciation for, and ability to implement physical therapy professional practice core values, in addition to skills in communication, cultural competence, clinical reasoning, evidence-based practice, and education. Students also will gain inductor clinical skills that relate to patients with all types of movement disorders who require physical therapy services. Corequisites: PT506 and PT508.

Credits: (9), Graded, Semester Calendar

Lecture, Discussion, Laboratory, Fall Semesters

PT 506 **Professional Foundation for Physical Therapy**

This course assists the student in an exploration of the structure of the health care system and the evolving role of the physical therapy profession as a primary participant. The course integrates topics such as history, ethics, politics, sociology, and economics, using seminal articles from a variety of healthcare fields to broaden the learning experience. Utilizing a largely discussion-based format, each student and faculty member will have the opportunity to facilitate interaction by drawing from assigned readings, clinical examples, and students' life experiences. This course will be integrated with case discussions in PT 505 and will provide the foundation for growth as a professional throughout the physical therapy curriculum and beyond.

Prerequisite: Admission to graduate physical therapy professional curriculum (DPT). Corequisites: PT505 and PT508.

Credits: (2), Graded, Semester Calendar

Lecture, Fall Semesters

PT 508 **Literature Critique and Review**

This course provides students with foundational concepts of evidence-based practice (EBP), and skills for critical evaluation of physical therapy research literature related to both background questions (e.g., risk factors) and foreground questions (e.g., interventions). Students will contrast and critique different types of intervention research and relate to levels of evidence. Students learn how to search for, identify, obtain, analyze and summarize appropriate literature using appropriate tools such as PubMed, PEDro, PTNow, and clinical practice guidelines. The capstone project is a literature review poster presentation. Corequisites: PT505 and PT506.

Credits: (1), Graded, Semester Calendar

Lecture, Fall Terms

PT 515 **Cardiopulmonary-Exercise Science**

Using a Problem-Based Learning (PBL) format in small tutorial groups, clinical lab, anatomy lab using cadavers, inquiry seminars and self-directed learning students will develop the cognitive, psychomotor and affective skills necessary to be physical therapists and provide services to individuals with cardiorespiratory disorders, acute conditions found in hospital settings, and exercise and fitness environments. Foundational sciences, behavioral sciences, and clinical science related to cardiorespiratory disorders are covered in different learning environments. Students will gain an appreciation for and ability to implement physical therapy professional practice core values, in addition to skills in communication, cultural competence, clinical reasoning, evidence-based practice, and education. In the different learning environments, the skills and knowledge related to the management (screening, examination, evaluation, diagnosis, prognosis, plan of care, intervention and outcomes assessment) of patients/clients with cardiorespiratory disorders are covered. Students will gain skills in practice management for individuals with cardiorespiratory disorders who require physical therapy services. Prerequisites: PT505, PT506, PT508. Good standing in the graduate physical therapy professional curriculum (DPT).

Corequisites: PT517 and PT518.

Credits: (9), Graded, Semester Calendar

Lecture, Discussion, Laboratory, Spring Semesters

PT 517 **Professional Practice I**

Participation in planned small group part time professional practice experiences. Observation and participation in Phase II and III cardiac rehabilitation, pulmonary rehabilitation, and acute care, with emphasis on examination and intervention for patients with cardiac and pulmonary illness or disease. Emphasis on addressing administrative and professional issues inherent to such clinical environments. Integration of these professional practice experiences with the case studies used in PT 515 Cardiopulmonary-Exercise Science. Prerequisites: PT505, PT506, PT508. Good standing in the graduate physical therapy professional curriculum (DPT).

Corequisites: PT515 and PT518.

Credits: (2), P/NC, Semester Calendar

Lecture, Spring Semesters

PT 518 **Principles of Tests and Measures**

Students will participate in discussions and activities focused on understanding principles of measurement and concepts related to measurement error, reliability, validity, sensitivity, specificity, minimal detectable change, minimal clinically important difference, likelihood ratios, odds/risk ratios, and clinical prediction rules. Practical interpretation of the psychometric properties for standardized tests and measures in physical therapist practice will occur through critical analysis of research articles, discussion, practice and comprehensive review of commonly utilized standardized measures in physical therapist practice. Prerequisites: PT505, PT506, PT508. Good standing in the graduate physical therapy professional curriculum (DPT).

Corequisites: PT515 and PT517.

Credits: (1), Graded, Semester Calendar

Lecture, Spring Terms

PT 525 **Musculoskeletal Physical Therapy**

Using a Problem-Based Learning (PBL) format in small tutorial groups, clinical lab, musculoskeletal lab, inquiry seminars and self-directed

learning students will develop the cognitive, psychomotor and affective skills necessary to be physical therapists and provide services to individuals with musculoskeletal disorders. Foundational sciences, behavioral sciences, and clinical science related to musculoskeletal disorders are covered in the different learning environments. Students will gain an appreciation for and ability to implement physical therapy professional practice core values, in addition to skills in communication, cultural competence, clinical reasoning, evidence-based practice, and education. In the different learning environments, the skills and knowledge related to the management (screening, examination, evaluation, diagnosis, prognosis, plan of care, intervention and outcomes assessment) of patients/clients with musculoskeletal disorders are covered. Students also will gain skills in practice management for individuals with musculoskeletal disorders who require physical therapy services. Prerequisites: PT515, PT517, PT518. Good standing in the graduate physical therapy professional curriculum (DPT).

Corequisites: PT527 and PT528.

Credits: (9), Graded, Semester Calendar

Lecture, Discussion, Laboratory, Summer Semesters

PT 527 Professional Practice Preparation

PT527 is the capstone course for preparation of upcoming internship courses throughout the curriculum. This course includes both scheduled course and individual meeting sessions. Students will discuss clinical education objectives, professional issues, select upcoming clinical internship sites, develop interview and daily organization skills, and learn how to utilize the full-time PT CPI website. Corequisites: PT515, PT517 and PT518

Credits: (2), P/NC, Semester Calendar

Lecture, Summer Semesters

PT 528 Analytical Methods for Evidence Based Practice

Students will learn about various analytical methods used in evidence based practice, with an emphasis on statistical methods. Students will learn to select, apply, and interpret statistical methods commonly used in physical therapy research, and will critique analytical methods used in research. Prerequisites: PT515, PT517 and PT518

Corequisites: PT525, PT527 and PT528

Credits: (1), Graded, Semester Calendar

Lecture, Summer Terms

PT 537 Professional Practice II

The first full-time internship course within the DPT curriculum, students participate in eight weeks of full-time internship at an orthopedic or acute care/cardiopulmonary setting following the third semester. Students synthesize their knowledge of musculoskeletal and/or cardiopulmonary disorders and gain an appreciation for managing multiple patients and responsibilities. The focus of this internship is on the patient/client management process-examination, evaluation, diagnosis, prognosis, intervention, and outcomes -- for patients within these settings with a variety of impairments leading to activity and participation limitations. Prerequisites: PT525, PT527, PT528. Good standing in the graduate physical therapy professional curriculum (DPT).

Credits: (6), P/NC, Semester Calendar

Lecture, Fall and Summer Semesters

PT 605 Neuromuscular Physical Therapy I

Using a Problem-Based Learning (PBL) format in small tutorial groups, clinical lab, neuroanatomy lab, inquiry seminars and self-directed

learning, students will develop the cognitive, psychomotor, and affective skills necessary to be physical therapists and provide services to individuals with neuromuscular disorders. Foundational sciences, behavioral sciences, and clinical science related to neuromuscular disorders are covered in the different learning environments. Students will gain an appreciation for and ability to implement physical therapy professional practice core values, in addition to skills in communication, cultural competence, clinical reasoning, evidence-based practice, and education. In the different learning environments, the skills and knowledge related to the management (screening, examination, evaluation, diagnosis and prognosis, plan of care, intervention, and outcomes assessment) of patients/clients with neuromuscular disorders are covered. Students will also gain skills in practice management for individuals with neuromuscular disorders who require physical therapy services. Prerequisites: PT525, PT527, PT528. Good standing in the graduate physical therapy professional curriculum (DPT).

Corequisites: PT537.

Credits: (4), Graded, Semester Calendar

Lecture, Discussion, Laboratory, Fall Semesters

PT 606 Neuromuscular Physical Therapy II

Using a Problem-Based Learning (PBL) format in small tutorial groups, clinical lab, neuroanatomy lab, inquiry seminars and self-directed learning students will develop the cognitive, psychomotor and affective skills necessary to be physical therapists and provide services to individuals with neuromuscular disorders. Foundational sciences, behavioral sciences, and clinical science related to neuromuscular disorders are covered in the different learning environments. Students will gain an appreciation for and ability to implement physical therapy professional practice core values, in addition to skills in communication, cultural competence, clinical reasoning, evidence-based practice, and education. In the different learning environments, the skills and knowledge related to the management (screening, examination, evaluation, diagnosis, prognosis, plan of care, intervention and outcomes assessment) of patients/clients with neuromuscular disorders are covered. Students also will gain skills in practice management for individuals with neuromuscular disorders who require physical therapy services. Prerequisites: PT537, PT605, PT607, PT608. Good standing in the graduate physical therapy professional curriculum (DPT).

Corequisites: PT615, PT617, and PT618.

Credits: (6), Graded, Semester Calendar

Lecture, Discussion, Laboratory, Spring Semesters

PT 607A Professional Practice III-A

Students will participate in the first 8 weeks of a part-time clinical experience integrating clinical skills and practice management related to individuals with neurological impairments and disorders. Students will have the opportunity to practice patient interaction and management skills, clinical skills, and increase their knowledge of this complex patient population. Students will work with patients similar in diagnosis as discussed within tutorial cases and study concepts related to case management and policies that govern the clinical setting. The clinic portion of this course is highly integrated with PT 605 and PT 606, Neuromuscular Physical Therapy. Prerequisites: PT525, PT527, PT528. Good standing in the graduate physical therapy professional curriculum (DPT).

Corequisites: PT537.

Credits: (1), Graded, Semester Calendar

Clinical, Fall Terms

PT 607B Professional Practice III-B

This is the second half of a part-time clinical experience integrating clinical skills and practice management related to individuals with neurological impairments and disorders. Students will have the opportunity to practice patient interaction and management skills, clinical skills, and increase their knowledge of this complex patient population. Students will work with patients similar in diagnosis as discussed within tutorial cases and study concepts related to case management and policies that govern the clinical setting. This course will culminate in an in-house, 2-week intensive student-run clinic for neurologically impaired individuals. The clinic will afford the students an opportunity to utilize their clinical skills, patient experiences, and patient management principles learned throughout the semester and in previous clinical experiences. During this 2-week clinic, patients will be seen three times per week, up to 4.5 hours per day. Students will be responsible for the workings of the clinic, including: policies and procedures, patient examination, evaluation and intervention, and case management. The clinic portion of this course is highly integrated with PT 606, Neuromuscular Physical Therapy II. Prerequisites: PT 525, PT 528, PT 537, PT 607A
Credits: (1), Graded, Semester Calendar
Clinical, Spring Terms

PT 608 Research Methods

Students will examine and contrast a variety of research methods, including both primary and secondary research (i.e. original data collection vs. systematic review/meta-analysis). Students will learn to integrate critique of multiple research articles and apply to clinical situations. This course will address a variety of ethical issues associated with research. By the end of the semester, students will have selected and developed a plan for their capstone research project. Prerequisites: PT525, PT527, PT528, and good standing in the graduate physical therapy professional curriculum (DPT)
Corequisites: PT537
Credits: (1), Graded, Semester Calendar
Lecture, Fall Terms

PT 615 Physical Therapy for Multiple System Disorders I

Using a Problem-Based Learning (PBL) format in small tutorial groups, clinical lab, neuroanatomy lab, inquiry seminars, and self-directed learning students will develop the cognitive, psychomotor, and affective skills necessary to be physical therapists and provide services to individuals with disorders of multiple systems. Foundational sciences, behavioral sciences, and clinical science related to disorders of multiple system disorders are covered in the different learning environments. Students will gain an appreciation for and ability to implement physical therapy professional practice, and education. In the different learning environments, the skills and knowledge related to the management (screening, examination, evaluation, diagnosis, prognosis, plan of care, intervention and outcome assessment) of patients/clients with multiple system disorders are covered. Students also will gain skills in practice management for individuals with multiple systems disorders who require physical therapy services. Prerequisites: PT537, PT605, PT607, PT608. Good standing in the graduate physical therapy professional curriculum (DPT).
Corequisites: PT606, PT617, and PT618.
Credits: (3), Graded, Semester Calendar
Lecture, Discussion, Spring Semesters

PT 616 Physical Therapy for Multiple System Disorders II

Using a Problem-Based Learning (PBL) format in small tutorial groups, clinical lab, neuroanatomy lab, inquiry seminars, and self-directed learning students will develop the cognitive, psychomotor, and affective skills necessary to be physical therapists and provide services to individuals with disorders of multiple systems. Foundational sciences, behavioral sciences, and clinical science related to disorders of multiple system disorders are covered in the different learning environments. Students will gain an appreciation for and ability to implement physical therapy professional practice, and education. In the different learning environments, the skills and knowledge related to the management (screening, examination, evaluation, diagnosis, prognosis, plan of care, intervention and outcome assessment) of patients/clients with multiple system disorders are covered. Students also will gain skills in practice management for individuals with multiple systems disorders who require physical therapy services. Prerequisites: PT606, PT615, PT617, PT618. Good standing in the graduate physical therapy professional curriculum (DPT).
Corequisites: PT627.
Credits: (6), Graded, Semester Calendar
Lecture, Discussion, Summer Semesters

PT 617A Professional Practice IV-A

Students will develop and implement a community-based health and wellness project during PT 617A, with continuation in PT 617B. Each student will participate in at least six hours of wellness/prevention activities and/or education by developing and implementing a project selected by the faculty (4-6 hours estimated per session based on preparation, performance, analysis of outcomes, and program changes for future sessions). Throughout the project, each student will need to attend to his or her established program goals in order to prepare and implement an effective wellness session. The students, working with peers, are also expected to assess outcomes on an ongoing basis in order to modify methodologies to most effectively obtain the desired behavioral response from the participants. Through this project, it is expected that students will develop independent thinking and problem solving skills by utilizing available resources to meet the needs of their assigned facility and through continuous self-reflection. The format of this course is seminar-based for learning wellness and health promotion concepts for developing a community program, develop skills for consultation practice, and successfully execute a community wellness program. Prerequisites: PT537, PT605, PT607, PT608. Good standing in the graduate physical therapy professional curriculum (DPT).
Corequisites: PT606, PT607B, PT615, and PT618.
Credits: (1), P/NC, Semester Calendar
Seminar, Spring Terms

PT 617B Professional Practice IV-B

Students will develop and implement a community-based health and wellness project during PT 617A, with continuation in PT 617B. Each student will participate in at least six hours of wellness/prevention activities and/or education by developing and implementing a project selected by the faculty (4-6 hours estimated per session based on preparation, performance, analysis of outcomes, and program changes for future sessions). Throughout the project, each student will need to attend to his or her established program goals in order to prepare and implement an effective wellness session. The students, working with peers, are also expected to assess outcomes on an ongoing basis in order to modify methodologies to most effectively

obtain the desired behavioral response from the participants. Through this project, it is expected that students will develop independent thinking and problem solving skills by utilizing available resources to meet the needs of their assigned facility and through continuous self-reflection. The format of this course is seminar-based for learning wellness and health promotion concepts for developing a community program, develop skills for consultation practice, and successfully execute a community wellness program. Prerequisites: PT 537, PT 605, PT 607A, PT 607B, PT 617A and good standing in the graduate physical therapy professional curriculum.

Credits: (1), P/NC, Semester Calendar
Seminar, Summer Terms

PT 618 **Research Practicum**

Students work in small groups to implement their research plans from the previous semester. Students will either collaborate with faculty on primary research, or conduct a systematic review of literature related to a clinical question. By the end of this semester, students should have completed most or all components of their projects except for writing. Prerequisites: PT537, PT605, PT607, PT608. Good standing in the graduate physical therapy professional curriculum (DPT).

Corequisites: PT 606, PT615, and PT617

Credits: (1), Graded, Semester Calendar
Independent Study, Spring Terms

PT 627A **Professional Practice V-A**

PT627A is the second full-time internship course within the curriculum. Students will participate in the first 7 weeks of a total 10 weeks of full-time clinical internship (remaining 3 weeks through PT627B). This is scheduled during the summer semester of their second year at designated clinical education sites. Prior to this internship, students have completed five semesters of academic coursework covering the cardiopulmonary, musculoskeletal, neurologic, and integumentary systems throughout the lifespan, a 10-week full-time clinical internship, and multiple part-time clinical experiences. The focus of this internship will be on the examination, evaluation, diagnosis, prognosis, intervention, and outcomes for complex patients with a variety of impairments leading to activity and participation limitations. The financial aspects of patient care, supervision of support personnel, communication and education of patients, their families, peers, and interdisciplinary team members, and professional behavior development will be emphasized and progressed during this experience. Prerequisites: PT606, PT615, PT617, PT618. Good standing in the graduate physical therapy professional curriculum (DPT).

Credits: (5), P/NC, Semester Calendar
Clinical, Summer Semesters

PT 627B **Professional Practice V-B**

PT627B is the second full-time internship course within the curriculum. Students will participate in the final 3 weeks of a total 10 weeks of full-time clinical internship (first seven weeks in PT627A). This is scheduled during the fall semester of their second year at designated clinical education sites. Prior to this internship, students have completed five semesters of academic coursework covering the cardiopulmonary, musculoskeletal, neurologic, and integumentary systems throughout the lifespan, an eight week full-time clinical internship, and multiple part-time clinical experiences. The focus of this internship will be on the examination, evaluation, diagnosis, prognosis, intervention, and outcomes for complex patients with a

variety of impairments leading to activity and participation limitations. The financial aspects of patient care, supervision of support personnel, communication and education of patients, their families, peers, and interdisciplinary team members, and professional behavior development will be emphasized and progressed during this experience. Prerequisites: PT 627A

Credits: (2), P/NC, Semester Calendar
Clinical, Fall Semesters

PT 645 **Practice Management in the Autonomous Environment**

Using a Problem-Based Learning (PBL) format in small tutorial groups, clinical lab, administrative workshops, inquiry seminars and self-directed learning students will develop the cognitive, psychomotor, and affective skills necessary to be physical therapists and provide services to individuals with varied complex disorders. Foundational sciences, behavioral sciences, and clinical science related to neuromuscular, musculoskeletal, cardiopulmonary, practice management, and women's health are covered in the different learning environments. Students will gain an appreciation for and ability to implement physical therapy professional practice core values, in addition to skills in communication, cultural competence, clinical reasoning, evidence-based practice, and education. In the different learning environments screening, examination, evaluation, diagnosis, prognosis, plan of care, intervention and outcomes assessment are covered. Prerequisites: PT616, PT627. Good standing in the graduate physical therapy professional curriculum (DPT).

Corequisites: PT648 & PT657

Credits: (8), Graded, Semester Calendar
Lecture, Discussion, Fall Semesters

PT 648 **Writing and Presenting Research**

Students work in small groups to write up their systematic review or primary research as an abstract and full manuscript and will give a platform presentation. During the process, students will participate in a peer review process within the class to improve their scientific writing and to become familiar with the publication process. Prerequisites: Good standing in the graduate physical therapy professional curriculum (DPT).

Corequisites: PT645, and PT657

Credits: (2), Graded, Semester Calendar
Lecture, Fall Terms

PT 657 **Advanced Clinical Skills**

Emphasis is placed on advanced clinical skills that progress, refine, and expand skills previously acquired. Includes topics such as: pediatrics, geriatrics, neurological treatment, exercise progression, post-surgical care, alternative modalities, manual therapy. Didactic presentations of evidence-based practice literature and clinical laboratory skills. Presentations by students who have had the opportunity to develop advanced clinical skills under mentorship during their clinical experiences. Application of principles of professional practice education through planning, supervising and assessing peers clinical skills practice. Integration of professional practice experiences with case studies used in PT 645 Practice Management in the Autonomous Environment. Prerequisites: PT616, PT627. Good standing in the graduate physical therapy professional curriculum (DPT).

Corequisites: PT645 & PT648

Credits: (2), Graded, Semester Calendar
Lecture, Fall Semesters

PT 667 Professional Practice VI

The third full-time internship course within the curriculum, students will participate in a 10-week, full-time clinical internship scheduled during the first half of the final spring semester at selected clinical education sites. The focus of this internship is on the application and refinement of the PT patient/client management process for complex patients with a variety of impairments leading to activity and participation limitations. The administrative and financial aspects of patient care; consultation; communication and education of patients, their families, peers and interdisciplinary team members; and continued professional development will be emphasized and progressed during this experience. Prerequisites: PT645, PT648, PT657. Good standing in the graduate physical therapy professional curriculum (DPT).

Credits: (8), P/NC, Semester Calendar
Clinical

PT 677 Professional Practice VII

The fourth and final full-time internship course within the curriculum, students will participate in a 10-week, clinical internship scheduled during the second half of the final spring semester at selected clinical education sites. The focus of this internship is on the application and refinement of the PT patient/client management process for complex patients with a variety of impairments leading to activity and participation limitations. Continued professional development, administrative and financial aspects of patient care; promotion of the profession, pro bono opportunities, and communication and education of patients, their families, peers and interdisciplinary team members will be emphasized and progressed during this experience. Corequisites: PT667. Good standing in the graduate physical therapy professional curriculum (DPT).

Credits: (8), P/NC, Semester Calendar
Clinical, Spring Semesters

Psychology**PY 553 Advanced Topics in Social Psychology**

In this course, students will engage in an in-depth examination of several classic and cutting-edge topics in social psychology, including social motivation, self-esteem, social identity and intergroup relations, the psychology of meaning, embodied social cognition, and social neuroscience. Students will develop their understanding and communication of social psychological concepts, theories, and research by engaging in class debate and discussion, giving oral presentations, and writing scientific literature reviews. To increase the intensity of the learning experience, graduate students enrolled in this course will be required to complete 50% more in-class presentations and written assignments.

Credits: (3), Graded, Semester Calendar
Lecture, Spring Semesters

PY 900 Thesis, Dissertation or Special Project in Psychology

Student performs research toward a masters degree under the guidance of a faculty thesis advisor. A graduate thesis committee monitors student progress and provides guidance toward completion of the project. Work done in satisfaction of the requirements for a degree will be assigned a grade when the thesis is submitted and approved.

Credits: (1-15), Thesis, Semester Calendar
Thesis Research, Every Semester

RUS 500 Contemporary Russian Language

This course will focus on conversational Russian. The primary goal of this course is to develop your analytic speaking abilities by perfecting your already existing Russian vocabulary and grammar and by providing you with numerous opportunities to practice the language with your classmates and instructor, and on your own. You will continue to develop a sense of the structure of the language through the aid of authentic materials and communicative exercises. Although our focus is primarily on the Russian language, another important aspect of the course is the practical introduction of contemporary issues in Russian culture and political and social life. You will demonstrate your understanding of contemporary Russian culture and expertise in the language through participation in "situations" (see detailed weekly syllabus for specific cultural situations).

Credits: (3), Graded, Semester Calendar
Lecture, Fall and Spring Terms

Russian**RUS 590 Russian Short Story: Pathologies of the Everyday**

As the title suggests, in this course we will examine both the formal particularities of the short story, as well a theme which will run through all the works on our syllabus, namely, the authors' images of Russian daily life. Beginning with the ramifications of Alexander Pushkin's turn to prose (in terms of thematic material, the role played by the narrator, and the style of language used), we will move to an examination of Mikhail Lermontov's "superfluous" hero, Pechorin, and Nikolai's Gogol's phantasmagoric dream-world. Dostoevsky takes us into the mind of the "dreamer," a continuation and multi-layered look at this romanticist trope. Among other formal considerations, we will focus on what constitutes this prose genre. Is the primary qualification of the Russian short story a simple issue of quantitative criteria such as the number of words or pages, or does it include the qualitative and formal differences that mark the short story as a distinctive genre in its own right? The existence in Russian of such different terms, each of which are subsumed by the general definition of "short form," only furthers the complication. We will investigate issues of genre as well as the general themes mentioned above. The course will be conducted in Russian as a combination of lectures and class discussion.

Credits: (3), Graded, Semester Calendar
Lecture, Fall and Spring Terms

Study Abroad**SA 500 Graduate Student Study Abroad**

Credits: (19), Graded, Semester Calendar
Independent Study

School of Business**SB 500 Pre-MBA Module: Information Systems**

This course provides students with a broad overview of information systems and their uses in organizations. The course will examine basic components of organizational IT infrastructure, such as standard hardware and software components, network and the Internet technologies, as well as databases and business applications. In addition, students will understand the roles these components play in an organizational information system.

Prerequisite: graduate standing (admitted to the MBA program).
Credits: (0), P/NC, Semester Calendar
Lecture, Summer Terms

SB 505 Pre-MBA Module: Management Communications

This course is intended to improve the student's ability to communicate using standard English in social, academic, and professional venues. Students will learn to improve speaking skills, written expression, and listening for comprehension to prepare for the upcoming academic year. The course will consist of classroom sessions with public speaking exercises, role playing, group work etc. During this course, students will also have exposure to and interaction with the local business community. This course is designed as a prerequisite course for International students planning to attend the MBA program.

Credits: (0), P/NC, Semester Calendar

Lecture, Summer Terms

SB 510 Pre-MBA Module: Macroeconomics

An introduction to macroeconomics including the analysis of national income determination, interest rate determination, and economic growth. Monetary and fiscal policy and selected issues in international macroeconomics are also covered.

Prerequisite: graduate standing (admitted to the MBA program).

Credits: (0), P/NC, Semester Calendar

Lecture, Summer Terms

SB 520 Pre-MBA Module: Microeconomics

An introduction to microeconomics covering the role of the price system in, and public policies toward, the allocation of goods and resources. Topics include supply and demand, market structures, analysis of firm behavior, household behavior, and the gains from international trade.

Prerequisite: graduate standing (admitted to the MBA program).

Credits: (0), P/NC, Semester Calendar

Lecture, Summer Terms

SB 530 Pre-MBA Module: Accounting

An introduction to accounting concepts necessary for an understanding of financial reporting, and managerial planning and control. Basic elements of the balance sheet, the income statement and the statement of cash flows are introduced. Cost concepts important for business decision making are also covered.

Prerequisite: graduate standing (admitted to the MBA program).

Credits: (0), P/NC, Semester Calendar

Lecture, Summer Terms

SB 540 Pre-MBA Module: Law and Society

A course designed to provide a basic understanding of (1) the nature, functions and limitations of law and legal systems; (2) the basic relationship among justice, ethics, legal systems and social structure; and (3) the relationship among society, law and business activity. In addition, this course is designed to enlighten with respect to rules, principles, standards and doctrines of law fundamental to a free enterprise system. The course covers the substantive areas of constitutional law, torts and contracts.

Prerequisite: graduate standing (admitted to the MBA program).

Credits: (0), P/NC, Semester Calendar

Lecture, Summer Terms

SB 550 Pre-MBA Module: Statistics

Introduction to statistical methodology. Topics include descriptive statistics, probability distributions, point and interval estimation, hypothesis testing, two-sample tests, comparisons, measuring and testing association, correlation, regression. Emphasis on business

applications, intuitive development, and problem solving technique using a statistical software.

Prerequisite: graduate standing (admitted to the MBA program).

Credits: (0), P/NC, Semester Calendar

Lecture, Summer Terms

SB 560 Pre-MBA Module: Marketing

This course provides a basic understanding of management of marketing activities in contemporary organizations. The course is based on the premise that the purpose of a firm is to satisfy the needs and desires of its customers. Topics covered include: segmentation and target market selection, buyer behavior, market research, and marketing strategy (including product planning, pricing, distribution, and promotion.) the changing nature of marketing and the trends in domestic and international marketing are also examined.

Prerequisite: graduate standing (admitted to the MBA program).

Credits: (0), P/NC, Semester Calendar

Lecture, Summer Terms

SB 570 Pre-MBA Module: Organizational Behavior

An introduction of the fundamental theories and concepts required to manage contemporary organizations. This course focuses on individual behaviors as they relate to the functions of planning, organizing, controlling, and leading. Critical concepts and theories in behavioral science related to the practice of management are presented and discussed to assist the student in developing understanding of the pervasiveness of the discipline in all types of organizations and processes. Topics include motivation, leadership, perceptions, personality theory, team processes and group behavior, and decision making.

Prerequisite: graduate standing (admitted to the MBA program).

Credits: (0), P/NC, Semester Calendar

Lecture, Summer Terms

SB 580 Pre-MBA Module: Operations/Production Management

An introduction to the planning, analysis and control of production systems. Topics include, inventory management models, materials requirements planning, manufacturing process types, supply chain management, lean concepts, and quality management tools including statistical process control.

Prerequisite: graduate standing (admitted to the MBA program).

Credits: (0), P/NC, Semester Calendar

Lecture, Summer Terms

SB 590 Pre-MBA Module: Finance

A study of the problems associated with the financial management of business organizations. Topics include: a review of time value of money, analysis of capital investments, valuation, capital structure, short and long term financing, and business failure.

Prerequisite: graduate standing (admitted to the MBA program).

Credits: (0), P/NC, Semester Calendar

Lecture, Summer Terms

SB 609 Corporate Ethical Decision Making

[Cross-listed with SB 610] This course provides a basis for integrating the MBA curriculum, and enable students to develop the ethical awareness and understanding needed to cope with ongoing problems and challenges in corporate and industrial contexts. Students will acquire a basic understanding of moral theories and principles, become familiar with well known case studies, understand the role of business in society (including the influences of various macro-

environmental forces, such as technological, social/cultural, political, that influence corporate decision making), and become adept at applying sound ethical reasoning and decision making in their daily professional lives.

Prerequisites: completion of all CUSB MBA foundation requirements and admission to the MBA program.

Credits: (2), Graded, Semester Calendar

Lecture, Fall Semesters

SB 610 Corporate Ethical and Social Responsibility

[Cross-listed with SB 609] The central goal of the course is to give students an intellectual foundation to frame a wide range of ethical/moral issues/dilemmas facing contemporary business organizations operating within a global environment. As the business environment grows increasingly complex, managers are confronted with important questions that have ethical ramifications. These questions include: Does a company have any obligation to help solve social problems such as poverty, corruption, pollution, unemployment, and income inequality? What are the ethical responsibilities of a multinational corporation operating in foreign countries, especially those characterized as corrupt? What obligation does a manufacturer have to the consumer with respect to product defects and safety? A wide selection of case studies provides students with the opportunity to hone their skills for applying ethical principles and decision making approaches to address complex, 'real-world' business problems within the context of an evolving political, economic, social, technological and global environment.

Credits: (3), Graded, Quarter Calendar

Lecture, Fall Terms

SB 613 Entrepreneurship and New Venture Creation

In this course, students will execute the 'entrepreneurial process,' a sequence of activities related to the creation of a new business venture. As such, this course is intended for students whose personal and near-term objectives involve entrepreneurship. The major components of the entrepreneurial process include idea creation and opportunity assessment, industry research and analysis, strategic and operational planning, and resource mobilization and implementation. These process components will be discussed and implemented throughout the semester; as such, this course is very experiential in nature. Fulfillment of these activities will include extensive out-of-class research, in-class peer reviews and brainstorming sessions, and the development of formal business plan proposals. Students are required to sign non-disclosure agreements, and may elect to present their finished proposals to a panel of small business executives for review.

Prerequisite: consent of the instructor.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

SB 640 Adv Topics in Supply Chain Management

[Cross-listed with SB 641] This course provides a theoretical and analytical framework for managing critical supply chain components. Topics include revenue management, dynamic pricing, supply chain risk and disruption management, supply chain agility and flexibility, supply chain network design under uncertainty, and supply chain contracts. Hands-on simulation provides an opportunity to gain experience dealing with complex strategic and tactical global supply chain issues.

Credits: (3), Graded, Quarter Calendar

Lecture, Fall Terms

SB 641 Advanced Topics in Supply Chain Management

[Cross-listed with SB 640] This course provides a theoretical and analytical framework for managing critical supply chain components. Topics include revenue management, dynamic pricing, supply chain risk and disruption management, supply chain agility and flexibility, supply chain network design under uncertainty, and supply chain contracts. Hands-on simulation provides an opportunity to gain experience dealing with complex strategic and tactical global supply chain issues.

Prerequisite: OM606 or OM607.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

SB 651 Communicating Globally

[Formerly MBA 651] An increasingly global marketplace affords organizations all over the globe the opportunity to conduct business and distribute goods and services to new customer bases with unique needs and interests. At the same time, globalization presents company leaders, corporate communicators, and organizational gatekeepers with the challenges inherent in intercultural communication. The course: "Communicating Globally" introduces a way of thinking that enables students to acquire cultural competence and function effectively in diverse cultural situations. It presents essential concepts of corporate and national cultures and examines key differences in communication, decision making styles, and pattern of interactions in multi-cultural teams and cross-cultural negotiations - laying the foundation for necessary behavioral adaptations. The course begins with a discussion of the major facets of international business with the cultural aspect presented as the most challenging dimension. Students discover the reasons that cultures form and persist, as well as the variation and interdependence of cultures across the world. In addition, students are exposed to a variety of ideas about cultural values in different nations, and how those values influence management decisions and organizational practices. The readings build upon students' existing knowledge of the functioning of American and Western European business organizations, and help them develop an understanding of how organizations function in a wide variety of cultures. The course puts a strong emphasis on interactions and practical applications in real world business and professional situations. This practical dimension is enhanced through cases, interviews, and field studies.

Credits: (3), Graded, Semester Calendar

Lecture

SB 658 Bridging the Innovation Gap

"Bridging the Innovation Gap" is an MBA course for the Innovation and New Venture track. The "innovation gap" refers to the hard-to-navigate space between invention and innovation/commercialization. The course examines successful and unsuccessful "bridging the gap" practices across a range of industries, including communicating and translating inventions to diverse stakeholders, engaging stakeholders, gaining commitment, resourcing, and managing gaps over time and across different settings (e.g., solo startups, not-for-profits, and corporate environments). Students will become more adept at managing the various stakeholders and processes within a given invention-innovation space, and at choosing between bridging strategies for different settings. The course uses a studio-based, make-to-learn pedagogy, where learning happens through creative experimentation with live

problems.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

SB 662 **International Business**

[Formerly MBA 662] This course examines international business management as influenced by the important economic, political and cultural environment within which businesses must conduct international trade and investment. The problems and issues confronting international managers are evaluated related to a firm's strategy, organizational structure, manufacturing, material management, marketing, R&D, human resources and finance. Competitive strategies are examined that have been successful in leading international companies. Case studies are used extensively to illustrate the relevance of these topics in the practice of international business.

Credits: (3), Graded, Quarter Calendar

Lecture, Fall Terms

SB 664 **Entrepreneurship**

[Formerly MBA 664] The primary objective of this course is to develop an awareness of the process of new venture creation, whether it is an intrapreneurial or entrepreneurial event. The skills, knowledge and attitudes important for creating new ventures, and the complex tasks faced by individuals who start and manage new and growing businesses as well as corporate ventures and franchises will be addressed. The course is designed to provide a broad overview of management and financial issues. We will pay particular attention to: entrepreneurial decision-making, techniques entrepreneurs and investors use for evaluating and testing the feasibility of business opportunities, understanding the impact of market and industry forces on start up, performance and survival of new ventures, financing a business opportunity, etc.

Credits: (3), Graded, Quarter Calendar

Lecture, Fall Terms

SB 668 **MBA Global Study**

[Formerly MBA 668] This course includes intensive study of issues in a country or region outside of the United States followed by a one-to-two-week trip abroad to that location. Each section, centered on a unifying theme and geographic location, will include these components: case studies and research work prior to and following the trip, practitioner presentations, in-country university lectures and visits to companies, governmental agencies, and important cultural sites. Students successfully completing this course will gain a better perspective on the economic, political, cultural issues as well as the business practices prevalent in another region of the world. Students should develop cultural awareness, an understanding of economic, cultural, and political differences between the US and other countries, and the role cultural, historical and political factors play in the conduct of business in a global economy.

Credits: (3), Graded, Quarter Calendar

Lecture, Fall Terms

SB 674 **Growing an Entrepreneurial Business**

[Formerly MBA 674] This course will focus on the challenges in growing a small to medium size business. The issues facing an entrepreneur when starting a new venture are very different than those he/she faces when growing an existing company or business. The course focuses on the unique issues an entrepreneurial leader

faces as he/she looks to grow and scale their business. We will discuss and analyze the issues surrounding effectively scaling a business, and the impact that various decisions and initiatives have on the chance of success. How issues such as strategic marketing, team building and top-grading, financing, partnerships and leadership impact the growing business will be presented and discussed from the perspective of the business leader or entrepreneur. The course will include case studies, lectures, guest speakers, and discussions.

Credits: (3), Graded, Quarter Calendar

Lecture, Winter Quarters

SB 678 **Inventive Practices**

This interdisciplinary graduate course focuses on 1) the practices of exemplary inventors around the world, 2) students' current invention practices, and 3) considers how student practices might be improved via applied, in-course projects and the use of exemplary inventor's practices. Students will gain a fine-grained understanding of the strengths and weaknesses of their invention practices, acquire new invention tools, and improve their abilities to inventively tackle and reframe difficult problems across a variety of disciplines. The course is deliberately open to graduate students throughout CU, particularly Master of Science and PhD students.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Terms

SB 681 **Logistics Strategies**

This course will examine effective strategies to manage forward and reverse flow of goods in a supply chain. Students will develop the skills to perform logistical functions within an organization, as well as assess and design the overall logistics strategy of the organization. Primary topics covered include management and design of integrated logistics networks, supply chain distribution management, coordinating strategic alliances with distributive intermediaries, warehousing, transportation, international logistics and the current trends and impact of technology on contemporary supply chain channels. Case studies, articles, numerical assignments, and simulation exercises may be utilized.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

SB 684 **Venture Capital and Private Equity**

The course will focus on the venture capital and private equity industries. The course will introduce students to the concepts of private equity and its various forms with a focus on venture capital. The course will explore the impact of Venture Capital and Private Equity on the US and global economy. The course will also cover the corporate and organizational structures, decision making processes, and the transactions common in the Venture Capital and Private Equity industry. The course will have examples of investment criteria, term sheets, due diligence, and investment agreements taking into account both the investor and the entrepreneurs.

Credits: (3), Graded, Quarter Calendar

Lecture, Given When Needed

SB 687 **Special Graduate Topics**

An investigation of a problem undertaken by the student which is acceptable to and under the guidance of the faculty member and chairperson. The course provides an opportunity for the student to investigate and analyze a problem in depth on an independent study basis.

Requirement: Instructor and Program Chair permission

Credits: (1-3), Graded, Semester Calendar
Independent Study, Given When Needed

SB 688 **EGOM Project Presentation**

This course ensures that students pursuing the Engineering and Global Operations Management (EGOM) MS degree meet the requirement of completing a project. This course will show up on a student's transcript upon successful presentation of an outcomes-based synopsis of a work-related project that incorporates components of core/elective classes in the EGOM curriculum. Prerequisite: Completion of at least six (6) EGOM courses. Open only to EGOM MS students.

Credits: (0), P/NC, Quarter Calendar
Independent Study

SB 693 **Seminar in International Business I**

This course includes intensive study of business that represents an international experience for the students followed by a two-week trip to the area of study. Each section, centered on a unifying theme and geographic location, will include three components: structured classes, practitioner presentations, and visits to companies, governmental agencies, and important cultural sites. Students successfully completing this course will gain an understanding of the economic, political, cultural issues as well as the business practices prevalent in a region of the world that is foreign to them.

Credits: (3), Graded, Semester Calendar
Seminar, Given When Needed

SB 694 **Seminar in International Business I**

This course includes intensive study of business that represents an international experience for the students followed by a two-week trip to the area of study. Each section, centered on a unifying theme and geographic location, will include three components: structured classes, practitioner presentations, and visits to companies, governmental agencies, and important cultural sites. Students successfully completing this course will gain an understanding of the economic, political, cultural issues as well as the business practices prevalent in a region of the world that is foreign to them. Prerequisite: consent of the director of Graduate Business Programs.

Credits: (3), Graded, Quarter Calendar
Seminar, Given When Needed

SB 696 **Global Business Strategies**

This course attempts to familiarize and sensitize students to current issues and practices relating to the globalization of markets. Topics include global manufacturing and international competitiveness, international marketing, international finance and international management strategies. The case study approach is used to introduce a diversity of perspectives into the classroom. This course is team-taught by faculty from the Production/Operations Management, Marketing, Finance and Organizational Studies areas.

Credits: (3), Graded, Semester Calendar
Lecture, Given When Needed

SB 699 **Global Business Strategies**

This course attempts to familiarize and sensitize students to current issues and practices relating to the globalization of markets. Topics include global manufacturing and international competitiveness, international marketing, international finance and international management strategies. The case study approach is used to introduce a diversity of perspectives into the classroom. This course is team-

taught by faculty from the Production/Operations Management, Marketing, Finance and Organizational Studies areas.

Credits: (3), Graded, Quarter Calendar
Lecture, Given When Needed

SB 999 **Special Graduate Topics**

A graduate level course for which there is no comparable Clarkson course. Used for transfer credit only.

Credits: (1-10), Graded, Semester Calendar
Lecture, Transfer Credit Only

School of Science

SC 575 **Science Demonstrations**

Science is more than just a body of knowledge, it is way of thinking and a process to be experienced. Students best learn science by engaging in its practices as they investigate observable phenomena. They must also think deeply about the concepts that cross science disciplines in order to explain those phenomena. This is the premise of the Next Generation Science Standards and the New York State Science Learning Standards modeled from them. Yet many traditional secondary science courses focus mainly on the topics or core ideas without adequately addressing the other dimensions of the course. The design of this 3-credit course is to meet the needs of students currently conducting their internship or anticipating an internship as they prepare to teach three dimensionally. Students will research publications and internet sites in order to compile a usable resource binder of activities that promote a deep understanding of science for themselves and for their adolescent students. The activities they investigate will relate to all conceptual areas of biology, chemistry, physics, and earth science. Laboratory activities necessary for students' successful completion of the New York State Regents science courses will be addressed. The activities that students develop will not only be presented to the class, but should also be used during their internships at local high schools. Students will evaluate their own and others' activities using a standard form provided by the instructor. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar
Lecture, Spring Terms

Semester in Industry

SI 500 **Professional Internship**

Practical, hands-on experience that focuses on an area directly related to the student's field of study, the internship course is an integral part of the curriculum. The student must develop all details for the internship under the supervision of the instructor and within the established course objectives; the latter will include a project that carries the course credit and is due after completion of the internship. Prerequisites: Permission from the course instructor/student's academic advisor, the Career Center, and the International Student Advisor (if applicable.)

Credits: (1-9), P/NC, Semester Calendar
Independent Study, Given When Needed

SI 533 **Research for International Students**

Practical, hands-on experience that focuses on an area directly related to the student's field of study. The student must develop all details for the research under the supervision of the instructor. Consent by the International Education Office is required.

Credits: (0), P/NC, Semester Calendar
Independent Study, Given When Needed

Sociology

SOC 530 Health, Wealth, Inequality and the Environment

[Cross-listed with EV 530] This course will examine how social inequality impacts the relationship of people to their environment and how it affects their physical well being. We will look at how social and political structures perpetuate conditions of injustice for low-income communities and communities of color. One emphasis of this course will be on how social inequality impacts environmental factors involved in transmission of communicable diseases and hazards due to exposure to chemical and physical materials in our environment. We will examine sociological and public health literature pertaining to environmental health on a global level and also address public policies that may affect health and environmental justice. Graduate students will have additional work as stated on syllabus.

Credits: (3), Graded, Semester Calendar

Lecture, Spring Semesters

Spanish Language

SPN 515 Teaching Spanish in American Schools

Students will become familiar with American public high schools through reading, discussion, school visits and observations. Over the course of the semester students will practice the following skills in both the target language and in English: improve their reading and writing skills with a focus on interpretation, analysis, and argumentation; improve grammar and language skills related to academic reading and writing; evaluate and critique written arguments, delineate and reason one's own argument on a variety of topics; interpret words and phrases in context; use textual evidence to make inferences, analyze actions, understand ideas, and draw conclusions.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

SPN 540 Advanced Methods in Teaching Spanish

This course will expand upon the theory and practice of foreign language instruction examined in ED 513, with a focus on teaching Spanish at the secondary level. Particular emphasis will be paid to the planning, instruction and assessment cycle. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture

SPN 545 Building Cultural Competency

The course centers on the role, selection, and assessment of authentic cultural materials in the Spanish classroom at the 9-12 level. Students will learn, read, and discuss about the viability of employing cultural artifacts - literature and media, digital art, advertisements, music, etc. - to complement or supplement classroom lessons. As part of the course, students will create a portfolio of culture modules that can be adapted for various classroom contexts and needs, including the possibility of connecting these short lessons with grammar-based content. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

SPN 580 MAT Project in Spanish (Content Area)

The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom? Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture

SPN 988 Independent Study in Spanish

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Independent Study, Given When Needed

SPN 989 Independent Study in Spanish

A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Independent Study, Given When Needed

Social Sciences

SS 580 Graduate Research Methods in the Social Sciences

In addition to all of the requirements of SS 380, graduate students will engage in additional readings and techniques determined by the instructor to enrich the specific research agenda and/or project of those students. These materials may include survey design, additional statistical training for Stata or other software packages, embedded approaches for mixed method design, implementation of semi-structured interviews, etc.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

Statistics and Probability

STAT 581 Probability

[Cross-listed with MA 581] Sample spaces; axioms of probability; basic theorems; random variables (discrete and continuous); combinatorial methods; Bayes' Theorem and conditional probability; expected values and variances; distribution functions, including: binomial and multinomial, Poisson, normal and bivariate normal distributions, and others such as geometric, hypergeometric, negative binomial, exponential, gamma and beta; joint distributions; covariance and correlation; central limit theorem; geometric probability; method of transformations; introduction to stochastic processes.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

STAT 582 Mathematical Statistics I

[Cross-listed with MA 582] A rigorous course in statistics. Topics include random variables and their distributions, data reduction, estimation, sampling distributions, testing, optimal tests, analysis of variance and nonparametric statistics. A large project is required.

Prerequisites: STAT381.

Credits: (3), Graded, Semester Calendar

Lecture, Odd Spring Semesters

STAT 584 Advanced Applied Statistics

Review of basic concepts (estimation, testing and simple linear regression). Multiple regression, analysis of variance and experimental design. Additional topics may include nonparametric statistics, goodness of fit tests, analysis of covariance and quality control. This course will require use of statistical software. Interpretation of computer output and applications will be emphasized throughout.

Prerequisites: STAT383 or equivalent.

Credits: (3), Graded, Semester Calendar, Lecture, Even Spring Semesters

STAT 585 Bayesian Data Analysis

This course will introduce both the principles and practice of Bayesian methods for data analysis. This is a hands-on course that will use MATLAB software. Students will learn to write their own Bayesian computer programs to solve problems relevant to engineering, biology, chemistry, physics, earth science, ecology, economics, signal processing and machine learning. Topics that will be included are parameter estimation, model selection, time series and error analysis.

Credits: (3), Graded, Semester Calendar

Lecture,

STAT 709 Directed Study in Probability and Statistics

A directed study in Probability and Statistics, intended to give a student the opportunity to further explore an area of interest to them under the supervision of a faculty member.

Credits: (1-10), Graded, Semester Calendar

Independent Study, Given When Needed

Science, Technology, Engineering, Math**STEM 501 STEM Pedagogy and Professionalism**

STEM Pedagogy and Professionalism is designed to help graduate students, particularly graduate TAs, develop the skills necessary to be successful in their graduate programs as instructors and in their future roles as academics. The course will highlight methods for developing and enhancing the pedagogical content knowledge and instructional skill set of graduate STEM teaching assistants. Within the context of STEM learning; audience, environment, nature of science, formative assessment, models of instruction, learning theory, and reflective practice will be studied. A focus on STEM literacy, will help TAs think critically about multiple data sources in order to promote higher-order thinking skills among their students. The course also addresses intercultural communication in the classroom; providing an opportunity for students to improve their cultural and sociolinguistic competence. In particular, students will work on developing their professional communication skill set including oral comprehensibility, impromptu speaking skills and interactions with undergraduates. Daily lessons will model

instructional strategies and habits of mind that students will evaluate with their own students' needs in mind.

Credits: (4), Graded, Semester Calendar

Lecture, Summer Terms

STEM 530 Anal Scientific & Math Theories from Phil & Hist Persp

This 3-credit course is neither a history of STEM disciplines course nor a philosophy of STEM disciplines course. Rather, it is a course that looks at teaching STEM-related content from historical and philosophical perspectives, as its title suggests. This is an important distinction for several reasons. First, we believe that you will be best served by an introduction to history and philosophy of STEM disciplines and nature of STEM core concepts which are taught in a manner and at a level that models effective teaching. Modeling the teaching of these concepts in the course will provide you with strategies you might use with your own middle and high school students. Second, we are hoping that you will not only assimilate the concepts presented but will also evaluate and create instructional strategies and materials that can infuse these concepts into your own secondary courses. This expectation is in many respects more demanding and time-consuming than expecting you to learn an abundance of historical detail and philosophical argument and regurgitate it back on an examination. Third, the research has revealed that teachers who complete traditional courses in the history or philosophy of STEM disciplines typically do not use this content in their own secondary school teaching. That is, understanding concepts and methods does not ensure that they are applied to classroom practice. This course will argue that historical and philosophical content can be used to enhance secondary students' understanding of the STEM concepts and methods they are expected to attain and ask you to develop or restructure lessons and materials to illustrate that enhancement. The course developers and instructors should also be forthright in saying that the course was originally planned and executed to focus on the history and philosophy of science and science education is the primary expertise of the instructors. However, we tried to create an approach and assignments that could also incorporate the history and philosophy of mathematics and technology and show the interactions existing among science, mathematics, and technology. Ideally, having science, mathematics, and technology students in the course this year will enhance the general knowledge of all participants and help them distinguish between the unique elements of each enterprise. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture

Teaching English**TE 501 Teaching Practicum**

The TESOL Teaching Practicum course provides an opportunity for students to apply the skills learned concurrently in Foundations of Teaching TESOL (TE540), and English Grammar (TE530) in a classroom setting. The practicum provides TESOL students with an opportunity to observe TESOL instruction and practice instructional techniques in preparations for the Fall Teaching Internship. TESOL students will be placed in local settings and will participate in this online course to share and reflect upon classroom experiences. Students will be placed in summer school ENL classes, community-based English language classes, or local community college/university English language

classes as a volunteer, first observing and then assisting in instruction. The goal of the practicum is to give the TESOL student practical experience in all areas of teaching ELLs through observation and participation.

Credits: (1), Graded, Semester Calendar

Practicum, Given When Needed

TE 513 Curriculum and Methods of Teaching ESOL

This course serves as an introduction to the theory and practice of ESOL teaching. We will examine key aspects of current theories, methods of instruction, and assessment in TESOL education. This course is based on a view of teaching and learning as facilitated by social interaction and that each individual brings unique background knowledge and beliefs to their learning.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

TE 517 Teaching & Assessment Methods for TESOL

TESOL Teaching Methods will introduce students to the NYS New Language Arts Progressions (part of the Bilingual Common Core Initiative), TESOL and WIDA National Standards, formative and summative assessments (including NYSITELL and NYESLAT), and methodology for integrated, stand-alone, and content-based instruction for ELLs. Students will gain expertise in lesson planning, delivery and assessment; collaboration and co-teaching; state regulations; culturally relevant instruction; advocating for ELLs; and practical pedagogy for English Language Learners, pre k-12.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

TE 530 English Grammar for the ENL Teacher

English Grammar is a course on the structure, analysis, and methods of teaching American English grammar to English language learners. The dual purpose of this course is to develop a thorough understanding of the forms and use of English grammar systems as well as develop instructional strategies for teaching English grammar to speakers of other languages in a communicative and meaningful way.

Credits: (3), Graded, Semester Calendar

Lecture, Summer Terms

TE 531 TESOL English Linguistics

English Linguistics is an introduction to linguistics for Teachers of English to Speakers of Other Languages. It presupposes little or no formal linguistic knowledge. We will study the rudiments of phonetics, phonology, syntax, morphology, semantics, sociolinguistics and language acquisition. We will study linguistics both as an end in itself and as it informs classroom teaching. This course will prepare students to teach English as a New/Second Language, with a firm knowledge of the linguistic challenges English presents to language learners. Discussions and connections between theory and practice are a significant component of this course.

Credits: (3), Graded, Semester Calendar

Lecture, Fall Terms

TE 540 Foundations of Teaching TESOL

Foundation of Teaching TESOL serves as an introduction to the theory and practice of second language (SL) teaching. In an intensive 6 week online format, students will be immersed in activities to create a strong foundation of knowledge on language development, standards and policy, and pedagogy. We will examine key aspects of historical

and current theories of second language acquisition, as well as methods of instruction and assessment in SL education. Language modalities, language functions, content and context-based instruction will be introduced. This course is based on a view of teaching and learning as facilitated by social interaction in which each individual brings unique background knowledge and beliefs to their learning. It is expected that students will make connections between the readings and learning activities of the Foundations course to their experiences in the Teaching Practicum (TESOL501).

Credits: (3), Graded, Semester Calendar

Lecture, Summer Terms

TE 542 TESOL Literacy (Online and In School Settings)

TESOL Literacy introduces students to issues in reading, writing and new literacies for students who are learning a new or second language. We will review current instructional practices in light of theoretical foundations, educational policy, and culture forces that shape acquisition and development of a new/second language. In addition, we will dissect practical strategies for teaching English language learners. Your understanding of course ideas and issues will be assessed frequently through a variety of on-line discussions, assignments, activities, and a final project. This course includes 20 hours of required field experience.

Credits: (3), Graded, Semester Calendar

Lecture, Given When Needed

TE 551 TESOL Teaching Residency Elementary

The 5-credit elementary internship (grades K-6) begins after the intern completes the New York State required Field Practicum, ED501, during the summer semester. The Intern will first observe and co-teach with his/her Mentor at the beginning of the school year. The Intern is expected to gradually assume responsibility for two of the mentor's classes, at first co-teaching with the Mentor, but independently teaching within 5 weeks, if prepared to do so. After successful completion of the elementary teaching internship in the fall (grades K-6), the Intern will complete a secondary (grades 7-12) internship in the spring semester. A full-year intern is in school for a minimum of half of the school day. Which half of the day depends on the schedule assigned to the Mentor by the school district. During January/February, the intern will complete the requirements of edTPA. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (5), Graded, Semester Calendar

Field Studies, Every Term

TE 552 TESOL Teaching Residency Secondary

The 5-credit secondary (grade 7-12) internship begins in the second semester. The Intern is expected to gradually assume responsibility for two of the mentor's classes, at first co-teaching with the Mentor, but independently within 6 weeks, if prepared to do so. The secondary ENL internship fulfills the second half of a full year experience and follows the successful completion of an elementary (grade pre k-12) ENL internship. A full-year intern is in school for a minimum of half of the school day. Which half of the day depends on the schedule assigned to the Mentor by the school district. During January/February the Intern will complete the requirements of edTPA. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (5), Graded, Semester Calendar

Field Studies, Every Term

TE 580 **TESOL Project**

The TESOL Project is a one semester, online research project class whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in the field of TESOL. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern and their teaching setting. TESOL projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom?

Preequisites: ED550, TE517, TE531, TE551, ED502, TE552

Credits: (3), Graded, Semester Calendar

Research

Technology

TECH 580 **MAT Project in Technology (Content Area)**

[Formerly TEC 580] The MAT Project is a one-term research project whose purpose is to allow students time and supervision to develop breadth and/or depth of knowledge to become a better teacher in their certification field. What the project will entail varies greatly from student to student. The course is intended to be custom-tailored to meet the specific needs of an individual intern. MAT projects are well-grounded in research and theory, but also include a strong and extensive applied aspect, directly addressing the question: What would this look like in the classroom? Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Lecture

TECH 988 **Independent Study in Technology**

[Formerly TEC 988] A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Independent Study, Given When Needed

TECH 989 **Independent Study in Technology**

[Formerly TEC 989] A graduate level course for which there is no comparable Clarkson course. This course may be used to satisfy course requirements for a graduate degree. Restriction: This course is open only to students matriculated in the Master of Arts in Teaching program (or by instructor consent)

Credits: (3), Graded, Semester Calendar

Independent Study, Given When Needed