design science

Student Guide
2014-2015

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Dear Design Science Students:

On behalf of the Integrative Systems+Design directors, council members, and staff, welcome to the University of Michigan and the Design Science Program.

This Student Guide is the roadmap to your program. This book includes instructions on how to register for classes, which courses are offered and the people who will provide support and answers to your questions.

The Student Guide was put together at the request of our current students. We hope this document will prove to be helpful to you. Our students are important to the success of the program. We welcome your suggestions for improvement.

Sincerely,

Patricia M. Mackmiller
Manager, Academic Programs

Overview

This guide provides general information specific to students in the Design Science Doctoral Program at the University of Michigan, and augments the information provided by the H.H. Rackham Graduate School. Specific program information includes program scope, admission, financial aid, coursework, candidacy, preliminary examination and practicum.

Program Scope

Design Science (DESCI) is an interdepartmental program. Students whose design interests can be Satisfied within an existing single-department program in the University should pursue that program. The DESCI program is appropriate for students who find that a single-department discipline constricts the pursuit of their desired course of design research study and dissertation composition. A guiding principle of the program is that its students conduct research on design problems that must be addressed by composing knowledge from at least two established departmental disciplines, and a study plan must be prepared accordingly. Each student must have two dissertation co-advisors from two different schools or colleges in the University, and follow a uniquely defined program of study tailored to his or her background and interest in consultation with those advisors. The course curriculum must be structured so that knowledge from at least two disciplines permeates the program of study. The qualifying examination and dissertation work also follow the same guiding principle.

Financial Aid

Admitted students must have ensured financial support for the first two years of study, and preferably for the expected duration of their studies. The program has limited resources for financial aid, and these are typically used to offer fellowships to first-year students. Continuing financial support must be provided through other fellowship programs (e.g., Rackham Merit Fellowships or NSF Fellowships) or through Graduate Student Research Assistantships (GSRA) in research projects conducted by the co-advising faculty. Funding for such projects may be sought based on successful research work in the early years of a student's study in the program. Occasionally, a Graduate Student Instructor (GSI) position may be available for a DESCI course or for a course in the home units of the student's advisors. The program makes every effort to help with continuing financial support of its students but cannot take responsibility for funding their entire course of study. This responsibility lies with the students and their advisors.

Program Coursework

Coursework requirements include: (A) a core, two-semester course sequence (6 credits) consisting of DESCI 501 and DESCI 502, and two semesters (1+2 credits) of DESCI 790 shown as Group A below; (B) five courses (15 credits) selected from existing disciplinary offerings shown as Group B below.

Group A: Core courses (9 credits):

The first course aims at establishing a common experience in "doing design." The second course aims at providing a common basis for 'studying design.' The colloquium will provide exposure to modern research topics and a forum for interactions and building a community.

DESCI 501 Analytical Product Design (3)

DESCI 502 Design Process Models (3)

DESCI 790 Design Science Colloquium (1+2)

DESCI 791 Design Science Seminar (1)

Responsible Conduct of Research (RCR) Course (1) (Required for entering students by Rackham)
     A one-credit course offered by any unit covering ethics in research.Example courses from the College of LSA are UC 415, UC 416 and Psych 506.

Group B: Required Electives (15 credits):

Students must select one course from each of three different disciplines as listed below (9 credits), and one additional course from two of these disciplines (6 credits). Students can petition the program advisor to substitute courses not in this list. The list is updated through periodic reviews.

Architecture and Urban Planning
ARCH 513 Soc Change and Architecture
ARCH 516 Architectural Representation
ARCH 519 Theories of Urban Design
ARCH 552 Architectural Design V
ARCH 571 Digital Fabrication
ARCH 575 Building Ecology
UP 526 Sociocultural Issues in Planning and Architecture
UP 572 Transportation and Land Use Planning

Art and Design
ARTDES 610 Directed Studio Practice

Business

MKT 501/503 Marketing Management
MKT 601 Strategic Market Planning
MKT 603 Strategic Brand Management
MKT 607 Distribution Strategy
MKT 612 Retailer Management and Trade Marketing
MKT 613 Consumer Behavior
MKT 619 Marketing Research Design and Analysis I
MKT 620 Marketing Research Design and Analysis II
MKT 625 New Product and Innovation Management
MKT 630 Marketing Engineering
OMS 551/552 Intro to Operations and Operations Management
OMS 605 Manufacturing & Supply Operations

Engineering
IOE 533 Human Motor Behavior and Engineering Systems
IOE 536 Cognitive Ergonomic
IOE 552 Financial Engineering I
IOE 553 Financial Engineering II
IOE 565 Time Series Analysis
IOE 623 Computational Finance
ME 555 Design Optimization
ME 558 Discrete Design Optimization
ME 559 Smart Materials and Structures
ME 577 Materials in Manufacturing and Design
ME 581 Global Product Development
ME 587 Reconfigurable Manufacturing for Market Responsiveness
ME 589 Sustainable Design of Technology Systems

Environmental Studies (multi-school)
CEE 586 Industrial Ecology
CEE 686 Case Studies in Environmental Sustainability
EHS 572/NRE 514 Environmental Impact Assessment
HBEHED 516 Global Health Anthropological Perspectives
OMS 613 Sustainable Operations
UP532 Sustainable Development: Resolving Economic & Environmental Conflicts
POLSI 761 Global Environmental Change and the State

Information Science
SI 621 Information, Ethics and Applied Policy
SI 648/748: Infoculture: Theory and Methods in the History and Sociology of Information Technology

Anthropology
Anthrcul 554 Media Anthropology

Economics
Econ 601 Microeconomic Theory I

Econ 602 Microeconomic Theory II
Econ 631 Industrial Organizations and Public Policy

Psychology
Psych 613 Adv Statistics I
Psych 614 Adv Statistics II
Psych 644 Computational Modeling of Cognition
Psych 682 Advanced Social Psychology
Psych 687 Methods of Survey Sampling
Psych 711 Question Design
Psych 721 Mathematical Psychology
Psych 722 Decision Processes
Psych 746 Human Performance
Psych 785 Group Processes

*Group C: Dissertation work (12-18 credits):
These are standard Rackham courses for research credit.
DESCI 990 Dissertation Pre-candidate (6)
DESCI 995 Dissertation candidate (6-12)
http://www.rackham.umich.edu/downloads/oard-dissertation-timeline.pdf

*Please note: you must be enrolled for at least 8 credits (full-time) when taking the preliminary exam or defending.
http://www.rackham.umich.edu/help/graduating/candidacy_deadlines/
http://www.rackham.umich.edu/help/graduating/doctoral_degree_deadlines/ .

Sample Programs

Sample Program 1: Student with MS degree in Mechanical Engineering

Year 1 Fall
DESCI 501 Analytical Product Design
IOE 552 Financial Engineering I
PSYCH 613 Adv Statistics I
DESCI 790 Design Science Colloquium (1 credit)

Year 1 Winter
DESCI 502 Design Process Models
DESCI 791 Design Science Seminar (1 credit)
PSYCH 614 Adv Statistics II
ME 555 Design Optimization
PSYCH 506 Professional Issues in Psychology (1 credit)

Year 1 Spring-Summer
Internship of on-campus research

       Year 2 Fall
       PSYCH 721 Mathematical Psychology
       MKT 501/503 Marketing Management
       DESCI 990 Pre-Candidate Dissertation Research
       DESCI 790 Design Science colloquium (2 credits)

       Year 2 Winter
       MKT 630 Decision Models Marketing (extra credits if desired)
       DESCI 990 Pre-Candidate Dissertation Research
       DESCI 791 Design Science Seminar (1credit)
       Prelim Examination
       http://www.rackham.umich.edu/help/graduating/candidacy_deadlines/

       Year 2 Spring-Summer
       Practicum off-site

       Year 3 Fall
       DESCI 995 Dissertation Research
       http://www.rackham.umich.edu/downloads/oard-dissertation-timeline.pdf
       GSI assistanceship

       Year 3 Winter
       DESCI 995 Dissertation Research

       Year 3 Spring-Summer
       Dissertation preparation

          Year 4
          Dissertation defense

Sample Program 2: Student with MA/Equivalent study in LSA/Psychology

Year 1 Fall
DESCI 501 Analytical Product Design
PSYCH 644 Comp. Modeling of Cognition
IOE 536 Cognitive Ergonomic
DESCI 790 Design Science Colloquium (1credit)

Year 1 Winter
DESCI 502 Design Process Models
DESCI 791 Design Science Seminar (1credit)
PSYCH 722 Decision Processes
HBEHED516 Global Health Anthropological Perspectives
PSYCH 506 Professional Issues in Psychology (1 credit)
Year 1 Spring-Summer
Internship of on-campus research

> **Year 2 Fall**
> IOE 533 Human Motor Behavior and Engineering Systems
> MKT 613 Consumer Behavior
> DESCI 990 Pre-Candidate Dissertation Research
> DESCI 790 Design Science Colloquium (2 credits)
> Prelim Examination
> http://www.rackham.umich.edu/help/graduating/candidacy_deadlines/
>
> **Year 2 Winter**
> MKT 612 Retailer Management and Trade Marketing
> DESCI 791 Design Science Seminar (1 credit)
> DESCI 995 Dissertation Research
> http://www.rackham.umich.edu/downloads/oard-dissertation-timeline.pdf
>
> **Year 2 Spring -Summer**
> Practicum off-site

> > **Year 3 Fall**
> > DESCI 995 Dissertation Research
> > GSI training
> >
> > **Year 3 Winter**
> > DESCI 995 Dissertation Research
> >
> > **Year 3 Spring-Summer**
> > Dissertation defense

Important Information about Academic Standing

All students in the Design Science Program must maintain satisfactory academic standing as outlined in the enclosure. Please read carefully and if you have any questions or need clarifications, contact your academic advisor. Design Science will follow these guidelines for both academic standing and graduation requirements.

cc: Student file

Academic Standing and Graduation Requirements

The Design Science Program will follow this policy for all students pursuing the PhD in Design Science degree. To maintain a satisfactory standing, a student must have a minimum cumulative graduate grade point average (GPA) of "B" (3.00) for all graduate courses taken for credit and applied toward the degree program in which the student is enrolled.

I. A student whose cumulative GPA falls below a "B" (3.00) in a given term or half term will be placed on probation for the following term or half term, or may be denied permission to register. A student whose cumulative GPA falls below a "B" for two successive terms or half terms may, upon the recommendation of the Director of the Program, be granted a final opportunity to correct the scholastic and/or academic deficiency. A student whose cumulative GPA falls below a "B" averages for three successive terms or half terms will not be permitted to continue in the Program.

II. A student, who has been admitted to the Program on probation, must meet the minimum GPA conditions specified in the admissions letter. Failure to do so will, upon the recommendation of the Director of the Program, disqualify the student to continue further in the Program.

III. A student with a cumulative GPA is below a "B" (3.00/4.00) cannot be recommended for a degree.

Under certain special circumstances the actions described above may be waived, by petition, to modify the conditions of academic standing or discipline as follows: If a student who was not in good academic standing when last enrolled in the Design Science program at the Rackham Graduate School wishes to be readmitted or change degree level, he or she must petition the program director for modification of the conditions of academic standing or discipline. The petition should provide the reasons for the previous poor performance and explain how those conditions have changed and present specific plans for future study. The Program Director must   approve   the   petition.

Advancement to Candidacy and Preliminary Examination

http://www.rackham.umich.edu/help/graduating/candidacy_deadlines/

Students are admitted to the program as pre-candidates. Candidacy will normally be achieved no later than at the end of the second year of study after completion of the Preliminary Examination; completion of course requirements in Group A (9 credits), and partial completion of courses from Group B (9 credits) with a grade-point-average of at least 3.0; completion of an MS/MA/MFA in another discipline, if not earned prior to admission, or completion of the 24 credit requirement without a master's degree.

The Preliminary Examination ("Prelim") has two parts. In Part I the student must articulate the design research problem to be studied and how two or more disciplines are required to address it successfully. The student must also demonstrate competence in basic knowledge in the two selected disciplines above. In Part II the student makes a comprehensive presentation of the proposed dissertation topic and is subjected to a critical evaluation by the dissertation committee. Part I can be taken at any appropriate time during the first three semesters in the program and functions as a 'qualifying' examination functions in some other programs. Part II is normally taken no later than at the end of the second year of study.

Prelim Part I is administered by a committee with a minimum of three faculty members. These typically will include the student's two co-advisors and a third member appointed by the program, who will chair the examination committee. The student prepares a short document (typically about five pages) where he/she articulates the design research problem to be studied and documents that there are at least two disciplines involved in addressing it. A draft of this document is submitted to the co-advisors and upon their approval to the program chair, who then appoints the examination committee chair. The student arranges a one-hour oral examination with the committee members, and submits the final Prelim Part I document to the committee and the program. During the examination, the student makes a short presentation (15-20 minutes) followed by Q&A by the committee. The goal of the exam is for the committee to ascertain that the student has identified a promising area of design research and has sufficient knowledge in the disciplines involved in addressing the eventual dissertation questions successfully. The student does not need to have a specific dissertation topic detailed at this time. Following the exam, the committee chair submits a short report to the program with the exam committee's conclusions and recommendations.

BEFORE PRELIM PART II, THE STUDENT SUBMITS THE DISSERTATION COMMITTEE MEMBERS' NAMES TO THE PROGRAM OFFICE FOR SUBMISSION ON THE PROPER FORM TO RACKHAM FOR APPROVAL.

Prelim Part II is administered by the dissertation committee following standard Rackham rules. The cognate member requirement is automatically satisfied by the DESCI co-advisor composition. The student prepares a comprehensive document (typically 25 pages or more, possibly with appendices) articulating the dissertation proposal. The main parts of this document are the following: general problem definition and why it is a design science problem; previous work on this problem across the relevant disciplines; specific problem definition, given prior work and unanswered questions; specific research tasks; results to date; research milestones and dates; expected contributions to knowledge; comprehensive bibliography; student resume and coursework completed, with grades. The student prepares this document in consultation with his/her co-advisors, assembles the dissertation committee, and schedules the exam. The exam is typically 90 minutes long; the student makes an oral presentation (40-45 minutes) followed by Q&A by the dissertation committee. The co-advisors submit the results of the examination and recommend candidacy action to the program chair, along with a copy of the dissertation proposal. The program subsequently submits its recommendation to Rackham.

Practicum

Students are expected, prior to graduation from the program, to complete one semester equivalent of practicum or internship with an industrial or academic partner. These are arranged typically after the first year of study. Although this is not a program requirement, it is a strongly recommended experience. The program works with its national and international partners to help students for such placement. Similarly, students are expected to participate in at least a one-semester teaching experience, whether as a formal GSI or informally working with a DESCI faculty member usually in DESCI 501 or DESCI 502. This experience will typically take place after the first year of study. Students will pursue arrangements for these experiences in consultation with their dissertation advisors and the program chair.

Continuous Enrollment Policy

The Continuous Enrollment Policy for Ph.D. students, effective as of Fall of 2010, calls for students to register in each fall and winter semester until they complete their degrees, unless they are on an approved leave of absence. The policy is designed to improve the likelihood that students will complete their Ph.D. degrees, without imposing any new financial burden on students or on graduate programs. Each school and college has developed a plan to provide tuition support for all Ph.D. students who are making satisfactory academic progress but would not have registered under current policies and practices. The plans do not replace or alter existing commitments to students from departments, graduate programs, schools or colleges for financial support that includes tuition, stipend, and benefits. The school and college plans for tuition fellowships provide an additional layer of support that is designed to protect current students from new financial burdens as a result of the policy.

Please view the Continuous Enrollment Policy in detail at the website below:
http://www.rackham.umich.edu/current-students/policies/doctoral/phd-students/plans-for-schools-and-colleges

Leave of Absence Policy

Effective Fall 2010, Ph.D. students may request a temporary leave of absence when certain life events prevent continued active participation in their degree program. Rackham's Leave of Absence Policy enables students to officially suspend their work toward their degree for a limited time.
Students who need to take a leave of absence may request a leave as early as six months prior to the semester they are requesting a leave, through the drop/add period of the term. A leave will be granted to students for documented illness (either physical or mental) or injury, to provide care or assistance for family or dependents, to meet military service obligations, or for other personal reasons.
The Leave of Absence Policy, a checklist for students in Ph.D. programs, and a checklist for faculty and staff in graduate programs are available. Taken together, they provide guidance and information about how the process will work to promote academic planning and to protect students' privacy.
Please view the Leave of Absence Policy in detail at website below:
www.rackham.umich.edu/current-students/policies/doctoral/phd-students/leave-of-absence

General Forms and Procedures

Registration

- Information about registration may be found on at "Student Business" on "Wolverine Access" (http://wolverineaccess.umich.edu/).

- Students may add, drop, and swap classes from the Registration page once their enrollment appointment begins and <u>before the add/drop deadline dates</u>. *See Registrar's Office website for deadline dates. http://www.umich.edu/~regoff/*

- Students who want to add, drop, or modify courses after the deadline date must use the Add/Drop Approval form available from the Registrar's Office or the IS+D program office. See sample form below.

- Any course for which a drop is registered after the "drop" deadline will appear on the permanent record as "W".

- There is no early registration for non-Business School students at Ross School of Business. Students must contact the instructor of the course by email to request permission to enroll. See the "IS+D Getting Started Presentation" PowerPoint, page 14, for more details.

IS+D - Getting Started Presentation

The Ross School does not use a letter grade scale system. Grades are converted by the Registrar's Office as follows: Excellent = A+; Good = A; Pass = B+; Low Pass = B; Fail = E

Add/Drop Approval Form

Last			First		Middle		UM ID Number			Term and Year	
School or College			Field of Study			Undergraduate ☐		Graduate/Professional ☐			
Register/Add							**Drop**				
Class #	Subject	Course #	Credit Hrs.	Section	Section	Modifier	Class #	Subject	Course #	Credit Hrs.	Section	Section

If you are changing only credit hours or modifiers (P/F, Visit enter change below.

Class #	Subject	Course #	New Hours	Modifier	Approved by/Date
					The University of Michigan Election Form

Visiting (Auditing) a Course

With the permission of the advisor and the course instructor, a student may enroll in a course as a visitor (auditor), rather than for credit. A visit (audit) will not be counted toward degree credit requirements. Full fees will be assessed at the current rate of tuition. After registering for the course online via Wolverine Access, the student must register for this status in person at the Registrar's Office, and present a Drop/Add form with the signatures of both the instructor and the student's department graduate chair or advisor.   Before enrolling, the student must confer with the instructor to reach an agreement on what will constitute satisfactory completion of the course.   The student is expected to attend class regularly and may be asked to submit assignments and to take examinations. See below for an explanation of how visits (audits) are noted on the permanent academic record.

Elections of visited (audited) courses must appear on the class schedule printout provided at registration.   Students should check their class schedule printouts for accuracy and completeness.

After a grade has been issued, a course may not be changed from letter graded to visit (audit) status, or vice versa.

Adding, Modifying, Dropping and Repeating a Course

Students are urged to change course selections only after consultation with their advisors. The Registrar's Office evaluates revised course elections to determine if an adjustment in fees is necessary.

Through the third week of classes in a full term (or the second week of classes in a half term), students may add or drop a course, change status from credit to visit (audit), or increase or decrease the hours for a course within the range listed in the Time Schedule on its website: http://www.umich.edu/~regoff/.   Departmental approval is necessary to change course elections.   Departments and programs may have separate deadlines or procedures.   A student who seeks to drop the only course for which he or she is registered must follow procedures for a term withdrawal as outlined on the Registrar's website.

After the third week in a full term (or the second week in a half term), and until the last day of classes of that term or half term, students must obtain signed approval from the course instructor and the chair of the home department or program before an add, drop or change of status from credit to visit (audit) can be made.   Students should contact the department or program administrator for election worksheets or contact the Registrar's Office 12 1210 LSA Building, 500 S. State St.; or at Pierpont Commons on North Campus.   Note: Any course for which a drop is registered after the third week in a full term (or the second week in a half term) will appear on the permanent record as "W" (withdrawn).

No changes to a course are allowed after a grade has been assigned. Retroactive changes to a course or credit are exceptions to normal policy, and permission is granted only for

unusual reasons and with approval from the department or program. Petitions must be submitted to Rackham OARD for approval.

Additional information and procedures for changing courses is available at the University Registrar's website.

International students should consult with the International Center before dropping below the full time status level of eight credits, as this may affect immigration status.

Students may repeat a course with permission of the advisor and course instructor. Credits for the course may not be earned beyond the limit set by guidelines of the department or program. Each election and grade for a course that is repeated will remain on the transcript, and will be counted into the grade point average as separate elections.

Information Relating to the Rackham Doctoral Degree Process

For information and forms relating to the Rackham Graduate School doctoral degree process please visit the websites listed below:

Rackham Doctoral Students homepage
http://www.rackham.umich.edu/doctoral_students/

Graduate school academic policies
http://www.rackham.umich.edu/policies/article/gsh/

PLAN -"Professional. Life. Academics. Networks. for Doctoral Students"
http://www.rackham.umich.edu/plan/

Information Relating to the Design Science Annual Progress Report

The Design Science program requires an annual progress report from each of its students, generally submitted before the end of the Winter term (April).

Each student will receive an Annual Report form via email from the program directors.
The report will contain fields to be filled in by the student.

It is also expected that each student will meet with his/her academic advisors both to discuss progress and plans, and to complete the annual report with both advisors signatures.

Dissertation Committee Form

Dissertation Committee Recommendation and Approval is processed online as of March 2014.

http://www.rackham.umich.edu/downloads/oard-dissertation-committee-guidelines.pdf
http://www.rackham.umich.edu/downloads/oard-dissertation-committee-worksheet.pdf

- Student should review the committee guidelines before completing the committee worksheet.
- The worksheet is initiated by the student and then forwarded to the Graduate Coordinator to submit online.
- As the request moves through the workflow, each approver (student, advisor) will receive email triggering a request for action.

Recommendation for Candidacy Form

Recommendation for Candidacy form is processed online as of August 2013.
https://secure.rackham.umich.edu/OARD/atc/index.php/ATCForm/add

- The Prelim 2 Committee Chair must send an email to the Graduate Coordinator indicating approval for Recommendation for Candidacy form to be initiated.
- The Recommendation for Candidacy form is initiated by the Graduate Coordinator in the online system.
- Any Prelim presentation materials must be forwarded from the student to the Graduate Coordinator for retention in the student's electronic file.

Phone Numbers and Web Addresses

Please Note: To reach campus numbers from a campus phone, dial only the last 5 digits. All numbers listed below are within the 734 area code.

EMERGENCY..**911**..

Sexual Assault Prevention and Awareness
Center 24-Hour Crisis Line......................936-3333..

University Hospital Emergency Dept............936-6666...

Elective Tuition Refund Plan-
Medical Withdrawals..764-5182........................http://www.uhs.umich.edu/tri

General Information
Ann Arbor Directory Assistance......................... 555-1212...

Campus Information Centers.............................764-INFO ....http://www.umich.edu/~info

University Operator ....0(on campus)...

University Operator (Off Campus) ....764-1817...

University of Michigan Gateway ....http://www.umich.edu

College of Engineering ....647-7000........................http://www.engin.umich.edu

IS+D office...764-3071.......................http://isd.eng.umich.edu

Ross School of Business...763-5796............................http://www.bus.umich.edu

Graduate Guide to Commencement at UM ....http://www.umich.edu/~gradinfo/

Michigan Engineering Commencement at UM....http://www.engin.umich.edu/students/graduation/

Engineering Career Resource Center (ECRC)...647-7160.....................http://career.engin.umich.edu

Campus Career Center...764-7460.......... http://www.careercenter.umich.edu
.

Bookstore and Copy Centers
Print, Plot, & Copy Shop...763-3584...http://www.tcaup.umich.edu/mediacenter/

Ross School Course Pak (order online).. ....link available from class website

Ross School Text Book Requirements ....list available from class instructor

North Campus Commons Book Store................668-6022........................ http://umnorth.bncollege.com

Course and Registration Information
College of Engineering Course Descriptions...http://www.engin.umich.edu/bulletin/ged/index.html

Office of the Registrar (Main Registrar)..........764-6280....................http://www.umich.edu/~regoff

Office of the Registrar Schedule of Classes........................http://www.umich.edu/~regoff/schedule/

Office of Registrar Final Exams Schedule.................................http://www.umich.edu/~regoff/exams

Office of Registrar Academic Calendar... http://ro.umich.edu/calendar/

Registering for Classes.. http://wolverineaccess.umich.edu

Student Financial Operations ....764-7447.........http://www.finops.umich.edu/student

Appendix I - Design Science Course Descriptions

DESCI 501 ANALYTICAL PRODUCT DESIGN Fall (3 credits)
Prerequisites:
The design of artifacts is addressed from the multidisciplinary perspective that includes engineering, art, psychology, marketing, and economics. Using a decision-making framework, emphasis is placed on understanding basic quantitative methods employed by the different disciplines for making design decisions, building mathematical models, and accounting for interdisciplinary interactions throughout the design and development process. Students work in teams to apply the methods on design project from concept generation to prototyping and design verification.

DESCI 502 DESIGN PROCESS MODELS Winter (3 credits)
Prerequisites: DESCI 501 or Permission of Instructor
Interaction and coordination of decisions based on multi-discipline design analyses is studied in the context of newly developed artifacts. Innovation and creativity are addressed as elements of the design process. Enterprise design decisions made on functionality and business criteria are analyzed within psychological, organizational, cultural and social models. Students propose and test novel analysis methods and design process models. The material is studied through lectures and reading assignments. Students work individually and in teams on in-class and out-of-class activities designed to explore concepts and enhance understanding of issues at an experiential level. Students study the literature and propose and test a novel design analysis method or design process model of their choice, individually or in small teams. Teams with diverse backgrounds are particularly encouraged. Students present their findings as end-of-term projects. There is no final exam. Class meetings typically comprise two hours of lecture/recitation and one hour of individual and/or team activities.

DESCI 790 DESIGN SCIENCE COLLOQUIUM Fall (1 credit + 2 credits)
Topics on Design Science are presented by doctoral candidates and by invited speakers across campus and from outside the University. The aim of the colloquium is to aid in identifying appropriate dissertation topics and build a community. All students can take it twice; first time enrollment is for 1 credit and the second for 2 credits, requiring individual research study and presentation. After required course enrollments, continuing students are expected to participate in this course as part of community building for the program.

DESCI 791 DESIGN SCIENCE SEMINAR Winter (1credit)
Topics on Design Science are presented by doctoral candidates with an emphasis on interdisciplinary scholarship and students' own research projects. The aim of the seminar is to build community, discuss recent journal papers and provide an opportunity for students to discuss their own research. The course must be taken twice; each time for one credit. After required course enrollments, continuing students are expected to participate in this course as part of community building for the program.

DESCI 990 DISS PRE-CAND (1-8 credits)
Dissertation/Pre-candidate --Dissertation work by doctoral student not yet admitted to status as candidate. The defense of the dissertation, that is, the final oral examination, must be held under a full-term candidacy enrollment.

DESCI 995 DISS CAND (8 credits)
Dissertation/Candidate – Dissertation work by doctoral student admitted to status as candidate. The

defense of the dissertation, that is, the final oral examination, must be held under a full-term candidacy enrollment.

ARCHITECTURE AND URBAN PLANNING

ARCH 516 ARCHITECTURAL REPRESENTATIONS Fall (3 credits)

This course focuses on the development and techniques of architectural representation. Modes of representation are not simply neutral depiction but construct a proposition of architecture. Through investigating potentials within the forms and conventions of representation, this course examines and strengthens the relationship between drawing, model, and architectural intention. The course will be broken into two primary and interrelated parts: 1. Development and Theories of Architectural Representation (Lecture) 2. Drawing Methods (Studio Workshop)

ARCH 519 PRINCIPLES AND PRACTICE OF URBAN DESIGN I Fall (3 credits)

The seminar is designed as a critical and collective inquiry into theories of urban design in order to develop an in-depth, interdisciplinary approach toward a more meaningful urban design for the future. Through a series of readings, discussions, case studies, presentations, and research work, students focus on deficiencies and opportunities in current urban design approaches, and formulate their own perspectives and strategies of urban form intervention, based on a critical understanding of the fundamental nature of cities versus the nature of thinking in the field of urban design.

ARCH 552 ARCHITECTURAL DESIGN V Fall (6 credits)

These graduate-level studio design courses, characterized by architectural problems of increasing scale and complexity, usually one semester in length, require solutions that are thorough in their conception, development, and execution. Approximately twelve studio sections are offered in each regular term, each with a unique focus, but all dedicated to comprehensive architectural design. Examples include: aesthetic and symbolic issues, comprehensive building design, facilities planning, housing, community design, urban design, historic preservation and conservation, the architect as developer, structure, energy systems and conservation, professional practice and management, computer applications to design, and honors studio. Detailed course descriptions for each section are posted during registration. Many sections require that specific 500/600-level architecture lecture/seminar courses be taken prior to or concurrent with the design studio.

ARCH 571 DIGITAL FABRICATION Fall/Winter (3 credits)

Digital technology is transforming not only the way we conceive of and design buildings but through manufacturing advances in aerospace, automotive, and shipbuilding, it is transforming the way we manu-facture and construct buildings. This course explores the crossover between computer-aided design and advanced fabrication techniques. Through a series of hands-on labs and small design projects students learn various software applications and computer-driven hardware tools as a means of introducing basic concepts of manufacturing and construction.

ARCH 575 BUILDING ECOLOGY Fall (3 credits)

The objective of this course is to provide students with an understanding of ecological principles in architecture. Principles of life-cycle design, economy of resources and humanistic design are introduced and ecological factors associated with each of these principles are examined. Design strategies to increase environmental sustainability in buildings are investigated. An emphasis is given to how environmental factors (heat, light, and sound) influence

thermal, visual, and acoustic qualities in built-in environments. Field trips to visit selected buildings to analyze their ecological characteristics comprise an important part of the course.

URP 526 SOCIOCULTURAL ISSUES IN PLANNING AND ARCHITECTURE (3 credits)

Throughout US history, socio-cultural factors have influenced the formation of places, and consequently, social relations and conditions within them. Yet, the fields of planning and architecture have traditionally not emphasized issues such as race, ethnicity, gender, class relations, immigration status (among other) as central topics to be addressed. The purpose of this course is to examine socio-cultural issues and their significance to planning and architecture practice and education. The course has three main goals: 1) Students will gain an understanding of the historical role that social and cultural factors have played in shaping the current context within which planning and architecture work takes place; 2) Students will engage in critical examination of theories and practices that shape the fields of planning and architecture and their social implications; and 3) Students will reflect on the current and desired roles carried out by planners and architects in deliberately or inadvertently affecting social conditions.

URP 572 TRANSPORTATION AND LAND USE PLANNING Winter (3 credits)

This course explores the interrelated systems of urban transportation and urban land use to discover principles and ideas that can be useful in developing plans that affect the two. The course covers four broad areas: 1. Transportation Planning History: What assumptions and approaches have guided domestic transportation planning? How does transportation planning's roots and traditions affect current practice? In what ways did transportation planning and technologies interact to produce evolving city forms? 2. Transportation and Land Use Theory: What frameworks have been developed to understand the interrelationships between transportation and land use, and how might these affect how we view potential transportation planning alternatives? 3. Transportation Planning Techniques: Formal approaches to modeling domestic land use and transportation systems in the past few decades. We explore these approaches as well as their limitations. 4. Urban Transportation Policy: Alternative definitions of "the transportation problem" can lead to different directions for policy. We explore various contemporary transportation planning concerns and approaches to dealing with them.

ART AND DESIGN

ARTDES 610 DIRECTED STUDIO PRACTICE (3-6 credits)

The Directed Studio Practice forms the core of the MFA program. Students engage in six
credit hours of intense exploration and production of creative work through a process of studying motivations, researching content, gathering resources, designing methods, developing skills, producing work, presenting the creative work, and reflecting on results. Faculty advisors direct this independent studio work. Students are responsible for identifying, selecting, and confirming an advising commitment from
faculty advisors according to the advising policy described in the Advising section of this handbook (page 30). Students may elect to split the Directed Studio Practice for 3 graduate level credit hours of an advanced studio class and 3 credit hours of Directed Studio Practice no more than two times during the MFA program. If a graduate level studio class is taken, then the instructor for that studio class will be one of the student two A & D Directed Studio Advisor.

MKT 501/503 MARKETING MANAGEMENT Fall (3 credits)
This course is concerned with understanding 1) an entity's own goals and abilities and 2) its potential and existing customers and competitors as bases for setting objectives and making decisions about products, services, pricing, promotion, and distribution. The ability to analyze current situations and objectives, recognize impediments, and generate solutions is the foundation for creating, achieving, and maintaining competitive advantage. This is a management-oriented course designed to give students an integrative framework for analyzing marketing programs and making marketing decisions. Leveraging the Business School's action-based learning approach, student teams take an active part in course development by creating cases based on their own areas of interest. The course consists of a mixture of lectures, student case presentations, in-class exercises, and a case-based final examination.

MKT 601 STRATEGIC MARKET PLANNING Winter (3 credits)
This course builds directly from Marketing Management 503 and is designed to provide an in-depth, "hands- on" learning experience in marketing strategy, planning and analysis. This course outlines key planning concepts and processes using lectures, case studies and a sophisticated competitive marketing simulation game where feedback is provided to management teams regarding the impact of their strategic and tactical decisions. The course integrates marketing decision making within the context of manufacturing and financial dimensions of
a business organization. Course participants should expect to use large doses of common business sense and managerial acumen and to rely heavily on sound business and marketing principles in the learning process.

MKT 603 STRATEGIC BRAND MANAGEMENT Fall (2.25 credits)
In almost every industry, strong brands sell more, earn more, and last longer. This course covers the creation and leveraging of strong brands, for marketers, general managers, and consultants. We first learn what makes brands strong, via cases, research, and models. Once we develop a roadmap for building strong brands, we cover the strategy and tactics needed to do so: how to create high awareness and relevant identity; a reputation for high quality and leadership; relevant, differentiating, ownable and motivating imagery and associations; and emotional loyalty. Scores of brands, from many industries and countries, are discussed. Then we get to the smart leveraging of brand investments, via successful brand extensions. Finally we look at brand architecture and brand valuation. The emphasis is on practical, useful, real-world learning. For their term projects, student teams study a brand and strategies and tactics to make it stronger.

MKT 607 DISTRIBUTION STRATEGY (2.25 credits)
The course deals with the design and management of marketing channels and primarily focuses on two aspects: understanding the role of marketing channels in creating and sustaining the firm's positioning and analyzing marketing channels as systems of inter-dependent parties that simultaneously cooperate and compete with other parties within as well as across systems. Analysis is based on economic, structural, and behavioral rationales to understand and predict the actions of the relevant parties/firms. Topics include designing channel structure and incentives to match positioning, managing channel conflict, exploring links between channel and branding strategies, understanding multi-channel approaches, and internet distribution. The course relies on lectures, case discussions, readings, and a group project.

MKT 612 RETAILER MANAGEMENT AND TRADE MARKETING (3 credits)

This course covers various aspects of the management of retail companies, with an emphasis on those aspects that bear direct relevance to marketers selling to and through them. In addition, it examines the intricate power relationship between retailers and marketing companies and issues arising from managing such relationship on both sides. The course tackles strategic and tactical issues facing retailers and their vendors, as well as introduces students to quantitative analysis techniques to support these decisions.

MKT 613 CONSUMER BEHAVIOR Winter (1.5 credits)

Virtually all decisions involved in developing an effective marketing mix for a product or service rely on in-depth knowledge of the consumers who comprise the target market. Thus, a clear understanding of the principles, concepts, and results of consumer behavior is critical to successful marketing. In this course we will directly examine the available theory and research concerning the behavior of the consumer, with the goal of understanding how marketing managers can use these ideas. This course focuses on the consumer as an individual. The topics dis- cussed comprise an examination of basic psychological processes: i.e., decision-making, information processing, and social influences. Thus, this course provides both a micro and macro perspective on the factors influencing a customer.

MKT 619 MARKETING RESEARCH DESIGN AND ANALYSIS I (1.5 credits)

This course is about Data: how to gather it and how to make sense of it. The last decade has seen an explosion in the quantity and in the quality of information available to managers. We will focus on understanding data useful to marketers, the types available, experimental design and methods of collection. Course participants will learn to unambiguously define a research goal and create an effective measurement instrument (survey, focus group, store sample), with an eye toward future analysis. Problem areas to be covered include research design and implementation, qualitative research (attitude measurement), survey methods and sampling techniques, in short, what marketers need to know before going `out into the field' and gathering or purchasing data on their own.

MKT 620 MARKETING RESEARCH DESIGN AND ANALYSIS II (1.5 credits)

This course will focus on analyzing, rigorously but in a user-friendly way, marketing-relevant information from surveys, experiments and large-scale databases. Although basic multivariate analytic techniques will be introduced, the course will no emphasize analytic techniques per se, but rather how the marketing research process is carried out conceptually, translating managerial concepts to concrete information about a firm's customers and competitors. Students will also get a feel for the role state-of-the-art marketing research techniques play in the modern organization. Among the topics covered will be commercial and electronic data sources, sampling techniques and the standard methods of multivariate analysis (e.g., conjoint measurement; LOGIT; factor and cluster analyses; multidimensional scaling). Throughout, emphasis will be placed on types of analyses appropriate to particular kinds of marketing data; however, the course will be neither statistically nor 'computerly' intensive.

MKT 625 NEW PRODUCT AND INNOVATION MANAGEMENT Winter (2.25 credits)

The goal of this course is to expose you to new approaches to innovation and new product/service/business development. We will discuss "business models" as a point of departure. The experience of interactions and outcomes between customers and companies in business networks are new sources of value. Companies are innovating new experience environments that facilitate customer interactions with a company's products, processes, employees, as well as customer communities, that generate new value to both sides. We will discuss how companies are building new capabilities for innovation, particularly through co-creation.

MKT 630 MARKETING ENGINEERING Winter (2.25 credits)

The structure and content of those employed in marketing is rapidly changing due to vast increases in desktop computer power and exploding volumes of marketing data. Professions such as marketing manager, account manager, market researcher and Marketing (research) consultant are evolving rapidly in the new technology intense marketing environment. New approaches to marketing are heavily dependent upon analytical tools, and the effectiveness of the new use of those tools depends on the knowledge and skills of the users. The new marketing looks like marketing engineering and is in need of people with marketing engineering skills. This course develops those skills.

OMS 551/552 INTRO TO OPERATIONS AND OPERATIONS MANAGEMENT Fall (3 credits)

This course prepares students to think managerially and analytically about operations processes, and to use the results of analysis to make things work better, faster and cheaper. Operations management studies the value-creating processes by which inputs of materials, labor, capital and information are transformed into products and services which customers want and are willing to play for. These processes can be managed well or poorly. Knowledge introduced in this course will help you understand the reasons for both.

OMS 605 MANUFACTURING & SUPPLY OPERATIONS Winter (3 credits)

This course is the basic concepts and techniques of operations and inventory management. The foundation of the course is a system of manufacturing laws collectively known as "Factory Physics". These laws relate various measures of plan performance such as throughput, cycle time, work-in-process, customer service variability, and quality, in a consistent manner and provide framework for evaluating and improving operations. Concepts and methods are examined via exercises and case studies.

ENGINEERING

IOE 533 (MFG 535) HUMAN MOTOR BEHAVIOR AND ENGINEERING SYSTEMS Fall (3 credits)

This course is designed to provide a basic perspective of the major processes of human motor behavior. Emphasis will be placed on understanding motor control and man-(machine)-environment interaction. Information processing will be presented and linked to motor behavior. Application of theories to the design of the work- place, controls and tools will be underlined and illustrated by substantial examples.

IOE 536 COGNITIVE ERGONOMIC (3 credits)

Theories and concepts of human information processing are introduced to analyze human perceptual and cognitive performance in human machine information systems such as intelligent transportation and manufacturing systems. Conceptual and quantitative models, interface design techniques, and research and evaluation methods are presented. Samples of on-going research are also discussed.

IOE 552 FINANCIAL ENGINEERING I Winter (3 credits)

Theory and applications of financial engineering. Designing, structuring and pricing financial engineering products (including options, futures, swaps and other derivative securities) and their applications to financial and investment risk management. Mathematical methodology that forms the basis of financial engineering, applied stochastic processes and numerical methods in particular.

IOE 553 FINANCIAL ENGINEERING II Fall (3 credits)

Advanced issues in financial engineering: stochastic interest rate modeling and fixed income markets,

derivative trading and arbitrage, international finance, risk management methodologies including Value-at-Risk and credit risk. Multivariate stochastic calculus methodology in finance: multivariate ltoís lemma, ltoís stochastic integrals, the Feynman-Kac theorem and Girsanovís theorem.

IOE 565 TIME SERIES ANALYSIS Fall (3 credits)

Time series modeling, analysis, forecasting, and control, identifying parametric time series, autovariance, spectra, Green's function, trend and seasonality. Examples from manufacturing, quality control, ergonomics, inventory, and management.

IOE 623 COMPUTATIONAL FINANCE Winter (3 credits)

This is a course in computational methods in finance and financial modeling. Particular emphasis will be put on interest rate models and interest rate derivatives. The specific topics include: Black-Scholes theory, no arbitrage and complete markets theory, term structure models: Hull and White models and Heath Jarrow Morton models, the stochastic differential equations and martingale approach: multinomial tree and Monte Carlo methods, the partial differential equations approach: finite difference methods.

ME 555 DESIGN OPTIMIZATION Winter (3 credits)

Mathematical modeling of engineering design problems for optimization. Boundedness and monotonicity analysis of models. Differential optimization theory and selected numerical algorithms for continuous nonlinear models. Emphasis on the interaction between proper modeling and computation. Students propose design term projects from various disciplines and apply course methodology to optimize designs.

ME 558 DISCRETE DESIGN OPTIMIZATION Fall, alternate years (3 credits)

Fundamentals of discrete optimization for engineering design problems. Mathematical modeling of engineering design problems as discrete optimization problems, integer programming, dynamic programming, graph search algorithms, and introduction to NP completeness. A term project emphasizes applications to realistic engineering design problems.

ME 559 SMART MATERIALS AND STRUCTURES Fall, alternate years (3 credits)

A unified approach to the modeling, analysis and simulation of energetic dynamic systems. Emphasis on analytical and graphical descriptions of state-determined systems using Bond Graph language. Analysis using interactive computer simulation programs. Applications to the control and design of dynamic systems such as robots, machine tools and artificial limbs.

ME 577 MATERIALS IN MANUFACTURING AND DESIGN Fall (3 credits)

Material selection on the basis of cost, strength, formability and machinability. Advanced strength analysis of heat-treated and cold-formed parts including axial, bending, shear and cyclic deformation. Correlations of functional specifications and process capabilities. Problems in redesign for productibility and reliability.

ME 581 GLOBAL PRODUCT DEVELOPMENT Fall (3 credits)

A project-based course in which each (global) student team comprising students from three universities will be responsible for development of a product for the global market. Teams will use collaboration technology tools extensively. Several case studies on global product development will be presented and follow-up lectures will focus on the issues highlighted.

ME 587 (MFG 587) GLOBAL MANUFACTURING Winter (3 credits)
Prerequisite: one 400-level MFG or DES or BUS class. II

Globalization and manufacturing paradigms. Product-process-business integration. Product invention strategy. Customized, personalized and reconfigurable products. Mass production and lean production. Mathematical analysis of mass customization. Traditional manufacturing systems. Reconfigurable manufacturing systems. Reconfigurable machines. System configuration analysis. Responsive business models. Enterprise globalization strategies. The global integrated enterprise.

ME 589 SUSTAINABLE DESIGN OF TECHNOLOGY SYSTEMS Fall (3 credits)

A scientific basis for understanding and reducing the environmental impact of engineering design and manufacturing decisions from a life cycle perspective. Environmental impact principles: air/water pollution, ozone depletion, global warming, resource sustainability. Life cycle assessment and environmentally conscious manufacturing of metals, plastics, and electronics products. Systems design metrics, disassembly, remanufacturing, recycling, policy considerations. Case studies include: sustainable mobility, alternative energy sources, tooling and machining, refrigeration, electronics remanufacturing.

ENVIRONMENTAL STUDIES (MULTI-SCHOOL)

CEE 586 INDUSTRIAL ECOLOGY Winter (3-4 credits)
Prerequisite: senior standing

Analysis of material and energy flows in industrial systems to enhance eco-efficiency and sustainability. Methods: life cycle assessment quantifies energy, waste, emissions (greenhouse gases) for materials production, manufacturing, product use, recovery/disposition. Life cycle design integrate environmental, performance, economic, and regulatory objectives. Multi-objective analysis, engineering design analysis, cross-functional teamwork, large sea modeling skills.

CEE 686 CASE STUDIES IN ENVIRONMENTAL SUSTAINABILITY Winter (2-3 credits)
Prerequisite: senior or graduate standing.

Case studies focusing on utilization of the principles of industrial ecology and environmental sustainability in professional practice. Development of environmental literacy through examination of current and historical examples of environmental issues and related corporate and industrial practices.

EHS 572/NRE 514 ENVIRONMENTAL IMPACT ASSESSMENT Winter (3 credits)

This 3-credit course develops a comprehensive framework for evaluating and predicting the environmental impacts of manmade projects. The theory and application of mathematical and computer models predicting the transport and fate of contaminants in air, water and soil media are presented. The selection, application, integration and evaluation of models are emphasized. This is a core course in the Environmental Health program. (Winter term; Cross listed in Civil and Environmental Engineering and School of Natural Resources)

HBEHED 516 GLOBAL HEALTH ANTHROPOLOGICAL PERSPECTIVES Fall (3 credits)

Master's level lecture course designed to provide an extensive overview of the major initiatives and issues in global health over the past three decades. Anthropological perspectives on and critiques of international health development programs will be emphasized. Readings will focus on examples of anthropology in global public health, and written reactions to these readings, along with two objective exams, will form the basis for course grading. The course constitutes an elective for students in the developing Global Health IC, and will be cross-listed as an upper-division undergraduate course in the Department of Anthropology (LS&A). Although anthropological perspectives will be emphasized no prior anthropological coursework or competencies are expected of students.

OMS 613 SUSTAINABLE OPERATIONS Winter (1.5 credits)

This course will examine important emerging manufacturing management issues through the lens of the triple bottom line: economic, environmental and social sustainability. A successful student will leave the course; a) with a much deeper understanding of these major forces shaping manufacturing; b) better able to analyze and make decisions involving complex tradeoffs across economic, technological, ethical, human rights and environmental dimensions; c) more creative in identifying, proving and implementing profitable business opportunities that address these difficult tradeoffs.

URP 532 SUSTAINABLE DEVELOPMENT: RESOLVING ECONOMIC & ENVIRONMENTAL CONFLICTS Winter (3 credits)

A growing body of evidence suggests that human populations world-wide are not living on the earth in ways that can be sustained indefinitely given current patterns of natural resource consumption, population growth, land development, and institutional arrangements. In response to this predicament, the concept of "sustainable development" has become prominent in popular and academic policy-making and planning debates over the past decade. Does the notion of sustainable development itself offer any useful guidance for making public policy and planning decisions, or is it merely an attractive oxymoron that different interests can agree on only at an abstract level? The goal of this class is to explore this question in depth. The course begins by considering the variety of ways in which our current lifestyles, locally and globally, are not sustainable, and then works through the concept of sustainable development from different vantage points: in terms of fundamental principles, scale (from global to local), and institutions, policies, and laws. Finally, the course addresses a variety of policy-making and planning prescriptions that have been offered and assesses whether and how those various prescriptions will likely work in practice. Working in groups, students test these theories of sustainability by applying them to selected client communities in Michigan.

POLSCI 761 GLOBAL ENVIRONMENTAL CHANGE AND THE STATE (3 credits)

This course will examine the interaction between global environmental change and political institutions, activities, and ideas. It asks if the perception that we are beginning to experience widespread global environmental change is altering the function, shape or significance of the state in the contemporary world. The course begins with an examination of the dominant philosophical, historical, and social science theories of the interaction between the environment and the organization and conduct of political activities. It then examines the various ways that environmental change has influenced the state and political activities historically, and finally it compares these to contemporary environmental influences on politics and the state. The largest section of the course will be divided into three broad sections, one on the role of environmental concerns in political processes, one on their influence on governance, and one on inter-state relations. Human beings have always been influenced by the physical environment. Through climate, weather, and agriculture, the physical environment has affected what they can and cannot do; some argue that the environment may even have been the most significant force on human activities in pre-industrial societies. However, human beings have not merely been shaped by the environment. They also played a significant t role in creating the physical and ecological environments in which they live. In recent year, with rapid population growth and industrial development, the impact of human activities on the environment has intensified and evidence of this change has been more widely recognized. Some now argue that environmental change may stimulate widespread migration, alter the political and economic relationships between states, and even cause violent conflict. The environment has become a pressing issue in political life globally. As such it is certain to have an impact within and among states. This is the subject matter of the course.

SI 621 INFORMATION, ETHICS AND APPLIED POLICY Fall (3 credits)

The "information" revolution and the pervasive use of information technology within all organizations, profit and not-for-profit, public and private, has created an environment in which electronic access to massive quantities of information is now possible at startling speeds. The technologies themselves, and the new software applications, are changing so rapidly that it is not unusual for new applications to be put into place without the users, and sometimes even the system administrators, fully understanding the way in which an application works. The extent to which a given application exposes the organization's proprietary data, the personal information of its employees or constituencies, or the entire organization to liabilities is generally not fully understood. Within this environment, policy makers, managers, indeed all individual users of the technology, must make decisions about how they want to use technology and software and, even, whether they will use the technology in a particular way. This changing environment requires that all individuals and managers of organizations clarify their organizational values, understand ethical and unethical responses to issues that arise, and actively process information to make informed decisions, develop effective policies, and institute best practices.

SI 648/748 INFOCULTURE: THEORY AND METHODS IN THE HISTORY AND SOCIOLOGY OF INFORMATION TECHNOLOGY Fall (3 credits)

Explores key theoretical and methodological concerns in the history and sociology of information technology. The tools, methodologies, and analytic strategies are primarily those of history and the interpretive social sciences -- sociology, anthropology, communication, and cultural psychology, in disciplinary terms. The first part of the course explores the history and historiography of information. Topically, it addresses the emergence of information technologies from writing and the book to modern media, computing, and the Internet. Theoretically, it explores debates around historical causation, trajectories, periodization, evidence, and the cultural framing and reception of information technologies and practices. The second part of the course draws selectively on the literatures of qualitative sociology, anthropology, cultural psychology, and the information sciences to explore a range of contemporary information phenomena: open source communities, online identities, creativity and play, distributed knowledge enterprises, mobile and ubiquitous computing, the semantic Web, etc. The longer term goal of the course is to build a more solid, rigorous, and creative foundation for the social study of information by drawing on promising theoretical and methodological approaches developed in the social sciences at large.

ANTHROPOLOGY

ANTHRCUL 554 MEDIA ANTHROPOLOGY Winter (3 credits)

This graduate seminar poses an anthropological critique of the ways in which media technologies (photography, radio, television, film, audiocassettes, newspapers, the Internet, etc.) are used to represent and construct cultures. We will question how and why mass media produce formulaic identities, and explore how people employ media technologies to interrogate, subvert, and redefine existing conventions.

ECONOMICS

ECON 601/602 MICROECONOMIC THEORY I & II Microeconomic Theory I (1.5 credits)

The first required microeconomic theory course for doctoral students. Topics include, theory of the consumer, aggregate demand, theory of the firm, general equilibrium and uncertainty. Students are expected to be comfort- able with multi-variable calculus including optimization as well as to follow and

replicate simple proofs involving basic algebra and logic.

Microeconomic Theory II (1.5 credits)
The first required macroeconomic theory course for doctoral students. Begins with an overview of aggregate income determination. Continues with an in-depth treatment of economic growth: the Solow, neoclassical, and new growth models. Proceeds with introduction of rational expectations models and techniques with application n to output determination and price adjustment in closed and open economies.

ECON 631 INDUSTRIAL ORGANIZATIONS AND PUBLIC POLICY (3 credits)
The focus of this course is on theoretical analysis of behavior in markets. The main emphasis is on how firms compete with one another, and secondary emphasis is placed on organizational behavior and how firms interact with consumers. In recent years topics have included: price discrimination, oligopoly theory with and without differentiated products, strategic trade, mergers, markets with imperfectly informed participants, entry deterrence, predation, collusive behavior, cartel behavior, research and development competition, and the sale or rental of durable goods. Non-cooperative game theory is the predominant tool of analysis and is developed as needed during the course.

PSYCHOLOGY

PSYCH 613 ADV STATISTICS I Fall (4 credits)
This is a two-term course (with Psych 614 in the Winter term), and is a prerequisite for Psych 614. Students will gain experience by analyzing data and gain an appreciation for the rationale underlying the standard statistical procedures used in psychological research. The course consists of five hours of lecture; additional review sections will also be available. Topics covered throughout the year include analysis of variance, regression, factor analysis, multidimensional scaling, clustering, and structural equations modeling. Students will also analyze data from their own research projects as well as design studies in their own area of research. All non-Clinical, first-year students should register for this class.

PSYCH 614 ADV STATISTICS II (4 credits)
The general linear model is presented with an emphasis on exploration data, contrast, and residual analysis. Topics covered include ANOVA, multiple comparisons, and randomized block. I square, factorial and repeated measure designs, random and nested effects, multiple regression, transformations, residual analysis and diagnostics. ANOVA: time series analyses; common tables; Logistic regression.

PSYCH 644 COMPUTATIONAL MODELING OF COGNITION (2-4 credits)

PSYCH 682 ADVANCED SOCIAL PSYCHOLOGY Fall (3 credits)
This course is a graduate level introduction to the field of social psychology. The course starts with a general introduction to the field. We consider how the field has conceptualized two of its primary concepts -- person or self and context or situation. We also examine evolutionary underpinnings of human social behavior. We will then turn to several select topics including dissonance, social cognition and attitudes, stereotype and prejudice, culture and cognition, self-esteem and honor, and health and well-being. We will read both classic and contemporary, cutting-edge papers on each topic. Throughout the course a strong emphasis is given to the power of social situations that are comprised of multi-level realities including personal, interpersonal, societal, and cultural.

PSYCH 687 METHODS OF SURVEY SAMPLING (3 credits)

This is a moderately advanced course in applied statistics, with an emphasis on the practical problems of sample design, which provides students with an understanding of principles and practice in skills required to select subjects and analyze sample data. Topics covered include stratified, clustered, systematic, and multi-stage sample designs, unequal probabilities and probabilities proportional to size, area, and telephone sampling, ratio means, sampling errors, frame problems, cost factors, and practical designs and procedures.

PSYCH 711 QUESTION DESIGN (3 credits)

This course is about the development of the survey instrument, the questionnaire. Topics include wording of questions (strategies for factual and non-factual questions), cognitive aspects, order of response alternatives, open versus closed questions, handling sensitive topics, combining individual questions into a meaningful questionnaire, issues related to question order and context, and aspects of a questionnaire other than questions. Questionnaire design is shown as a function of the mode of data collection such as face-to-face interviewing telephone inter- viewing, mail surveys, diary surveys, and computer-assisted interviewing.

PSYCH 721 MATHEMATICAL PSYCHOLOGY (3 credits)

Graduate standing in Psychology or approved joint programs and permission of instructor.

PSYCH 722 DECISION PROCESSES Fall (3 credits)

Recent, widely-publicized research in mechanisms of attention, the dopaminergic striatal system, and neuroeconomics have shined a light on a long and productive history of behavioral research in decision making. While this upswelling of interest in decision making is exciting and has already produced some valuable insights, in order for the field to truly benefit from the merger between neuroscience and behavioral decision making, people need to fully understand both aspects and to think critically about the ways in which neuroscience can answer questions that were heretofore unanswerable. To this end, students in PSYCH 722 will attend lectures for Frank Yates's undergraduate course in decision processes (PSYCH 449 — consult the course description for more information), where you will learn in detail about the history and breadth of views in behavioral decision making. In addition, students in PSYCH 722 will meet weekly with Stephanie Preston to discuss the lectures and additional readings from neuroscience and animal behavior that can shed light on the topic. During the academic term, each student will be expected to identify an outstanding issue in decision making and design an experiment that can clearly discriminate between two likely theories. Ph.D. students who plan to study decision making in any form, or who want to learn how to integrate across levels of analysis (e.g., behavior and neuroscience) are greatly encouraged to attend. Note: Psych 722 meets for 1.5 hours as a stand-alone class, then meets with Psych 808-002 for the Decision Consortium until 4:30pm.

PSYCH 746 HUMAN PERFORMANCE (3 credits)

Graduate standing in Psychology or approved joint programs and permission of instructor.

PSYCH 785 GROUP PROCESSES (3 credits)

Graduate standing

Appendix II - Design Science Program Committee and Participating Faculty

Program Committee

Jan-Henrik Andersen (janhande@umich.edu)
Associate Professor, School of Art and Design
Form Semantics, Technology-based Design Tools, Environmental Sustainability

Diann Brei (dibrei@umich.edu) – PROGRAM DIRECTOR
Associate Professor, Mechanical Engineering Department, College of Engineering
Smart materials and structures, sensor and actuator design, MEMS, structural dynamics, vibrations and noise control

Fred Feinberg (feinf@umich.edu)
Professor, Marketing, School of Business Administration
Choices Under Uncertainty, Mathematical Psychology, Bayesian Econometrics, Dynamic Programming

Brian Gilchrist (gilchrst@umich.edu)
Professor and Interim Chair, Electrical Engineering and Computer Science
Plasma Diagnostics, Spacecraft Technology

Richard Gonzalez (gonzo@umich.edu) Professor and Department Chair, Psychology
Judgement and Decision Making Product Design, Medical Decision Making, Applied Statistics

Panos Papalambros (pyp@umich.edu)
Donald C. Graham Professor of Engineering; Professor, Mechanical Engineering; Professor, School of Art and Design; Professor, Taubman College
Optimal Design, New Product Development

Predrag Klasnja (klasnja@umich.edu
Assistant Professor of Information, School of Information and Assistant Professor of Health Behavior and Health Education, School of Public Health

Colleen Seifert (seifert@umich.edu) – PROGRAM CHAIR
Professor, Psychology; Professor, School of Information
Cognitive Science, Cognitive Modeling, Intelligence, Knowledge Representation, Memory Retrieval, Problem Solving

Carolyn Yoon (yoonc@umich.edu)
Associate Professor, Marketing, School of Business Administration
Cognitive Aging in Consumer Contexts, Implicit Memory, Cognitive Neuroscience, Cross-cultural differences in memory

Participating Faculty

James Carpenter (jcarp@umich.edu)
Associate Professor and Chair, Orthopedic Surgery, Medical School
Orthopedic Medicine, Sports Medicine

Shanna Daly (srdaly@umich.edu)
Assistant Research Scientist, Undergraduate Education and Adjunct Lecturer in Arts Engineering, College of Engineering
Design approaches and ideation, innovation practices, and creative processes

James Duderstadt (jjd@umich.edu)
President-Emeritus; University Professor, Science and Engineering; Director, Millennium Project
Nuclear Fission Reactors, High Powered Lasers, Federal Science Policy, Information Technology

Georg Essl (gessl@umich.edu)
Assistant Professor for Electrical Engineering & Computer Science and Music
Sensory-rich human computer interaction

Ying Fan (yingfan@umich.edu)
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Industrial Organization, Applied Microeconomics

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Ryan Kellogg (kelloggr@umich.edu)
Associate Professor Economics Research bridges industrial organization, energy economics and environmental policy.

Yili Liu (yililiu@umich.edu)
Arthur F. Thurnau Professor; Associate Professor, Industrial and Operations Engineering Cognitive Modeling, Cognitive Ergonomics, Cognitive Psychology, Engineering Aesthetics, Human Factors, Human-Computer Interaction

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Hybrid forms of Art and Design Practice

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Human –computer interaction, particularly interactions that involve the senses of hearing and touch.

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Associate Research Scientist, Industrial and Operations Engineering, Transportation Research Institute.   Impact Biomechanics, Physical Ergonomics and Engineering Anthropometry, Cognitive Ergonomics

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Perceptual Acoustics, Music Processing, Statistical Signal Processing, Time-Frequency Distributions

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Professor, Psychology; Professor, Marketing
Judgment and Decision Behavior, Decision Aiding, Judgment Analysis, Applications of Cognitive Psychology

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Associate Dean for Entrepreneurial Programs, Professor of Aerospace Engineering, Professor Atmospheric, Oceanic and Space Science

Affiliated Faculty

[Mary Simoni (msimoni@rpi.edu)](mailto:msimoni@rpi.edu)
Dean, School of Humanities, Arts and Social Sciences at Rensselaer Polytechnic Institute

Appendix III- Design Science Program Students

The graduate student community in design science includes students majoring in design science and studentsfrom other disciplines who have been involved with the program. Prospective students may contact the graduate students below for further information on their experience with the program.

Clover Aguayo (caguayo@umich.edu) Ph.D Pre-Candidate (Design Science)
Disciplines: Mechanical Engineering and Psychology (User Perception)
Co-Advisors: Richard Gonzalez, Diann Brei, and Jonathan Luntz

Robert L. Alexander (rlalexan@umich.edu) Ph.D Candidate (Design Science)
Disciplines: Music/Psychaocoustics and exploratory data analysis (space physics)
Co-advisors: Sile O'Modhrain, Thomas Zurbuchen, and Jason Gilbert

Alexander Burnap (aburnap@umich.edu) Ph.D Candidate (Design Science)
Disciplines: Mechanical Engineering and Machine Learning
Co-Advisors: Richard Gonzalez and Panos Papalambros

Tseng-Ping Chiu (mattchiu@umich.edu) Ph.D Pre-Candidate (Design Science)
Disciplines: Psychology and Marketing
Co-Advisors: Carolyn Yoon and Shinobu Kitayama

Michael Deininger (midei@umich.edu) Ph.D Pre-Candidate (Design Science)
Disciplines: Biomedical Engineering and TBD
Co-Advisors: Kathleen Sienko and Shanna Daly

Namwoo Kang (nwkang@umich.edhu) Ph.D. Candidate (Design Science)
Disciplines: Marketing and Mechanical Engineering
Co-Advisors: Panos Papalambros and Fred Feinberg

Melody Ku (melodyku@umich.edu) Ph.D. Pre-Candidate (Design Science)
Disciplines: Information Science and Medical Sociology
Co-Advisors: Predrag Klasnja and Gary Hammer

Vineet Raichur (vineetr@umich.edu) Ph.D. Candidate (Design Science)
 Disciplines: Mechanical Engineering and Psychology
 Co-Advisors: Steve Skerlos and Richard Gonzalez

Amir Sabet Sarvestani (asabet@umich.edu) Ph.D. Candidate (Design Science)
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Appendix IV- Design Science Program Partners and Contact Information

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