Policies, Requirements, and Regulations

The University, the University Graduate School, and the College of Engineering and Computing have a set of guidelines to protect the student's rights and to ensure a timely graduation. Students must become familiar with all University, the University Graduate School, and College's graduate procedures. These procedures are described in the University's Student Handbook, this catalog and at **http://gradschool.fiu.edu**.

The programs, policies, requirements and regulations listed in the catalog are continually subject to review to serve the needs of the University's various stakeholders, including its students, and to respond to the mandates of the FIU Board of Trustees and the Florida Legislature. Changes may be made without advance notice.

Florida International University and the College adhere to opportunity practices, which conform to all laws against discrimination and are committed to non-discrimination with respect to race, color, creed, age, handicap, sex, marital status, or nationality. Additionally, the University is committed to the principle of taking positive steps necessary to achieve the equalization of educational and employment opportunities.

College of Engineering and Computing Dismissal Policy

A student who has been dismissed from the University for the first time may see the Graduate Program Director for that department to begin the appeal procedure. The Director will determine if the student is eligible to appeal the dismissal or if there is a way to lift the dismissal. If the student is eligible, he or she must make an appointment to see the department's chairperson or associate chairperson. The student must bring a letter stating when he or she was dismissed the first time and what he or she is going to do to ensure that he or she is not dismissed a second time. If the chairperson determines that the student is worthy of reinstatement, he or she will prepare and sign a memo for the College Dean's consideration stating the conditions for the student to be reinstated. The student may be readmitted on academic probation upon the approval of the Dean of the University Graduate School. If the student does not meet these conditions, he or she will be dismissed a second and final time from the program. The student must also sign an agreement stating that he or she understands that the department will not allow a second reinstatement if the student is dismissed again.

Any student who is dismissed a second time from FIU will not be readmitted under any circumstances. Only a first dismissal appeal is considered in the College of Engineering and Computing, a second dismissal appeal will not be accepted.

Department-Specific Information

For additional information refer to your selected department in this catalog, or call the graduate program director of each department. As listed above.

Other Important Contact Information
Website: **cec.fiu.edu**
Admissions:
http://gradschool.fiu.edu   (305) 348-7442
College of Engineering and Computing-
Graduate Admissions   (305) 348-7442

Campus Resources   (305) 348-2522
Career Services   (305) 348-1281
Financial Aid   (305) 348-7000
University Graduate School   (305) 348-2455
International Students and Scholars
Services   (305) 348-2421
Registrar's Office   (305) 348-2320
Scholarships   (305) 348-0349
Tuition Waivers   (305) 348-7000

Enterprise and Logistics Engineering

Chin-Sheng Chen, *Professor and Program Director*
Shih-Ming Lee, *Research Associate Professor*
Karen E. Schmahl, *Research Associate Professor*
Shabnam Rezapour, *Assistant Professor*

Affiliated and Research Faculty
Paul Bianco, *Affiliated Professor*
Seema Pissaris, *Affiliated Professor*
Jesus Sanchelima, *Affiliated Professor*
Hussein Tavana, *Affiliated Professor*
Javier Munoz, *Affiliated Professor*
J. Chris Ford, *Affiliated Professor*
Alvaro Carreras, *Affiliated Professor*
Kate Sackman, *Affiliated Professor*

Master of Science in Engineering Management

The Master of Science in Engineering Management (MSEM) program develops future leaders of business and industry in an engineering and technological environment. The program blends a carefully chosen mix of graduate courses offered by the College of Engineering and Computing, the College of Business Administration, and the College of Law. The MSEM program is designed to offer a tailored degree for those engineers who would like to advance to managerial positions and wish to acquire the necessary knowledge and skills for success. The MSEM program includes coursework that simulates a business environment where students learn and apply engineering tools, managerial theories, and best practices to design and operate industrial systems. Students in the program are expected to acquire contemporary engineering management theories and techniques, and simultaneously build a solid technical foundation in a chosen engineering track.

Admission Policies

The applicant to the MSEM program must have a bachelor's degree in engineering or a closely related field from a regionally accredited institution with a minimum of "B" average in upper-level undergraduate work, or a graduate degree from an accredited institution. In addition, international graduate student applicants whose native language is not English are required to submit a score for the Test of English as a Foreign Language (TOEFL) or for the International English Language Testing System (IELTS). A total score of 80 on the iBT TOEFL or 6.5 overall on the IELTS is required.   The applicant whose GPA does not meet the minimum GPA requirement may

be considered for conditional admission. For such consideration, the applicant must submit (1) three letters of recommendation; (2) a resume including education, training, and employment history, practical and research experience (such as projects and publications), skills and other pertinent information; and (3) a statement of objective in which the applicant must clearly state his/her intended engineering track, in addition to other information.

Degree Requirements

The MSEM program requires 30 credit hours of course work including 9 credit hours of engineering management core courses, 9 credit hours of business electives and 12 credit hours of approved graduate-level electives from an engineering track.

Engineering Management Core Courses

Students in the Engineering Management program are required to take three courses (9 credit hours) to build an engineering management foundation that includes topics in engineering quality management, systems improvement, engineering project management, intellectual property issues, and business laws. The three core courses are:

EIN 5226	Total Quality Management For Engineers	3
ESI 6455	Advanced Engineering Project Management	3
LAW 5072	Business Law and Intellectual Property for Engineers and Entrepreneurs	3

Business Electives

Students in the program are required to take three courses (9 credit hours) to gain fundamental knowledge about management functions that includes topics in accounting, finance, organizational behavior, leadership, marketing, and operations management. Additional business electives may be considered subject to the Director's approval. A suggested list of business elective courses is given below:

ACG 6026	Accounting for Managers	3
EIN 5359	Industrial Financial Decisions	3
EIN 6160	Management of Innovation and Technology	3
EIN 6325	Business Plan Development	3
FIN 6406	Corporate Finance	3
FIN 6425	Financial Management Policies	3
FIN 6487	Financial Risk Management- Financial Engineering	3
MAN 6209	Organization Design and Behavior	3
MAR 6805	Marketing Management	3
MAN 6830	Organization Information Systems	3
MAN 6501	Operations Management	3
MAN 6167	Leadership in a Global Environment	3

Engineering Tracks

Students in the Engineering Management program must choose an engineering track from any academic unit in the College of Engineering and Computing. Within a chosen track, students are required to take four courses (12 credit hours) that meet the program's technical requirement. These engineering electives are designed to broaden and deepen the students' understanding of engineering and technology development in a chosen track. Students

should have a proper educational background in order to take elective courses. Additional tracks and elective courses may be available, subject to the approval of the Engineering Management program director.

Biomedical Engineering Track

Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

BME 5005	Applied Biomedical Engineering Principles	3
BME 5036	Biotransport Processes	3
BME 5105	Intermediate Biomaterials Science	3
BME 5316	Molecular Bioprocess Engineering	3
BME 5340	Introduction to Cardiovascular Engineering	3
BME 5560	Biomedical Engineering Optics	3
BME 5573	Nanomedicine	3
BME 5505C	Engineering Foundations of Medical Imaging Instrument	3

Computer Engineering Track

Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

EEL 5718	Computer Communication Network Engineering	3
EEL 5725	Hardware Description Languages (VHDL or Verilog)	3
EEL 5757	Real-Time DSP Implementations	3
EEL 6167	VLSI Design	3
EEL 6253	Computer Analysis of Power Systems	3
EEE 6502	Digital Signal Processing	3
EEL 6575	Data Communications Engineering	3
EEL 6681	Fuzzy System Design	3

Computer Science Track

Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

CEN 5011	Advanced Software Engineering	3
COP 5725	Principles of Database Management Systems	3
COP 5614	Operating Systems	3
COT 5310	Theory of Computation I	3
COT 5407	Introduction to Algorithms	3

Construction Management Track

Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

BCN 5716	Productivity in Construction	3
BCN 5626	Construction Cost Analysis & Control	3
BCN 5645	Construction Economic Analysis	3
BCN 5728	Principles of Construction Scheduling	3
BCN 5774	Topics in International Construction	3
BCN 6775	Decision & Risk Analysis in Construction	3
BCN 6916	Development in Construction Technology	3
CCE 5505	Computer Integrated Construction	3

Electrical Engineering Track

Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

EEE 5425	Introduction to Nanotechnology	3

EEL 5171	Advanced Systems Theory	3
EEL 5500	Digital Communication Systems I	3
EEL 5501	Digital Communication Systems II	3
EEL 6219	Electric Power Quality	3
EEL 6261	Power Systems Engineering	3
EEL 6443	Electro-Optical Devices and Systems	3
EEE 6502	Digital Signal Processing	3

Enterprise Systems Track

This track is designed for students who have a career interest in management of operations at the entire enterprise level. Systems engineering tools and information technology are applied to planning, modeling, analysis, design, and implementation of contemporary enterprise systems in any business sector. Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

EGS 5620	Enterprise Systems Configuration	3
EGS 5621	Enterprise Systems Collaboration	3
EGS 5622	Enterprise Systems Integration	3
EGS 5623	Enterprise Systems Optimization	3
EIN 5346	Logistics Engineering	3
EN 5367	Design of Production Systems	3
EIN 6133	Enterprise Engineering	3
EIN 6336	Advanced Production Planning and Control	3
EIN 6345	Inventory Control Systems	3

Engineering Entrepreneurship Track

This track is designed for students who have a career interest in becoming an engineering entrepreneur who creates jobs in new business ventures or becoming and engineering manager who manages innovation working within a company. Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

EGN 5550	Risk Analysis in Business Concept Development for Engineers and Entrepreneurs	3
EGN 5644	Commercializing Innovation	3
EGN 6436	Manufacturing Process Design	3
EIN 5367	Design of Production Systems	3
EIN 6105	Technology Policies and Strategies	3
EIN 6160	Management of Innovation and Technology	3
EIN 6324	Technology Entrepreneurship	3
EIN 6325	Business Plan Development	3
EIN 6327	Entrepreneurship and New Venture Initiation	3
EIN 6329	Advanced Engineering Business Plan Development	3
EIN 6392	Product Design for Manufacturability and Automation	3

Environmental Engineering Track

Students in this track are required to take four courses from the following list with the approval of the Graduate Program Director and after meeting prerequisite requirements. Additional courses may be selected with approval of the program director.

ENV 5406	Water Treatment Systems and Design	3
ENV 5517	Design of Wastewater Treatment Plants	3
ENV 5666	Water Quality Management	3
CWR 5235	Open Channel Hydraulics	3

CWR 5125	Groundwater Hydrology	3
ENV 5104	Indoor Air Quality	3
ENV 5105	Air Quality Management	3
ENV 5347	Waste Incineration	3
ENV 5126	Particulate Air Pollution Control	3
ENV 5127	Gaseous Air Pollution Control	3
ENV 5356	Solid and Hazardous Waste	3
ENV 5027	Biomediation Processes	3
ENV 5335	Advanced Hazardous Waste Treatment Processes	3
ENV 5008	Appropriate Technologies for Developing Countries	3
ENV5007	Environmental Planning	3
ENV 5519	Chemistry for Environmental Engineers	3
ENV 6045	Environmental Modeling	3
ENV 6070	Green Engineering	3
ENV 6614	Environmental Impact Assessment	3

Information Technology Track

Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

CIS 5027	Computer Systems Fundamentals	3
CIS 5372	Fundamentals of Computer Security	3
CEN 5087	Software and Data Modeling	3
COP 5725	Principles of Database Management Systems	3
TCN 5030	Computer Communications and Networking Technology	3
EGS 5620	Enterprise Systems Configuration	3
EGS 5621	Enterprise Systems Collaboration	3
EGS 5622	Enterprise Systems Integration	3
EGS 5623	Enterprise Systems Optimization	3
EIN 6117	Advanced Industrial Information Systems	3
EIN 6133	Enterprise Engineering	3
ESI 5602	Engineering Data Representation and Modeling	3
ESI 6601	Data Warehousing and Mining	3

Logistics Engineering Track

Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

EIN 5346	Logistics Engineering	3
EIN 5367	Design of Production Systems	3
EIN 6133	Enterprise Engineering	3
EIN 6336	Advanced Production Planning and Control	3
EIN 6345	Inventory Control Systems	3
ESI 5522	Simulation Models of Engineering Systems	3
ESI 5010C	Forecasting and Demand Management	3
ESI 6316	Applications of OR in Manufacturing	3
ESI 6470	Stochastic Optimization	3

Mechanical Engineering Track

Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

EGM 5346	Computational Engineering Analysis	3
EGM 5354	Finite Element Methods Applications in ME	3
EGM 5615	Synthesis of Engineering Mechanics	3
EGM 6422	Advanced Computational Engineering	

	Analysis	3
EML 5103	Intermediate Thermodynamics	3
EML 5152	Intermediate Heat Transfer	3
EML 5505	Smart Machine Design and Development	3
EML 5509	Optimization Algorithms	3
EML 5530	Intermediate CAD/CAE	3
EML 5606C	Advanced Refrigeration and AC Systems	3
EML 5709	Intermediate Fluid Mechanics	3
EML 6725	Computational Fluid Dynamics	3

Operations Management of Orthotics and Prosthetics Track

Students in this track must take six credit hours of EGN 6940 Graduate Internship – Orthotics and Prosthetics Clinical Rotation or I&SE Internship (EIN 6940), and additionally are required to take at least six credit hours of courses from the following list. Additional courses may be selected with approval of the program director.

EGN 5435	Product Modeling	3
EGS 5620	Enterprise Systems Configuration	3
EGN 6436	Manufacturing Process Design	3
EGN 6438	Manufacturing Engineering	3
EGN 6940	Graduate Internship - Orthotics and Prosthetics Clinical Rotation	1-6
EIN 6133	Enterprise Engineering	3
EIN 6160	Management of Innovation and Technology	3
EIN 6324	Technology Entrepreneurship	3
EIN 6336	Advanced Production Planning and Control	3
EIN 6392	Product Design for Manufacturability and Automation	3

Production and Manufacturing Track

Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

EGN 5540	Quality and EH&S Management Systems	3
EGN 6436	Manufacturing Process Design	3
EIN 5332	Quality Engineering	3
EIN 5367	Design of Production Systems	3
EIN 6336	Advanced Production Planning and Control	3
EIN 6345	Inventory Control Systems	3
EIN 6392	Product Design for Manufacturability and Automation	3
ESI 5010C	Forecasting and Demand Management	3

Risk and Disaster Management Track

Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

BCN 5588	Vulnerability Analysis	3
BCN 5589	Hazard Mitigation	3
ENV 6614	Environmental Risk Assessment	3
FIN 6487	Financial Risk Management- Financial Engineering	3
PHC 6251	Disaster and Emergency Epidemiology	3
MAN 6706	Crisis Management	3
MAP 6630	Numerical Analysis in Risk Analysis and Management	3
MAP 6635	Risk Analysis and Management I	3

MAP 6636	Risk Analysis and Management II	3

Structural/Wind/Construction Track

Students in this track are required to take four courses from the following four groups (one per group) with the approval of the Graduate Program Director and after meeting prerequisite requirements. Additional courses may be selected with approval of the program director.

Group 1

CCE 5035	Construction Engineering Management	3
CCE 5036	Advanced Project Planning for Civil Engineers	3

Group 2

CES 5106	Advanced Structural Analysis	3
EGM 5421	Structural Dynamics	3

Group 3

CES 5715	Prestressed Concrete Design	3
CES 5606	Advanced Structural Steel Design	3
CES 6706	Advanced Reinforced Concrete Design	3
EGN 5439	Design of Tall Buildings	3

Group 4

CEG 5065	Geotechnical Dynamics	3
CEG 6105	Advanced Foundations Engineering	3

Systems Engineering Track

Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

EGN 5540	Quality and EH&S Management Systems	3
EIN 5332	Quality Engineering	3
EIN 5346	Logistics Engineering	3
EIN 5367	Design of Production Systems	3
EIN 6133	Enterprise Engineering	3
EIN 6336	Advanced Production Planning and Control	3
EIN 6345	Inventory Control Systems	3
EIN 6357	Advanced Engineering Economy	3
EIN 6940	Industrial and Systems Engineering Internship	3
ESI 5010C	Forecasting and Demand Management	3
ESI 5522	Simulation Models of Engineering Systems	3
ESI 6316	Applications of OR in Manufacturing	3
ESI 6440	Integer Programming	3
ESI 6470	Stochastic Optimization	3
ESI 6524	Advanced Industrial Systems Simulation	3
ESI 6546	Network Flow Analysis	3

Telecommunications Track

Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

TCN 5010	Telecommunications Technology and Applications	3
TCN 5030	Computer Communications and Networking Technologies	3
TCN 5060	Telecommunications Software and Methodologies	3
TCN 5640	Telecommunications Enterprise Planning and Strategy	3
TCN 6210	Telecommunications Network Analysis and Design	3
TCN 6430	Network Management and Control	

	Standards	3
TCN 6450	Wireless Information Systems	3
TCN 6880	Telecommunications Public Policy Development and Standards	3

Transportation Engineering Track

Students in this track are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

TTE 5205	Advanced Highway Capacity Analysis	3
TTE 5215	Fundamentals of Traffic Engineering	3
TTE 5607	Transportation Demand Analysis	3
TTE 5805	Advanced Geometric Design of Highways	3
TTE 6257	Traffic Control Systems Design	3
TTE 6506	Mass Transit Planning	3
CGN 5320	GIS Applications in Civil and Environmental Engineering	3

Water Resources Engineering Track

Students in this track are required to take four courses from the following list with the approval of the Graduate Program Director and after meeting prerequisite requirements. Additional courses may be selected with approval of the program director.

CWR 5140C	Ecohydrology	3
CWR 5235	Open Channel Hydraulics	3
CWR 5251	Environmental Hydraulics	3
CWR 5535C	Advanced Modeling Applications in Water Resources Engineering	3
CWR 6117	Stochastic Hydrology	3
CWR 5125	Groundwater Hydrology	3
CWR 6126	Advanced Groundwater Hydrology	3
CWR 6236	Engineering Sediment Transport	3
ENV 5666	Water Quality Management	3

Master's Project Option

Students in the Engineering Management graduate program may receive permission to conduct a master's project of three credit hours within their chosen track to complete the degree program. The master's project (EIN 6916) will replace one graduate elective course.

Grades and Credits

Students are required to maintain a GPA of 3.0. Courses with a grade below 'C' will not be counted toward the Master of Science degree in Engineering Management.

Transfer Credit

Students may receive permission to transfer up to a maximum of six semester credits provided that: (1) the courses were taken at the graduate level at an accredited college or university; (2) with a grade of 'B' or better; (3) the courses were judged relevant by the program director; (4) the credits were not used toward another degree; and (5) the credits will be no older than six years at the time of graduation. Students who already have earned (or are earning) a Master's degree that is closely related to his/her technical track (i.e., MSEM sub-plan) may transfer up to 12 semester hours to meet the track requirement, subject to the Program Director's approval. No more than 12 semester hours taken at FIU as a non-degree seeking student may be counted toward the Engineering Management graduate program.

Time Limit

All works applicable to the Master of Science degree in Engineering Management, including transfer credits, must be completed within six years of conferral of the degree.

Combined BS in Biomedical Engineering/MS in Engineering Management (BSBME/MSEM)

Students who pursue a BS degree and have completed 75~90 credits in the undergraduate program of Biomedical Engineering with an overall GPA of 3.2 or higher may, upon recommendation from three faculty members, apply to the department to enroll in the combined BSBME/MSEM program. Students must also submit an online application to the University Graduate School for admission to the MSEM program. In addition to the admission requirements of the MSEM program, students must meet all the admission requirements of the University Graduate School.

Students need only apply once to the combined degree program, but the application must be submitted to Graduate Admissions before the student starts the last 30 credits of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and be eligible for graduate assistantships.

Students enrolled in the combined degree program could count up to three BME graduate courses for both the BSBME electives and the MSEM electives, for a total saving of 9 credit hours. The following is a list of eligible BME graduate courses:

BME 5005	Applied Biomedical Engineering Principles	3
BME 5036	Biotransport Processes	3
BME 5105	Intermediate Biomaterials Science	3
BME 5316	Molecular Bioprocess Engineering	3
BME 5340	Introduction to Cardiovascular Engineering	3
BME 5560	Biomedical Engineering Optics	3
BME 5573	Nanomedicine	3

The combined BSBME/MSEM program has been designed to be a continuous program. During this combined BSBME/MSEM program, upon completion of all the requirements of the BSBME program, students will receive their BSBME degree. Students may elect to permanently leave the combined program and earn only the BSBME degree. Students who elect to leave the combined program and earn only the BS degree will have the same access requirements to regular graduate programs as any other student, but will not be able to use the 9 credit hours in both the BSBME and MSEM degrees.

For each of the graduate courses counted as credits for both BSBME and MSEM degrees, a minimum grade of "B" is required. Only graduate courses with formal lecture can be counted for both degrees. The students are responsible for confirming the eligibility of each course with their undergraduate advisors.

Students interested in the combined program should consult with their undergraduate advisor on their eligibility to the program. The student should also meet the MSEM Program Director to learn about the graduate program and available tracks/courses before completing the application

form and submitting it to their undergraduate advisor. Final decision for admission to the MSEM program will be made by the University Graduate School upon recommendation by the Engineering Management program director. Applicants will be notified by the Engineering Management Program and the University Graduate School of the decision on their applications.

Combined BS in Computer Engineering/MS in Engineering Management (BSCpE/MSEM)

Students, who are pursuing a Bachelor of Science degree in Computer Engineering and have completed at least 75-90 credits with a minimum of a 3.3 overall GPA may, upon recommendation from three ECE faculty members, apply to enroll in the combined BSCpE/MSEM program. Students need only apply once to the combined degree program, but the application must be submitted to Graduate Admissions before the student starts the last 30 credits of the bachelor's degree program. In addition to the admission requirements of the MSEM program, students must meet all the admission requirements of the University Graduate School.

Students enrolled in the combined degree program could count up to two Electrical Engineering graduate courses for both the BSCpE electives and the MSEM electives, for a total saving of 6 credit hours. A minimum grade of "B" is required graduate courses counted as credits for both BSCpE and MSEM degrees. Only 5000-level or higher courses may be applied toward both degrees. Only graduate courses with formal lecture can be counted for both degrees.

The combined BSCpE/MSEM program has been designed to be a continuous program. Students will receive their BSCpE degree upon completion of all the requirements of the BSCpE program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from his/her bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and be eligible for graduate assistantships.

Students may elect to permanently leave the combined program and earn only the BSCpE degree. Students who elect to leave the combined program and earn only the BS degree will have the same access requirements to regular graduate programs as any other student but will not be able to use the 6 credit hours in both the BSCpE and MSEM degrees.

Students interested in the combined program should consult with their undergraduate advisor on their eligibility to the program. The student should also meet the MSEM Program Director to learn about the graduate program and available tracks/courses before completing the application form and submitting it to their undergraduate advisor. Final decision for admission to the MSEM program will be made by the University Graduate School upon recommendation by the Engineering Management program director. Applicants will be notified by the Engineering Management Program and the University Graduate School of the decision on their applications.

Combined BS in Computer Science/MS in Engineering Management (BSCS/MSEM)

Students who pursue a BS degree and are in their first semester of the senior year in Computer Science and have earned at least a 3.2 overall GPA may, upon recommendation from three faculty members, apply to the department to enroll in the combined BSCS/MSEM program. Students must also submit an online application to the University Graduate School for admission to the MSEM program. In addition to the admission requirements of the MSEM program, students must meet all the admission requirements of the University Graduate School.

Students need only apply once to the combined degree program, but the application must be submitted to Graduate Admissions before the student starts the last 30 credits of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and be eligible for graduate assistantships.

Students enrolled in the combined degree program could count up to three Computer Science graduate courses toward satisfying both the BSCS and the MSEM requirements, for a total saving of 9 credit hours. Students are required to take four courses from the following list. Additional courses may be selected with approval of the program director.

CEN 5011	Advanced Software Engineering
COP 5725	Principles of Database Management Systems
COP 5614	Operating Systems
COT 5310	Theory of Computation I
COT 5407	Introduction to Algorithms

The combined BSCS/MSEM program has been designed to be a continuous program. During this combined BSCS/MSEM program, upon completion of all the requirements of the BSCS program, students will receive their BSCS degree. Students may elect to permanently leave the combined program and earn only the BSCS degree. Students who elect to leave the combined program and earn only the BS degree will have the same access requirements to regular graduate programs as any other student, but will not be able to use the 9 credit hours in both the BSCS and MSEM degrees.

For each of the graduate courses counted as credits for both BSCS and MSEM degrees, a minimum grade of "B" is required. Only graduate courses with formal lecture can be counted for both degrees. The students are responsible for confirming the eligibility of each course with their undergraduate advisors.

Students interested in the combined program should consult with their undergraduate advisor on their eligibility to the program, preferably during their junior year, since appropriate planning of coursework is required in order to achieve the full nine-credit benefit. The student should also meet the MSEM Program Director to learn about the graduate program and available tracks/courses before completing the application form and submitting it to their undergraduate advisor. Final decision for admission to the

MSEM program will be made by the University Graduate School upon recommendation by the Engineering Management program director. Applicants will be notified by the Engineering Management Program and the University Graduate School of the decision on their applications.

Combined BS in Electrical Engineering/ MS in Engineering Management (BSEE/MSEM)

Students, who are pursuing a Bachelor of Science degree in Electrical Engineering and have completed at least 75-90 credits with a minimum of a 3.3 overall GPA may, upon recommendation from three ECE faculty members, apply to enroll in the combined BSEE/MSEM program. Students need only apply once to the combined degree program, but the application must be submitted to Graduate Admissions before the student starts the last 30 credits of the bachelor's degree program. In addition to the admission requirements of the MSEM program, students must meet all the admission requirements of the University Graduate School.

Students enrolled in the combined degree program could count up to two Electrical Engineering graduate courses for both the BSEE electives and the MSEM electives, for a total saving of 6 credit hours. A minimum grade of "B" is required graduate courses counted as credits for both BSEE and MSEM degrees. Only 5000-level or higher courses may be applied toward both degrees. Only graduate courses with formal lecture can be counted for both degrees.

The combined BSEE/MSEM program has been designed to be a continuous program. Students will receive their BSEE degree upon completion of all the requirements of the BSEE program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from his/her bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and be eligible for graduate assistantships.

Students may elect to permanently leave the combined program and earn only the BSEE degree. Students who elect to leave the combined program and earn only the BS degree will have the same access requirements to regular graduate programs as any other student but will not be able to use the 6 credit hours in both the BSEE and MSEM degrees.

Students interested in the combined program should consult with their undergraduate advisor on their eligibility to the program. The student should also meet the MSEM Program Director to learn about the graduate program and available tracks/courses before completing the application form and submitting it to their undergraduate advisor. Final decision for admission to the MSEM program will be made by the University Graduate School upon recommendation by the Engineering Management program director. Applicants will be notified by the Engineering Management Program and the University Graduate School of the decision on their applications.

Combined BS in Information Technology/MS in Engineering Management (BSIT/MSEM)

Students who pursue a BS degree and are in their first semester of the senior year in Information Technology and have earned at least a 3.2 overall GPA may, upon recommendation from three faculty members, apply to the department to enroll in the combined BSIT/MSEM program. Students must also submit an online application to the University Graduate School for admission to the MSEM program. In addition to the admission requirements of the MSEM program, students must meet all the admission requirements of the University Graduate School.

Students need only apply once to the combined degree program, but the application must be submitted to Graduate Admissions before the student starts the last 30 credits of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and be eligible for graduate assistantships.

Students enrolled in the combined degree program could count up to three Management Electives toward their nine "interdisciplinary credits" in the BSIT degree program, for a total saving of 9 credit hours.

ACG 6026	Accounting for Managers
EIN 5359	Industrial Financial Decisions
FIN 6406	Corporate Finance
MAN 6167	Leadership in a Global Environment
MAN 6209	Organization Design and Behavior
MAN 6501	Operations Management
MAN 6830	Organization Information Systems
MAR 6805	Marketing Management

The combined BSIT/MSEM program has been designed to be a continuous program. During this combined BSIT/MSEM program, upon completion of all the requirements of the BSIT program, students will receive their BSIT degree. Students may elect to permanently leave the combined program and earn only the BSIT degree. Students who elect to leave the combined program and earn only the BS degree will have the same access requirements to regular graduate programs as any other student, but will not be able to use the 9 credit hours in both the BSIT and MSEM degrees.

For each of the graduate courses counted as credits for both BSIT and MSEM degrees, a minimum grade of "B" is required. Only graduate courses with formal lecture can be counted for both degrees. The students are responsible for confirming the eligibility of each course with their undergraduate advisors.

Students interested in the combined program should consult with their undergraduate advisor on their eligibility to the program, preferably during their junior year, since appropriate planning of coursework is required in order to achieve the full nine-credit benefit. The student should also meet the MSEM Program Director to learn about the graduate program and available tracks/courses before completing the application form and submitting it to their undergraduate advisor. Final decision for admission to the MSEM program will be made by the University Graduate School upon recommendation by the Engineering

Management program director. Applicants will be notified by the Engineering Management Program and the University Graduate School of the decision on their applications.

Combined BS in Mechanical Engineering/MS in Engineering Management (BSME/MSEM)

Students who pursue a BS degree and have completed 75~90 credits in the undergraduate program of Mechanical Engineering with an overall GPA of 3.2 or higher may, upon recommendation from three faculty members, apply to the department to enroll in the combined BSME/MSEM program. Students must also submit an online application to the University Graduate School for admission to the MSEM program. In addition to the admission requirements of the MSEM program, students must meet all the admission requirements of the University Graduate School.

Students need only apply once to the combined degree program, but the application must be submitted to Graduate Admissions before the student starts the last 30 credits of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and be eligible for graduate assistantships.

Students enrolled in the combined degree program could count up to three Mechanical Engineering graduate courses for both the BSME electives and the MSEM electives, for a total saving of 9 credit hours. The following is a list of eligible Mechanical Engineering graduate courses:

EGM 5346	Computational Engineering Analysis
EGM 5354	Finite Element Method Applications in ME
EGM 5615	Synthesis of Engineering Mechanics
EML 5103	Intermediate Thermodynamics
EML 5152	Intermediate Heat Transfer
EML 5505	Smart Machine Design and Development
EML 5509	Optimization Algorithms
EML 5530	Intermediate CAD/CAE
EML 5606C	Advanced Refrigeration and AC Systems
EML 5709	Intermediate Fluid Mechanics

The combined BSME/MSEM program has been designed to be a continuous program. During this combined BSME/MSEM program, upon completion of all the requirements of the BSME program, students will receive their BSME degree. Students may elect to permanently leave the combined program and earn only the BSME degree. Students who elect to leave the combined program and earn only the BS degree will have the same access requirements to regular graduate programs as any other student, but will not be able to use the 9 credit hours in both the BSME and MSEM degrees.

For each of the graduate courses counted as credits for both BSME and MSEM degrees, a minimum grade of "B" is required. Only graduate courses with formal lecture can be counted for both degrees. The students are responsible for confirming the eligibility of each course with their undergraduate advisors.

Students interested in the combined program should consult with their undergraduate advisor on their eligibility to the program. The student should also meet the MSEM Program Director to learn about the graduate program and available tracks/courses before completing the application form and submitting it to their undergraduate advisor. Final decision for admission to the MSEM program will be made by the University Graduate School upon recommendation by the Engineering Management program director. Applicants will be notified by the Engineering Management Program and the University Graduate School of the decision on their applications.

Master of Science in Logistics Engineering

The MS-Logistics Engineering program will include student learning outcomes that address logistics from several complementary perspectives: (1) Students will gain structural technical training dedicated to logistics engineering by teaching contemporary logistics systems, technology, and operations; (2) students will gain the systems engineering tools and techniques that apply to addressing emerging challenges in the industry with respect to design and development of logistics systems and technology; and (3) students will gain deeper knowledge of specific areas in logistics such as warehouse or inventory systems design through selection of elective courses.

Admission Policies

The applicant to the MS program in Logistics Engineering must have a bachelor's degree in industrial engineering, systems engineering, operations research, or a closely related area such as business administration, MIS, SCM, or other engineering disciplines, from a regionally accredited institution with a minimum of "B" average in upper-level undergraduate work, or a graduate degree from an accredited institution. In addition, international graduate student applicants whose native language is not English are required to submit a score for the Test of English as a Foreign Language (TOEFL) or for the International English Language Testing System (IELTS). A total score of 80 on the iBT TOEFL or 6.5 overall on the IELTS is required.

Degree Requirements

The MS program in Logistics Engineering requires 30 credit hours of 10 coursework from three clusters of graduate courses. The first consists of 4 core courses in logistics operations, the second consists of 3 elective courses in systems engineering, and the third consists of 3 elective courses in logistics systems and technology. Additional courses may be considered, subject to approval of the program director.

Logistics Engineering Core Courses: (4 courses, 12 credit hours)

ESI 5010C	Forecasting and Demand Management	3
EIN 5346	Logistics Engineering	3
EIN 6133	Enterprise Engineering	3
EIN 6345	Inventory Control System	3

Elective Systems Engineering Courses: (3 courses, 9 credit hours)

EIN 5226	Total Quality Management for Engineers	3
EIN 5332	Quality Engineering	3
EIN 5359	Industrial Financial Decisions	3
ESI 6316	Applications of OR in Manufacturing	3
ESI 6440	Integer Programming	3
ESI 6455	Advanced Engineering Project Management	3
ESI 6470	Stochastic Optimization	3
ESI 6524	Advanced Industrial Systems Simulation	3
ESI 6546	Network Flow Analysis	3

Elective Logistics Systems and Technology Courses: (3 courses, 9 credit hours)

EGS 5620	Enterprise Systems Configuration	3
EGS 5621	Enterprise Systems Collaboration	3
EGS 5622	Enterprise Systems Integration	3
EGS 5623	Enterprise Systems Optimization	3
EIN 6336	Advanced Production Planning and Control	3
EIN 5367	Design of Production Systems	3
ESI 5522	Simulation Models of Engineering Systems	3

Master's Project Option

Students in the Logistics Engineering graduate program may receive permission to conduct a master's project of three credit hours within their chosen track to complete the degree program. The master's project (EGN 6971) will replace one graduate elective course.

Grades and Credits

Students are required to maintain a GPA of 3.0. Courses with a grade below "C" will not be counted toward the Master of Science degree in Logistics Engineering.

Transfer Credit

Students may receive permission to transfer up to a maximum of six semester credits provided that:
1. The courses were taken at the graduate level at an accredited college or university;
2. With a grade of 'B' or better;
3. The courses were judged relevant by the program director; and
4. The credits will be no older than six years at the time of graduation. No more than 12 semester hours taken at FIU as a non-degree seeking student may be counted toward the Logistics Engineering graduate program.

Time Limit

All works applicable to the Master of Science degree in Logistics Engineering, including transfer credits, must be completed within six years of conferral of the degree.

Graduate Certificate in Engineering Management (GCEM)

This certificate program is designed for practicing engineers and graduate students in all engineering majors, who are interested in acquiring skills for managerial careers in the engineering and technology industries. The GCEM program is especially helpful for those engineers who seeking to transition into management and wish to acquire the necessary perquisite knowledge and skills. More than a sequence of coursework, the certificate program also simulates a business environment where students learn and apply engineering tools, managerial theories, and best practices to design and operate industrial and engineering systems. Students in the program are expected to acquire contemporary engineering management theories and techniques. This certificate program is open to both degree- and non-degree seeking students.

Admission Requirements

A minimum undergraduate GPA of 2.75 is required for admission. International graduate student applicants whose native language is not English are required to submit a score for the Test of English as a Foreign Language (TOEFL) or for the International English Language Testing System (IELTS). A total score of 80 on the iBT TOEFL or 6.5 overall on the IELTS is required.

Certificate Requirements

Students must take at least 5 graduate courses from the list below and receive an average grade of "B" or higher. All the credits earned in this Certificate program with "B" or better may be used in the Master of Science in Engineering Management (MSEM) degree program provided the student is admitted to the MSEM degree program prior to the completion of no more than 12 Graduate Certificate credits. Additional courses may be considered, subject to approval of the program director.

EIN 5226	Total Quality Management for Engineers	3
EIN 5359	Industrial Financial Decisions	3
EIN 6133	Enterprise Engineering	3
EIN 6160	Management of Innovation and Technology	3
EIN 6336	Advanced Production Planning and Control	3
EIN 6357	Advanced Engineering Economy	3
ESI 6455	Advanced Engineering Project Management	3
LAW 5072	Business Law and Intellectual Property for Engineers and Entrepreneurs	3

Graduate Certificate in Enterprise Systems (GCES)

This certificate program is designed for those who are interested in acquiring expertise and skills in the growing discipline of Enterprise Systems (ES). ES software utilizes the computational power with massive data storage and transmission capabilities to support enterprise processes, information flows, reporting, and data analytics within and among complex organizations. Typical Enterprise Systems include Enterprise Resource Planning (ERP), Supply Chain Management (SCM), and Customer Relationship Management (CRM). The software architecture aiming at facilitating the flow of information among all business functions inside the boundaries of the organization and to outside stakeholders. Built on a centralized database and business intelligence, ES aims to consolidate all business operations into a uniform, real-time, and enterprise-wide system environment. This certificate program is open to both degree- and non-degree seeking students.

The Graduate Certificate in Enterprise Systems (GCES) program combines the optimal design of enterprise structures and operations with SAP implementation. The Certificate program consists of five required graduate courses.

Admission Requirements

A minimum undergraduate GPA of 2.75 is required for admission. International graduate student applicants whose native language is not English are required to submit a score for the Test of English as a Foreign Language (TOEFL) or for the International English Language Testing System (IELTS). A total score of 80 on the iBT TOEFL or 6.5 overall on the IELTS is required.

Certificate Requirements

Students must take at least 5 required courses and receive an average grade of "B" or higher. In addition, students who attain "B" or better in at least three courses will also earn a SAP certificate. All the credits earned in this Certificate program may be used in the Master of Science in Engineering Management (MSEM) degree program provided the student is admitted to the MSEM degree program prior to the completion of no more than 12 Graduate Certificate credits. Additional courses may be considered, subject to approval of the program director.

EIN 5367	Design of Production Systems	3
EIN 6336	Advanced Production Planning and Control	3
EIN 6345	Inventory Control Systems	3
EIN 6133	Enterprise Engineering	3
EGS 5620	Enterprise Systems Configuration	3
EGS 5621	Enterprise Systems Collaboration	3
EGS 5622	Enterprise Systems Integration	3
EGS 5623	Enterprise Systems Optimization	3
ESI 5010C	Forecasting and Demand Management	3

Course Descriptions
Description of Prefixes
EGN-Engineering, General EGS-Engineering Support; EIN-Engineering, Industrial; ESI-Engineering Systems Industrial
F-Fall semester offering; S-Spring semester offering; SS-Summer semester offering.

EGN 5435 Product Modeling (3). Life cycle product data, geometry and form features, product information models and modeling techniques, product modeling systems, and product data standards. Prerequisites: EGN 3124 or equivalent.

EGN 5540 Quality and EH&S Management Systems (3). Design of management control systems for quality, environmental, and occupational health and safety requirements. Principles and process of auditing. Review of related standards. Prerequisite: EIN 5226.

EGN 5550 Risk Analysis in Business Concept Development for Engineers and Entrepreneurs (3). It integrates assumptions, risk/forecasting with engineering approach to new business development. The course uses exercises, cases and projects to develop practical experience with course theories.

EGN 5644 Commercializing Innovation (3). Product development/process, innovation, commercialization; needs analysis; market segmentation; value proposition; prototyping, packaging and branding; modeling costs and margins; hands-on practice. Prerequisite: Permission of the instructor.

EGN 6436 Manufacturing Process Design (3). Resources modeling, process plan modeling, and planning methodologies for process selection, operations selection, machining parameters selection, setup planning, and inspection planning. Prerequisite: EGN 5842.

EGN 6437 Manufacturing Systems Design (3). System design for production and process planning, resource management, material handling, process control, and quality control. Prerequisite: Permission of the instructor.

EGN 6438 Manufacturing Engineering (3). Manufacturing functions, product and process design, material processing and control, systems design and operations, resource and technology management, and analytical tools for manufacturing. Prerequisites: EIN 3390 or equivalent. (F)

EGN 6940 Graduate Internship - Orthotics and Prosthetics Clinical Rotation (1-6). To provide graduate students with real world clinical experience in Orthotics and Prosthetics, under approved professional supervision. Prerequisite: Permission of the program director.

EGN 6971 Master's Project (1-3). Individual work culminating in a professional practice-oriented report suitable for the requirements of the Master of Science in Manufacturing Engineering program.

EGS 5620 Enterprise Systems Configuration (3). Enterprise systems overview; major enterprise functions; standard operation procedures; system configuration and parameters; master data; user interfaces and reports; and hands-on experience. Prerequisite: Permission of the instructor.

EGS 5621 Enterprise Systems Collaboration (3). Collaborative engineering and environment; decision processes; changes management; virtual enterprise operation systems; and hands-on experience with a commercial enterprise operation system. Prerequisite: EGS 5622.

EGS 5622 Enterprise Systems Integration (3). Enterprise architectures; work flow modeling and design; systems integration methodology; vertical and horizontal integration; master data analysis and integration; and hands-on experience. Prerequisite: EGS 5620.

EGS 5623 Enterprise Systems Optimization (3). Supply networks overview; interactive supply network planning; optimal systems and process design; optimization techniques and heuristics; master and transaction data transfer; and hands-on experience. Prerequisite: EGS 5622.

EGS 5914 Advanced Research Methods in Engineering and Computing (3). Students will learn to review the literature, develop a research question and hypothesis or objective, design experiments, conduct collaborative research and present results in oral and written form.

EGS 6055 Foundations of Engineering and Computing Teaching and Learning (3). Introduction to learning theory and inclusive, learner-centered, and evidence-

based pedagogy and assessment in engineering and computing, using a human-centered design approach to educational design.

EGS 6057 Equity in STEM Education: Research, Policy, and Practice (3). An analysis of diversity and inclusion through research, policy and practice within science, technology, engineering and mathematics (STEM) education for the private and public sectors.

EIN 5001 Quantitative Foundation for Engineering Managers (3). Topics in operations research, engineering economic analysis and engineering data analysis considered quantitative foundation knowledge for engineering managers.

EIN 5106 Regulatory Aspects of Engineering (3). A survey of the legal and regulatory requirements encountered by engineers. Included will be OSH Act, NIOSH, ADA, EEOC, Worker's Compensation and Product Liability.

EIN 5226 Total Quality Management for Engineers (3). Fundamentals of TQM and its historical development. Integration of QC and management tools, QFD, benchmarking, experimental design for scientific management. (F,S)

EIN 5244 Cognitive Engineering (3). Advanced topics in human factors and cognitive engineering. Theoretical aspects of applied situation awareness and decision making, and applications in a variety of engineering domains. Prerequisite: EIN 4243.

EIN 5249 Occupational Biomechanics (3). Study of the theoretical fundamentals for the mechanics of the body. The link system of the body and kinematic aspects of body movement including applications of biomechanics to work systems. Prerequisites: EIN 4314 Work Design and Industrial Ergonomics or equivalent. (S)

EIN 5256 Usability Engineering (3). The usability aspects of software systems design and testing. The theory of interface design for usability and the methods and techniques for designing and testing technology interfaces. Prerequisite: Permission of Instructor.

EIN 5322 Engineering Management (3). Organization of engineering systems including production and service organizations. Inputs of human skills, capital, technology, and managerial activities to produce useful products and services. (F,S)

EIN 5332 Quality Engineering (3). This course examines quality control from an engineering standpoint. It covers ways to meet the challenge of designing high-quality products and processes at low cost. Prerequisites: EIN 3331 or equivalent. (S)

EIN 5346 Logistics Engineering (3). Concepts and tools for effective design and management of supply chain systems. Includes logistics strategies, inventory management, customer service, supply chain integration and logistics network design. Prerequisite: Permission of the instructor.

EIN 5359 Industrial Financial Decisions (3). The use of financial techniques and data in planning, controlling and coordinating industrial activities. This course will familiarize the student with accounting concepts and analytical methods. Prerequisite: EGN 3613. (SS)

EIN 5367 Design of Production Systems (3). The design of an industrial enterprise including feasibility, plant layout, equipment specifications, auxiliary services, economics and scheduling. Prerequisite: EIN 3365.

EIN 5436 Regulatory Compliance in Logistics and Supply Chain Management (3). Cargo security compliance; declaration and fiscal compliance; customs warehouse management; transportation regulatory services; industry program support; government solutions and technology solutions. Prerequisites: Senior or Graduate standing.

EIN 5605 Robotic Assembly Cell (3). Concepts of robot manipulation and sensing, part design for robotic assembly, planning manipulator trajectories, machine vision, robot programming language, cell control, and material transfer. Prerequisite: EIN 3600. (S)

EIN 6105 Technology Policies and Strategies (3). Strategies and policies for managing all aspects of technology. Includes value chain integration, intellectual property, and internal processes and systems.

EIN 6117 Advanced Industrial Information Systems (3). Review of the fundamental and theoretical foundation of industrial information systems. Application of the system design process and information system concepts to develop integrated engineering systems. (F,S)

EIN 6131 e-Systems Design (3). The study and application of engineering analysis and design methods for Internet-based systems. The integration of Internet technologies and applications into engineering information systems. Prerequisites: ESI 5602, EIN 6117.

EIN 6132 Collaborative Engineering (3). Product data management, visualization, collaboration, collaborative product commerce, document management, component supplier management, configuration management, enterprise application integration. Prerequisite: Permission of the instructor.

EIN 6133 Enterprise Engineering (3). Enterprise processes and functions, enterprise engineering methodology and techniques, enterprise scalability, systems and vertical integration, systems design and implementation. Prerequisite: Permission of Instructor.

EIN 6160 Management of Innovation and Technology (3). The course provides an integrated view of management of technology. The combination of theory and practice addresses the challenges of globalization, time compression, and technology integration. Prerequisite: Permission of instructor.

EIN 6248 Advance Ergonomics (3). Analysis of human factors in the design of engineering systems, with emphasis on the interphase of man-machine-media and human limitations in relation to equipment design and work environments. Prerequisites: EIN 4314, EIN 4243, and PCB 3702 or equivalent. (F)

EIN 6258 Ergonomic Design of Aerospace Systems (3). Application of ergonomic criteria in design of civil and military aircraft cockpits and control systems. Ergonomic consideration in design of outer space vehicles, stations, and systems. Prerequisite: EIN 6248.

EIN 6319 Advanced Work Design (3). Study of the various human physiologic systems and their responses

as it relates to occupational work including endurance, fatigue, recovery, and energy cost of work. Prerequisite: EIN 6248. (S)

EIN 6324 Technology Entrepreneurship (3). Entrepreneurial process, evaluation of technology, startup operations and strategy, business plans and venture capital, intellectual property and rights, growth and technology management.

EIN 6325 Business Plan Development (3). This course deals with the critical decisions and action steps that entrepreneurs must make in both planning and executing a new venture. It also covers how to develop an effective written plan. Prerequisite: Permission of advisor.

EIN 6327 Entrepreneurship and New Venture Initiation (3). It covers critical factors of initiating new ventures: entrepreneurial networks, venture creation, strategies, evaluation, financing, legal considerations, market strategies, and feasibility analysis.

EIN 6329 Advanced Engineering Business Plan Development (3). This course takes students through the process of writing a plan for a new business venture through to implementation. Heavy emphasis placed on research and case analysis. Prerequisites: EIN 6324 or MAN 6805.

EIN 6336 Advanced Production Planning and Control (3). Analytical and algorithmic planning methodologies, planning and scheduling technologies, sequencing rules, control strategies, and line balancing methods. Prerequisite: EIN 4334.

EIN 6345 Inventory Control Systems (3). Design of non-traditional inventory control systems. Development of several inventory system models. Exploration of methods of collecting appropriate demand and cost data for effective systems analysis. Prerequisite: ESI 3314.

EIN 6357 Advanced Engineering Economy (3). Review of engineering economy and the evaluation of advanced manufacturing systems. Evaluation of alternative capital investments considering income taxes, depreciation, inflation, risk and uncertainty. Prerequisite: EGN 3613. (SS)

EIN 6392 Product Design for Manufacturability and Automation (3). Overview and integration of the design-material-manufacture process. Design considerations for manufacturability, assembly, and economical production. Concurrent engineering systems. Prerequisite: EIN 4395. (S)

EIN 6393 Design and Implementation of Discrete Manufacturing Systems (3). Methodology and techniques for design, planning and implementation of discrete production systems including process/machine selections, material handling and inspection technologies, cell control, etc. Prerequisites: Graduate or seniors with EIN 3365, EIN 3390, and ESI 3523 or equivalent.

EIN 6397 Advanced Topics in Manufacturing Automation (3). Overview of manufacturing systems; evolution of controls and AI, material handling, automation clamps, jigs, and fixtures, cutting sensors, machine vision and autonomous manufacturing. Prerequisites: EIN 6392 and EIN 6398.

EIN 6398 Advanced Manufacturing Process Engineering (3). Non-traditional manufacturing processes. Tool selection, jig and fixture design, material handling, tolerance and dimensioning. Product assembly engineering economics, and manufacturing process planning. Prerequisite: EIN 3390. (F)

EIN 6603 Applied AI/Expert Systems in Industrial Engineering (3). Application of artificial intelligence and expert systems as engineering tools. Exploring the use of PCs and symbolic machine with various AI/Expert Systems software. Several projects are required. Prerequisite: CAP 5680.

EIN 6606 Robotic Systems (3). Basic robotic system principles, functional requirements of robotic systems, simulation of system preliminary design, and physical experimentation of robotic systems.

EIN 6908 Independent Study (1-3). Individual supervised study by a faculty. A study plan and a final report are work required. Prerequisite: Departmental approval.

EIN 6910 Supervised Research (1-9). Advanced research credits under the supervision of the dissertation advisor.

EIN 6916 Master's Project (1-3). Individual work culminating in a professional practice-oriented report suitable for the requirements of the MSEM degree project option. Only three credits are applicable towards the degree. Prerequisite: Departmental approval.

EIN 6932 Graduate Seminar (0). An examination of recent technical findings in selected areas of concern. Emphasis is placed on presentations (oral and written), research activities, readings and discussions among participants. (F,S)

EIN 6936 Design of Industrial Engineering Systems (3). Overview of systems theories. Systems design process including: Problem definition, analysis, generation of alternatives, systems evaluation, selection of preferred system, and implementation. Prerequisites: EIN 6345, ESI 6316, and ESI 6524.

EIN 6940 Industrial and Systems Engineering Internship (1-3). To provide graduate students with work experience under approved industrial supervision. Prerequisite: Departmental approval.

EIN 6950 Engineering Management Masters Project (1-3). Individual work culminating in a professional practice-oriented report suitable for the requirements of the Master of Science in Engineering Management program. Prerequisite: Departmental approval.

EIN 6971 Master's Thesis (1-3). The students following the thesis option should work on his/her thesis through this course. (F,S,SS)

EIN 7980 Ph.D. Dissertation (1-12). Doctoral research leading to Ph.D. dissertation in Industrial and Systems Engineering. Prerequisites: Doctoral Candidacy and permission of Graduate Director.

ESI 5010C Forecasting and Demand Management (3). Forecasting overview. Times series methods. Regression methods. Advanced forecasting models. Demand planning. Pricing and revenue optimization with capacity constraints. Case studies. Prerequisite: Permission of the instructor.

ESI 5456 Productivity Management in the Global Organization (3). Analysis of productivity management strategies. Major issues in performance and productivity management, domestic and global outsourcing, international labor standards and trade policies. Prerequisites: EIN 4214 or equivalent.

ESI 5522 Simulation Models of Engineering Systems (3). Simulation Methodology; design and implementation of models of engineering systems using computer software; case studies. Prerequisite: STA 3033 or EIN 3235 or equivalent and COP 3175 or equivalent.

ESI 5602 Engineering Data Representation and Modeling (3). The course will cover the life cycle of designing, developing, and implementing engineering database systems by applying the IDEFx methodology. Prerequisite: Permission of Instructor.

ESI 5603 Advanced Software Tools for ISE (3). Algorithms and principles to integrate heterogeneous tools. Principles of XML, ASP, and other tools. Development of programming projects.

ESI 6316 Applications of OR in Manufacturing (3). Overview of OR techniques. Manufacturing system and product selection. Shop loading, resource allocation, production scheduling, job sequencing, and plant layout problems. System performance evaluation. Prerequisite: ESI 3314. (F)

ESI 6319 Operations Research and Information Technology (3). Principles and paradigms for the design and implementation of OR models, which may be integrated into an organization's existing information system and technologies. Prerequisite: ESI 6316.

ESI 6324 Advances in Logistics Technology (3). Emerging logistics technology in financial transactions, communications, and material handling, scanning, tracking, monitoring, production, transportation, warehousing and distribution. Prerequisites: Permission of the instructor.

ESI 6440 Integer Programming (3). Formulating and solving decision-making problems with discrete decision variables. Methods to solve large-scale integer/mixed-integer models. Prerequisite: ESI 6316.

ESI 6455 Advanced Engineering Project Management (3). This course covers entire phases of project management including selection, planning, budgeting, scheduling, monitoring, and control. It focuses on the management of engineering projects through case studies and independent research assignment. Prerequisite: Permission of the instructor. (S,SS)

ESI 6460 Methods for Algorithm Development for Industrial Engineering Applications (3). Methods for algorithm development for Industrial Engineering applications, with emphasis on powerful optimization techniques and analysis tools. Prerequisites: ESI 3314 or permission of instructor.

ESI 6470 Stochastic Optimization (3). Formulating and solving decision-making models with uncertain data. Exact and approximation techniques for large-scale stochastic models. Prerequisite: ESI 6316.

ESI 6524 Advanced Industrial Systems Simulation (3). Advanced simulation techniques with a focus on practical systems modeling using several user-oriented simulation languages. Projects involving design of high-performance simulation programs are required. Prerequisite: ESI 5522 or equivalent. (S)

ESI 6528 Advanced Topics in Simulation Modeling (3). An examination of the role of artificial intelligence, object oriented programming, and databases as enabling technologies in the simulation modeling process. Review of the literature and case studies. Prerequisites: ESI 6524 or equivalent.

ESI 6546 Network Flow Analysis (3). Deterministic and stochastic network flow analysis; minimal cost flow, shortest route, max-flow, and out-of-kilter algorithms; constrained network analysis; and stochastic queuing networks. Prerequisite: ESI 3314.

ESI 6547 Stochastic Models of Industrial Systems (3). Applications of models from gaming, decisions analysis, queueing, inventory and scheduling to assess the performance level of industrial systems operating under random conditions. Prerequisite: ESI 6316.

ESI 6601 Data Warehousing and Mining (3). Knowledge discovery for effective design of data storage. Discussion of the difficulties associated with data warehousing and mining. Literature review and case studies.

Research, Development and Training Centers

Advanced Materials Engineering Research Institute (AMERI)

Arvind Agarwal, *Professor, Chairperson and Director Mechanical and Materials Engineering*

The Advanced Materials Engineering Research Institute provides an open access equipment infrastructure to support materials research and engineering over a broad range of technology and capabilities. The Institute provides analytical instrumentation, materials characterization, and process development laboratories to support faculty and industry in the development and characterization of new materials over the continuum from the nanoscale to bulk materials.

The Analytical Instrumentation Laboratory contains two field emission scanning electron microscope (FESEM), a 200 kev Transmission Electron Microscope (TEM), Focused Ion Beam (FIB), Atomic Force Microscope (AFM), X-ray diffraction, thermal (DSC, TGA, DMA, dilatometer flush diffusion, and mechanical testing (uniaxial/biaxial Instron). Process Development laboratories for ceramic processing (sol-gel, tape casting, milling), and thermal processing (air, vacuum, hydrogen, controlled atmosphere furnaces) are available to support faculty and student researchers.

The Institute consists of the **Motorola Nanofabrication Facility** which is supported by a class 100 clean room and nanofabrication capabilities including e-beam lithography and optical photolithography. Fabrication of nano/micro electromechanical systems (N/MENS) can be accomplished by a combination of nanolithography, focused ion beam (FIB) micro machining, nano imprinting, reactive ion etching, and thin film deposition by a variety of