College of Engineering and Computing

Dean	**John Volakis**
Associate Dean for Academic Affairs	**Anthony J. McGoron**
Associate Dean for Research	**Osama Mohammed**
Associate Dean for Research	**Arvind Agarwal**
Associate Dean for Undergraduate Education	**Mark A. Weiss**

The College of Engineering and Computing is committed to educate professionals who can serve industry and the community at large in a wide variety of fields, as well as conduct innovative basic and applied research that meets the technical needs of industry and government, improves the quality of life, and contributes to the economic viability of Florida, the Nation, and the world.

The College of Engineering and Computing consists of two schools: School of Computing and Information Sciences and Moss School of Construction, Infrastructure and Sustainability; and four academic departments: Biomedical Engineering, Civil and Environmental Engineering, Construction Management, Electrical and Computer Engineering, and Mechanical and Materials Engineering. These academic departments offer programs leading to the Bachelor of Science, Master of Science and Doctor of Philosophy degrees.

The College has two institutes and thirteen centers supporting its academic and research programs. The institutes are the Advanced Materials Engineering Research Institute (AMERI) and the Telecommunications and Information Technology Institute (IT2). The centers are the Bioinformatics Research Group (BioRG), Center for Advanced Distributed Systems Engineering, Center for Advanced Technology and Education (CATE), Center for Diversity in Engineering and Computing (CDEC), Center for Emerging Technology for Advanced Information Processing and High-Confidence Systems, Center for the Study of Matter at Extreme Conditions (CeSMEC), Engineering Information Center (EIC), Engineering Manufacturing Center (EMC), Eugenio Pino and Family Global Entrepreneurship Center, High Performance Database Research Center and the Lehman Center for Transportation Research (LCTR). Two major university centers, the Applied Research Center (ARC) and International Hurricane Research Center (IHRC), work very closely with the College of Engineering and Computing with many joint appointments at the faculty level.

The College has created an open-access Motorola Nanofabrication Research Facility to conduct research in nanoelectronics, bio/nanosensors and nanomaterials. In addition, the FIU College of Engineering and Computing has developed many collaborations with the industry and hospitals in Florida and across the nation.

The programs of the College are directed towards the practical use of scientific, engineering, and technical principles to meet the objectives of industry, business, government and the public.

The College provides each student with the opportunity to develop a high level of technical skills and to obtain an education, which will prepare him or her for a rewarding career and personal growth. Underlying the programs of the College is a recognition that the growing impact of technology upon the quality of life is increasing and that the proper application of technology is critical to meeting current and emerging human needs. The College faculty is actively engaged with business, industry and government. Faculty members also participate in a variety of basic and applied research projects in areas such as energy, transportation, solid waste disposal, biotechnology, biomedical devices and instrumentation, computer engineering, artificial intelligence, manufacturing, robotics telecommunications, micro-electronics, nano-electronics, nanotechnology, neuro-sciences/engineering, modeling and simulation, construction engineering, materials, structural systems, virtual prototyping, systems modeling, information technology, environmental sciences and engineering, image processing, engineering education, etc.

Doctor of Philosophy

The College offers Doctor of Philosophy degrees in Biomedical Engineering, Civil Engineering, Computer Science, Electrical and Computer Engineering, Mechanical Engineering, and Materials Science and Engineering.

Areas of study in Biomedical Engineering include:

- Biomechanics, Biomaterials, and Medical Devices
- Bioinstrumentation, and Biomedical Image/Signal Processing
- Drug Delivery and Tissue Engineering
- Medical Physics and Nuclear Medicine
- Bio-nanotechnology and Systems Biology

Areas of study in Civil Engineering include:

- Transportation Engineering
- Environmental Sciences and Engineering
- Structural Engineering
- Water Resources Engineering
- Geotechnical Engineering
- Construction Engineering and Management

Areas of study in Computer Science include:

- Networking and distributed systems, wireless networks, mobile and ubiquitous computing, routers, and switches, system modeling.
- Operating systems, distrusted computing, storage systems, virtualization, security, and real-time systems.
- Database systems, including distributed databases, information retrieval in heterogeneous databases, multimedia databases, data mining, and digital libraries.
- Software engineering, including formal methods, software testing techniques, software architecture, software security, software design, model-driven software development, and grid computing.
- Theory, including algorithms and data structures, programming languages, program verification, and logic.
- Bioinformatics and Computational Biology.
- Artificial Intelligence, including machine learning, expert systems, intelligent agents, affective computing, cognitive science, intelligent human-computer interaction, social informatics.

Areas of study in Electrical and Computer Engineering include:

- Biomedical Sciences and Engineering
- Micro-Electronics, Nano-Electronics and Photonics
- Computer Engineering
- Systems and Controls
- Electromagnetics and Nanomagnetics
- Power Systems
- Telecommunications and Networking
- Digital Signal and Image Processing

Areas of study in Mechanical and Materials Engineering include:

- Thermo/Fluids Sciences
- Biomedical Engineering
- Mechanics of Materials
- Nanostructured Materials
- Ceramics and Electronic Materials
- CAD/CAM
- Manufacturing
- Modeling and Simulation
- Nano Devices
- Applied Mechanics

Master of Science Degree Programs

The College offers Master of Science degrees in:

- Biomedical Engineering
- Civil Engineering
- Computer Engineering
- Computer Science
- Construction Management
- Cybersecurity
- Data Science
- Electrical Engineering
- Engineering Management
- Environmental Engineering
- Information Technology
- Logistics Engineering
- Materials Science and Engineering
- Mechanical Engineering
- Telecommunications and Networking

Distance Learning Programs

The Office of Distance Education (ODE) provides access to graduate and undergraduate level engineering courses and programs to individual students anywhere and anytime, whether it is at home or the workplace. Courses are delivered through streaming video over the Internet.

Research Centers and Institutes

Research spans from single discipline to multidisciplinary research in the College of Engineering and Computing. Thus, the College, through its research centers and institutes, has established many collaborative and cooperative partnerships with other units in the university as well as with local industry.

The research units involved in these efforts include:

- Advanced Materials Engineering Research Institute (AMERI)
- Applied Research Center (ARC)
- Center for Advanced Technology and Education (CATE)
- Center for the Study of Matters at Extreme Conditions (CeSMEC)
- Engineering Manufacturing Center (EMC)
- Florida Center for Cyber Infrastructure Education and Research for Trust and Assurance
- High Performance Database Research Center
- Industry/University Cooperative Research Center (I/UCRC) Center for Advanced Knowledge Enablement (CAKE)
- International Hurricane Research Center (IHRC)
- Lehman Center for Transportation Research (LCTR)
- Motorola NanoFabrication Research Facility
- Telecommunications and Information Technology Institute (IT2).

Student Success Services

The office of Student Success Services is responsible for the coordination of student services at the University. Students are informed of educational opportunities such as scholarships, tuition waivers, and campus resources.

Admission Requirements

Prospective students seeking a graduate degree in the College must satisfy all university admission requirements as well as the specific program requirements. Each department evaluates candidates for admission to its programs. Prospective students should refer to the appropriate section of the catalog for specific admission requirements. Contact information of the Graduate Programs Directors can be found at: cec.fiu.edu/resources/students/advising/graduate-program-directors/

Admitted Student Procedures

A student who has been accepted to a degree program in the College must meet with the Department's Graduate Program Director prior to the enrollment in the first class.

Enrolled students must choose an advisor during their first semester in the program.

Continued contact (at least once per semester) with the advisor is required to review progress and select courses for each succeeding semester.

Courses taken without the required prerequisites and co-requisites, or without the consent of the advisor, will be dropped automatically before the end of the term, resulting in a grade of "DR" or "DF".

Scientific Laboratory Fees are assessed for certain courses where laboratory classes are part of the curriculum. Specific information on scientific laboratory fees may be obtained from the University Financial Services.

Fellowships, Assistantships, and Scholarships

The College of Engineering and Computing offers a variety of fellowships, assistantships, and scholarships to qualified students. These awards are highly competitive; hence, prospective students are urged to apply and submit all required records and scores as early as possible so they can be considered for these awards.

The amounts of these awards vary depending on the type of the award, but they may provide full tuition and a monthly stipend. Visit: **cec.fiu.edu** for additional information.

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 publics, 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 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 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, *Professor of Practice*
Karen E. Schmahl, *Professor of Practice*
Shabnam Rezapour, *Assistant Professor*

Affiliated and Research Faculty
Cecilia Alvarez-Ortiz, *Affiliated Professor*
Paul Bianco, *Affiliated Professor*
Seema Pissaris, *Affiliated Professor*
Jesus Sanchelima, *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 6125	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 6125	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.

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 6246 Advanced Human-Machine Interaction Design (3). The application of human factors analysis and design methods to complex system interaction. Interface design for technological systems in workplace and consumer domains. Prerequisites: EIN 4243 or equivalent.

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 6259 Usability Engineering in E-commerce (3). This advanced course applies usability engineering theories and methods to models of e-commerce. Usability models are presented and evaluated using case studies. Prerequisite: EIN 5256.

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, *Director and Professor, 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 techniques (e-beam, sputtering, filament evaporation, cvd).

In addition to supporting research within the graduate program in materials science within the Department of Mechanical and Materials Engineering, the Institute supports faculty across all departments (physics, chemistry, geology, biology, electrical and computer engineering and biomedical engineering) in materials based research.

Research and Support Staff

Arvind Agarwal, *Director and Professor, Mechanical and*

Materials Engineering
Chunlei (Peggy) Wang, *Professor, Mechanical and Materials Engineering*
Benjamin Boes*l, Assistant Director and Assistant Professor, Mechanical and Materials Engineering*
Bilal El-Zehab, *Assistant Professor, Mechanical and Materials Engineering*
Jiuhua Chen, *Professor, Mechanical and Materials Engineering*
W. Kinzy Jones, *Professor Emeritus, Mechanical and Materials Engineering*
Chenzhong Li, *Professor, Biomedical Engineering*
Wenzhi Li, *Professor, Physics*
Norman Munroe, *Professor, Mechanical and Materials Engineering*
Surendra Saxena, *Professor Emeritus, Mechanical and Materials Engineering*
Shekhar Bhansali, *Chairperson and Professor, Electrical and Computer Engineering*
Sakhrat Khizroev, *Professor, Electrical and Computer Engineering and College of Medicine*
***Nezih Pala**, Associate Professor, Electrical and Computer Engineering*
Yuriy Vlasov, *Research Engineer*
Yesim Darici, *Associate Professor, Physics*
Watson Lees, *Associate Professor, Chemistry*
Kevin O'Shea, *Professor, Chemistry*
Patrick Roman, *AMERI Manager*

Applied Research Center (ARC)

Ines R. Triay, Ph.D. *Executive Director*
Leonel Lagos, Ph.D., PMP *Director of Research and Workforce Development*
Dwayne McDaniel, Ph.D., *Principal Scientist*
David Roelant, Ph.D. *Principal Scientist, Leads FIU Interdisciplinary Nuclear Research Program*
Himanshu Upadhyay, Ph.D., *Sr. Research Scientist*
Gloria Dingeldein, *Associate Director of Administrative Services*

ARC's **mission** is to be the leading international university-based research institution providing value-driven, real-world solutions, which will enable Florida International University to acquire, manage, and execute educationally relevant and economically sound research programs.

ARC's **vision** is to lead, integrate, and deliver multidisciplinary research and development solutions in environment, energy, and information technology to meet customer commitments on time and at cost. In carrying out this mission, the Applied Research Center is committed to providing training opportunities to the University's uniquely diverse student body under the mentorship of the Center's internationally recognized engineers and scientists.

Environment & Energy – ARC has been performing research and technology development for the environmental cleanup of the U.S. Department of Energy nuclear weapons complex sites since 1995. ARC engineers, scientists and students apply specialized knowledge and skills in state-of-the-art research facilities to understand the underlying science and develop and deploy technology solutions to complex environmental challenges while training the environmental workforce of tomorrow. For energy research, ARC collaborates with FIU's College of Arts, Sciences, and Education to develop R&D and support the growth of: the radiochemistry and health physics academic programs; and the FIU Nuclear Scholars and Nuclear Fellows programs for students.
Green & Sustainable Technologies: FIU is researching ways to improve technologies to use less electrical energy and natural resources in production and in operations while reducing waste and pollution. FIU's ARC is developing Green Buildings by improving technologies for heating and cooling buildings, a major source of energy usage in buildings. Improvements in heating, cooling and ventilation (HVAC) is one area of research. Another area is sustainable remediation which seeks to lower the Green House Gas footprint of operations while also reducing electrical energy use and other resources.
Soil & Groundwater Remediation: Increasing concentrations of heavy metals and radionuclides in the global environment require a focus on contaminant fate, transport, and persistence in soils and groundwater. The Applied Research Center (ARC) at Florida International University (FIU) carries out research and development of applications with a focus on soil and groundwater remediation. For the last twenty years ARC has developed programs and trained outstanding engineers and scientists to conduct advanced and applied research in areas that are vital to national and international needs in the areas of environmental engineering and soil and groundwater remediation. ARC's projects incorporate biogeochemical cycling, fate and transport of contaminants, and water and wastewater treatment. Researchers use data for testing, evaluation, and validation for new and innovative technologies to support DOE and industry.
Water Resources: ARC's water resources research is established to address key issues in hydrology at local and regional scales, primarily through the development and implementation of state-of-the-art integrated, data assimilating hydrological/transport models. The aim is to create hydrological models that are scalable to the regional, national and global extents which serve as effective tools for water resources management and monitoring.
Geographic Information Systems: Geographic Information Systems (GIS) technology is an integral part of many of FIU ARC's research and development activities as an analysis tool, its application spanning various areas of applied research including water resources management; soil and groundwater remediation; environmental assessment; nutrient, chemical and radioactive contaminant fate and transport; assessment of renewable energy resources; assessment and impacts of land use change; and climate change analysis. ARC researchers have extensive experience utilizing GIS for mapping and geospatial analysis; geodatabase development; integrated surface and groundwater modeling; air dispersion modeling; storm water modeling; geospatial data and metadata development; Internet and mobile application development; conversion of computer-aided design and drafting (CADD) data; and development of waste information management systems applications.
Radiochemistry and Nuclear Power: Nuclear research and education was launched in 1990 at FIU. Since 2014 FIU has developed a Radiochemistry PhD track launched in Aug. 2015 and a Health Physics Specialty under the BS in Physics launched in Aug. 2016. Over this period, many

new faculty, staff and students have engaged in nuclear related R&D. Presently over 110 faculty and staff and 75 students are active in nuclear research.

Deactivation & Decommissioning: ARC has over 20 years of experience in performing research in the area of D&D of nuclear facilities, having participated in over 300 projects since 1995 in support of the DOE's Office of Environmental Management. As part of this support, ARC has evaluated baseline and innovative technologies for D&D applications; to date, over 150 technologies have been assessed at ARC's facilities in Miami, at DOE sites, and at technology vendors' facilities.

Cyber Security & Information Technology

Applied Research Center (ARC) at Florida International University (FIU) performs applied and advanced research in the areas of Enterprise Systems, Cyber Security and Data Science. The solutions are tailored to deliver critical information to federal, state, local governments and the private sector clients, keeping them well informed, connected and secure. We share the commitment and responsibility to securing information and information networks with integration of people, operations, and technology.

Data Science: ARC performs extensive research in the area of Data Science to provide analytical solutions in the area of nuclear and cybersecurity to federal / state governments and national labs. Current research is focused on Machine Learning, Data Analytics and Visualization.

Cyber Security: ARC performs sponsored research in the areas of cyberspace architecture and framework, virtualization, memory forensics, ethical hacking and cyber analytics to support Department of Defense – Test Resource Management Center and US Department of Energy – Office of Environmental Management. Cyber research allows for the training of FIU STEM (Science, Technology, Engineering, and Math) undergraduate and graduate students with diverse technical background through Cyber Fellows (Cyberspace Work Force Development) program.

Enterprise Solution: ARC has extensive experience in building custom enterprise systems in the area of Waste Management, Knowledge Management, Database Management, Content Management and Mobile system, using the latest technologies for various clients like the U.S. Department of Energy (U.S. DOE) – Office of Environmental Management and U.S. Department of Defense (U.S. DOD) – Test Resource Management System.

Aerospace & Defense

At ARC, both applied and basic research are being conducted in areas of mechanical and materials engineering that provide support and solutions to a number of industries including aerospace and defense. Some of the fundamental efforts that include computational mechanics and composites can impact other disciplines as well, including energy, biomedical, marine and nuclear.

Robotics: Advancement in computer, material and design technologies has provided an avenue for robotic systems to be utilized in a number of engineering applications that includes manufacturing, inspection, and even simple household functions. At ARC, robotic systems are being developed to provide a means to inspect areas that may be difficult to obtain access to or unsafe for people to enter. These tools are being designed with sensor systems that can provide valuable information including the health of structures or the status of the area's environment.

Composites: Use of composite materials continues to increase in today's engineering applications due to improved strength to weight ratios, its resistance to corrosion and the reductions in repair and maintenance costs. At ARC, our engineers have focused research efforts on understanding how composite structures can be joined using adhesive bonding. In particular, we are investigating quality control procedures for bonding, the durability of the bonds and how contamination may affect bonds.

Computational Mechanics: Advances in simulation software will improve the ability for engineers to effectively simulate engineering processes without having to develop and test systems with costly experimental facilities. Engineers at ARC utilize finite element analysis to aid in the design of complex structures, and computational fluid dynamics software to assist in addressing complex challenges related to simulating fluid flow processes that further expand the capability of the simulation software. Some issues currently being addressed include modeling of mixing processes of multi-phase flows and using reduced-order models to efficiently capture the salient features of the flow.

Workforce Development and Training – The DOE-FIU Science and Technology Workforce Development program is an innovative program to create a "pipeline" of FIU STEM (science, technology, engineering, and math) underrepresented students specifically trained and mentored to enter the DOE workforce in technical areas of need. The main objective of the program is to provide a unique integration of FIU course work, DOE field work, and "hands on" training and mentoring at ARC. It is envisioned that once our DOE Fellows graduate from this program they will enter DOE-EM's Professional Development Corps Program and/or work for DOE's contractor firms. To date, over 130 FIU underrepresented students have joined the program. The students are officially inducted into the program and vested the name of DOE Fellows in a special Induction Ceremony celebrated during the Fall semester. DOE Fellows also have internship opportunities at DOE National Laboratories and DOE sites around the country. Since the program's initiation in 2007, over 110 DOE Fellows have participated in research internships at Oak Ridge National Laboratory, Idaho National Laboratory, Pacific Northwest National Laboratory, and DOE-HQ in Washington DC. In addition, our DOE Fellows directly support DOE contractors performing environmental remediation around the DOE Complex. DOE Fellows have done 199 Poster Presentations at Waste Management Symposia and other national/international conferences. Furthermore, this program enables undergraduate students to pursue the M.S. and Ph.D. degrees by providing Research Assistantships. So far, over 71 DOE Fellows have obtained B.S. degrees or Masters Degrees at FIU.

ARC is committed to the education and development of FIU students and has developed a Student Steering Committee (SSC) that oversees the academic and research progress of each student. This committee also conducts interviews and evaluates applicants for the program. ARC is working closely with federal, state agencies, community colleges and other universities to provide training in alternative energy areas such as: solar,

biomass, nuclear and weathering. This Energy Systems Training Network under the Florida Energy Systems Consortium (FESC) will help to develop a 21st century "green workforce".

Doing Business with the Applied Research Center – ARC's employees are drawn from a wide segment of the commercial, government, and academic arenas to collectively utilize their experience and expertise to support the needs of FIU's clients. Our operating philosophy recognizes and accommodates the critical performance characteristics of government and commercial activities, while exercising the benefit of its cost structure in a way that serves both client interests and those of the University and its students. Our staff is fully engaged in the project and program activities assigned. The critical difference in the ARC's structure is the project management and administrative processes and structures that have been put in place to serve its clients. The Center has executed work for federal agencies, state and local governments, and commercial entities. For more information on FIU's ARC, please visit **www.arc.fiu.edu** or call (305) 348-4238.

Center for Advanced Technology and Education (CATE)

Malek Adjouadi, *Director and Electrical and Computer Engineering*

Mission

The mission of the NSF-funded CATE center at FIU is to foster cross-disciplinary research as a catalyst for our students to train and develop their creative thinking by bringing in synergy the fields of image and signal processing with application to neuroscience and assistive technology research. In the merging of these technologies, we see a productive ground for the development of new methodologies and designs that (1) meet the impending needs in neuroscience as we elicit both the functional mapping of the brain, and the causality of key brain disorders; and (2) design assistive technology tools that address effectively the issue of "Universal Accessibility", focusing on visual impairment and motor disability. The premise is to translate new theoretical findings into the realm of real-world applicability.

Major Research Themes

- Image and signal processing
- Neuroimaging
- Machine learning
- Brain Mapping
- Informatics and big data
- Web interfaces
- Brain Stimulation for Therapeutic/Curative interventions

Major Activities of the CATE Center

Establish a research platform for the cohesive study of the human brain by bringing together several hospitals and academic institutions in a consortium that will instigate multi-site collaborative studies with a large number of patients in accordance to standardized protocols and tests.

- Create an environment that supports cross-disciplinary initiatives, joint collaborations and programs with access to modern equipment and facilities of unprecedented sophistication and integration.
- Extend the scientific reach of these interdisciplinary efforts to overcome the primary barriers in identifying the different factors that influence the functional organization of the brain, as new paradigms and new findings will come to benefit the scientific community as a whole, and to provide critical help to hundreds of patients yearly.
- Provide a consolidated infrastructure for neuroimaging that will come in support of a new cohort of Ph.D. students and to a well-trained and skilled workforce able to bridge engineering and computing know-how to the fields of medicine and the biosciences.

Faculty and Co-Principal Investigators

Mercedes Cabrerizo, CATE Co-Director, *Electrical and Computer Engineering*
Armando Barreto, Professor, *Electrical and Computer Engineering*
Sergio M Gonzalez-Arias, *Executive Associate dean for Clinical Affairs and Professor, Herbert Wertheim College of Medicine*
Angela R Laird, *Professor, Physics*
Naphtali D Rishe, *Professor, School of Computing and Information Sciences*
Raul Gonzalez, *Associate Professor, Psychology, Center for Children and Families*
Joseph S. Raiker, *Assistant Professor, Psychology, Center for Children and Families*

Laboratory and Infrastructure Manager

Niovi Rojas, *Research Specialist*

Coordinator, Student Recruitment

Stephanie Strange, *College of Engineering and Computing, Assistant Director of Recruitment and Retention*

Consultants

Ranjan Duara, *Medical Director, Wien Center for Alzheimer's Disease and Memory Disorders at Mount Sinai.*
David Loewenstein, *Center on Aging, Department of Psychiatry & Behavioral Sciences, University Miami Miller Medical School.*
Prasanna Jayakar, *Founding Chair, Brain Institute, Nicklaus Children Hospital*
William D. Gaillard, *Children's National Medical Center, George Washington University, and Georgetown University.*
Ilker Yaylali, *Neurology, Oregon Health and Science University.*
Dr. Alberto Pinzon, *Director, Epilepsy Program at Baptist Hospital*

Evaluator

Sarah Hug, *Alliance for Technology, Learning and Society (ATLAS) Institute at the University of Colorado at Boulder.*

Center for Student Access and Success

Norman Munroe, *Director and Professor, Mechanical and Materials Engineering*
Stephanie Strange*, Associate Director*
Francisco Fins, *Program Director, ENLACE*
Kristian Cosculluella, *Program Assistant*

South Florida's distinction as a multi-cultured, multi-lingual region has long been a diverse source of talent for FIU, particularly in the College of Engineering and Computing. In response to the challenge of attracting this diverse community to science and engineering, the College of Engineering and Computing has created a special center for Diversity in Engineering and Computing.

By building sound foundations in sciences and mathematics, the Center helps to prepare young students to deal with the rigors of higher-level education, and Engineering and Computing in particular. Currently the Center has several on-going programs as a service to the community and the University:

Scholarship Programs:

National Action Council for Minorities in Engineering (NACME)
*N*ACME's mission is to increase the proportion of minorities in engineering. It has been at FIU since 2003 to the present. Funding Endowments are derived from membership fees with NACME, Inc. The Advisory Board is comprised of CEOs of major companies such as; Lockheed Martin, Boeing, Shell Oil, Proctor & Gamble, Xerox, and others throughout the U.S. FIU is one of 51 universities that receive funding, and university presidents serve on the Advisory Board. FIU NACME has a 98% Retention to Graduation Rate. Students receive scholarship awards of $2,000 per year, for up to 5 years to graduate with a bachelor's degree in Engineering.

Florida/Georgia Louis Stokes Alliance for Minority Participation (FGLSAMP)
This is a National Science Foundation funded program in association with Florida Agricultural and Mechanical University (FAMU), the leading institution. This program focuses on engineering, math chemistry, biology, physics, and computer science undergraduate students. Participants receive scholarships, during the entire academic year based on high GPA and being a full time student. Opportunities for summer internships are available.

Educational Programs:

Florida Action for Minorities in Engineering (FLAME)
This is a cooperative program between Miami Coral Park Senior High School and Florida International University aimed at introducing the profession of engineering to high school students, and to identify, select, enroll and retain minority students in the engineering field. Senior High School students also registered for dual enrollment classes at FIU.

Tutoring/Learning Assistants:
The tutoring program targets core courses (gateway course) that are known to retard graduation and sometimes result in a change of major. Tutoring undergraduates in these gateway courses enhances retention as well as graduation rates. Faculty are provided Learning Assistants (LA) to introduce active learning into their courses.

Junior Engineering Technical Society (JETS) (TEAMS)
The **JETS Test of Engineering Aptitude, Mathematics and Science (TEAMS)** is an academic problem-solving competition, that serves all public and private high schools within our geographical area with focus on a one day activity at Florida International University.

(UNITE)
A collaborative effort between Florida International University, the U.S. Army, and the Junior Engineering Technical Society. The JETS UNITE Program's goal is to increase the number of underrepresented students in the field of engineering, to improve the performance of the students in their SAT/ACT exams, develop resourceful, self-motivated well rounded graduates who will be responsible and well adjusted citizens.
ENLACE/MIAMI The Children's Trust, this program is funded by The Children's Trust and provides after school and summer programs for 650 children (ages 7-17) residing in the Sweetwater, Doral and West Kendall areas. The after school program offers literacy support through individualized software-based reading intervention, social skills development, and health fitness education. The summer program offers students the unique opportunity to attend classes on a university campus.

K-12 Outreach Programs:

Engineering on Wheels (EOW) is a STEM outreach program where members of student organizations visit local high schools to conduct experiments and mentor students.
Engaging Latino Communities for Education (ENLACE) is an After School program and a 5 week summer camp.
MiamiPrep Summer Camp is a 5 week hands-on STEM summer camp for 3rd -11th graders. Students are instructed on coding in C++, Auto Cad drawing, MATLAB and Robotics and receive Research Laboratory Internship opportunities.
National Summer Transportation Institute (NSTI) a summer camp focused on systems of transportation.
Annual Engineering EXPO – Each year over 1600 elementary – high school students spend an entire day touring research laboratories and mentored by faculty, student organizations such as SHPE, NSBE, SWE, SAE, ASME, TBP, etc. and graduate students.

Center for the Study of Matters at Extreme Conditions (CeSMEC)

Jiuhua Chen, *Deputy Director and Professor, Mechanical and Materials Engineering*
Yu Zhong, *Assistant Professor, Mechanical and Materials Engineering*
Andriy Durygin, *Research Coordinator*
Vadym Drozd, *Research Assistant Professor*
Selva Venilla Raju, *Research Assistant Professor*

CeSMEC's mission is to study the behavior of materials at high pressures and temperatures. The range of research activities includes the study of planetary interiors and of matter at extreme industrial conditions. CeSMEC is one of

few facilities in the country where pressures are created to many million atmospheres and temperatures to several thousand degrees; the material is studied under such condition with x-ray and electroscopic techniques.

All materials are subject to three fundamental variables – the variables of temperatures, chemical composition, and pressure. Modern science has vigorously used only the first two variables in exploring nature and creating several amenities of modern civilization. Pressure, the third fundamental variable altering all states of matter, has been for years a relatively minor esoteric sub-field. The creation of this center is providing FIU's graduate students and faculty the opportunity to perform fundamental and applied research in high-pressure physics, high-pressure chemistry, and materials science. The center is raising the infrastructure at FIU to the level required to initiate world-class research in an emerging area of science and engineering.

With recent additions of a Hydrogen-Storage Materials Research Facility and a large volume high pressure-high temperature equipment, researchers can perform synthesis of novel materials for a variety of industrial applications.

Distributed Multimedia Information Systems Laboratory

Shu-Ching Chen, *Director and Professor, School of Computing and Information Sciences*

The mission of the Distributed Multimedia Information System Laboratory (DMIS) is to conduct leading edge research in multimedia database systems, data mining, networking and wireless, GIS and Intelligent Transportation Systems. Other research areas of this effort include Multimedia Communications and Networking, Digital Library, 3D Animation, and Distributed Computing.

Division of Corporate and External Programs

Caesar Abi Shdid, *Director and Senior Instructor, Civil and Environmental Engineering*

The **Division of External Programs (DEP)** develops, promotes and manages academic programs offered under the rubric of Executive Engineering Education, Continuing Education, and Distance Learning in the **College of Engineering and Computing**.

The DEP is managed by a director reporting to the Dean of Engineering & Computing. The director and staff of the DEP work with department chairs, center directors and faculty members to identify corporate and global partners; develop, promote and manage Executive Engineering Programs; weekend graduate programs for professional, Distance Learning Programs, and Continuing Education Programs; and identify new opportunities and new markets for all programs that are offered by the College of Engineering and Computing. Various categories of programs in which the DEP is involved include the following:

Overseas Programs

The overseas programs focus on the demonstrated education and training needs of selected industrial sector(s) in the host country. These programs are offered in collaboration with a sponsor which is a reputed university or institution that can support the delivery of the program by providing appropriate infrastructure facilities like classrooms, library and computer laboratories. The programs are designed in consultation with the faculty of the sponsor and the industry representatives in the host country. The goal of the overseas programs is to complement the existing academic programs offered by the sponsoring institution.

Overseas Programs

- Corporate Programs
- Certificate Programs
- Weekend Graduate Programs
- International Student Transfer Programs

The international student transfer program (Dual Degree and Articulation Programs) allows undergraduate students from foreign universities to complete approximately 75% of their curriculum at home institution and the remaining 25% at FIU, and receive their undergraduate degree from both institutions. An articulation agreement ascertains the student's ability to transfer courses taken at home institution to FIU such that FIU's core curriculum and other undergraduate program requirements are met.

All participants in the program proceed as a cohort through a lock-step curriculum of the selected courses. The local faculty from the host country is also involved in teaching to enrich the program by integrating the economic, cultural, social, political and legal issues of the host country in the curriculum.

The international student transfer program (Faculty Development Program) allows the foreign universities, mostly in Latin America, to send their MS degree recipient faculty member to complete their PhD education at FIU. These students complete their coursework and dissertations proposals at FIU and then return to their home institutions where they complete their dissertation work. Agreements between the two universities allow for a lot of assistance to the student's while they are working on their dissertation.

Corporate and Executive Programs

The Corporate Programs are designed for an individual corporation leading to an academic degree, certificate or short-term executive development program. The programs are delivered on site and the program delivery is supported by providing infrastructure facilities. Corporate programs are designed to meet the specific educational and training needs of the corporate clients. Currently, we offer the following engineering certificate programs: "Lean Six Sigma", "Six Sigma Green Belt", "Six Sigma Black Belt", "ISO 9001", and "Supply Chain Management" certification program every semester.

Continuing Education Programs

The Continuing Education Programs are designed to meet the licensing and certification needs of individual professionals in the engineering and construction fields. The programs are delivered at various locations around Florida and online. The Continuing Education Programs can be conducted on site for companies. Currently, we offer the following continuing education programs: "FDOT

Construction Training and Qualification Program (CTQP)", "FDOT Maintenance of Traffic in Construction Zones (MOT)", "Professional Engineering (PE) Licensing Exam Review Courses for the NCEES PE Civil, PE Mechanical, PE Electrical (Power), and PE Structural exams", "Fundamentals of Engineering Exam (FE) Review Course", "Florida General Contractor's Exam (GC) Review Course", "OSHA Training Certification Courses", "LEED Exam Prep Course", "Florida Laws and Rules Seminars", and "Continuing Education Seminars (for PEs and GCs)".

Weekend Graduate Programs for Professionals

DEP offers professionals in South Florida the ability to complete their master degrees in an accelerated one-year program that is conveniently offered on Saturdays in Broward County and the Miami downtown area. These programs are specifically designed for working professionals who aspire to a graduate degree without interrupting their careers. DEP currently offers a Professional MS Engineering Management and a Professional MS Construction Management degree programs in this lock-step format.

Distance Learning Programs

The Florida Engineering Education Delivery System (FEEDS) is a statewide distance learning system providing access to graduate and undergraduate level engineering courses and programs to individual students anywhere and anytime, whether it is at home or the workplace. Courses are delivered through streaming video over the Internet; and fully on-line.

FEEDS offers engineering students and professionals with work and family responsibilities the flexibility to take courses around their busy schedules. It also provides convenience to those who are not within driving distance of an academic institution. It allows them to continue their professional development, which plays an important role in the growth of high technology industries.

Currently, students can select the necessary courses from FIU via distance learning to obtain a Master's degree in Civil Engineering, Environmental Engineering, and Construction Management. Selected undergraduate courses are also available for the following undergraduate degree programs: Civil Engineering, Construction Management, Environmental Engineering, Mechanical Engineering, Electrical Engineering, and Computer Science.

A student taking a course through FEEDS must meet the same requirements as the student on campus and will earn the same credit as if he/she were to attend classes on campus. A student need not be enrolled in a graduate or undergraduate degree program in order to take a course. However, a non-degree seeking student who intends to seek admission to a program should be aware that no more than twelve (12) graduate or fifteen (15) undergraduate credits are allowed to be transferred into a program.

Engineering Information Center (EIC)

Hernan Bormey, *Director*

Create a technology that will help save lives or create your own website, simulate an electronic circuit, design a bridge, or just browse the Internet. The possibilities are endless at Engineering Information Center.

EIC helps faculty, scientists, researchers, and students to conduct cutting edge research and work on system designs, networking, scientific visualization, 3D Modeling, simulations, virtual reality, computer animation, and other computer and software applications.

The Center manages an array of Novell, Windows, and UNIX network servers that provide faculty, staff and students with the capacity to share valuable resources; therefore, fostering an atmosphere where collaboration and instruction grow with a synergy that is unique. Beyond the college community, EIC participates in sponsoring special outreach programs for the Miami-Dade County Public Schools by exposing young minds to latest technologies.

EIC is also home to The Graphic Simulation Laboratory with focus on Scientific Visualization, 3D Computer Modeling, and Virtual Reality, which have helped researchers to develop a wide array of technologies, strategies, and information designs. GSL has collaborated with NASA, The Center for Super Computing Applications, National Science Foundation, Computational Science Institute, Shodor Organization, Macromedia, and Kellogg Foundation, just to mention a few. From hardware to software support to 3D modeling of a heart valve, EIC delivers exceptional services with a personal touch.

Engineering Manufacturing Center (EMC)

Ibrahim Tansel, *Interim Chairperson, Director and Professor, Mechanical and Materials Engineering*
Mario Sanchez, *Senior Engineer and Manager*
Richard Zicarelli, *Coordinator*

The Engineering Manufacturing Center provides technical expertise in manufacturing to anyone in need of assistance. Typically the Center supports researchers, graduate and undergraduate students with projects requiring high-precision quality fabrication and requiring expert technical guidance. Undergraduate engineering students represent the largest group served. Students of all academic departments benefit directly through help with class projects, such as Senior Design (capstone) courses, critical components of all ABET accredited Engineering programs in the College. Other major undergraduate projects supported include the Mini-Baja, Mini-Submarine and Robot Competitions. Graduate students regularly request fabrication assistance with experimental devices, tools and fixtures. The Center's main facility supports the College's academic departments' general fabrication needs, including equipment repair, assembly, fixturing, installation, etc. An auxiliary EMC-supervised machine shop is available for student hands-on project work.

The Center also provides technical services to the outside community such as entrepreneurial consulting in product design and development and sub-contract fabrication work. Companies served by the EMC range from entrepreneurial to the well-established, some of which include aerospace, automotive, marine, medical and consumer product manufacturers. The Center runs state-of-the-art CAD/CAM software and operates a diverse array of rapid prototyping equipment combined with CNC capabilities providing a wide variety of fabrication processes. In addition, the Center can perform inspection,

measurement and reverse engineering capabilities through its automated measurement equipment.

For more information, contact the EMC by calling Mr. Richard Zicarelli (305) 348-6557 or Mr. Mario Sanchez (**sanchem@fiu.edu**), or refer to the center's website at **http://www.eng.fiu.edu/emc/**.

Eugenio Pino and Family Global Entrepreneurship Center

Jerry Haar, *Executive Director*

The Eugenio Pino and Family Global Entrepreneurship Center, founded in 2003 in the College of Business at Florida International University, fosters entrepreneurship throughout South Florida and internationally. The Pino Center provides the FIU and local communities with the knowledge and networks that enable them to reach their entrepreneurial objectives of designing, launching and nurturing successful new ventures and assisting established innovative enterprises in moving to the next level. Activities include: workshops and webinars, a business plan competition, a yearly conference on venture capital in the Americas, a venture mentor service, and a publication series, including working papers. Student and faculty in the Department of Management and International Business, as well as other departments and other schools and colleges within the University, are invited to participate in the programs and activities of the Pino Entrepreneurship Center. For more information, visit **www.entrepreneurship.fiu.edu**.

High Performance Database Research Center

Naphtali Rishe, *Director and Professor, School of Computing and Information Sciences*

One of our research efforts is the High-Performance Database Research Center (HPDRC). HPDRC conducts research on such theoretical and applied issues as Internet-distributed heterogeneous databases, database design methodologies, database design tools, information analysis, multi-media databases, database languages, data compression, spatial databases, and data visualization. The Center also designs specific database systems for highly complex applications.

International Hurricane Research Center (IHRC)

Stephen P. Leatherman, *Director*
Kegi Zhang, *Laboratory for Coastal Research, Co-Director*
Shahid Hamid, *Laboratory for Insurance, Financial and Economic Research, Director*
Arindam Chowdhury, *Laboratory for Wind Engineering Research, Director, and Associate Professor, Civil and Environmental Engineering*
Dario Moreno, *Laboratory for Social Science Research, Director*

Florida International University's International Hurricane Center has officially changed its name to the International Hurricane Research Center (IHRC). The change was made to better reflect the Center's research initiatives.

Serving the state of Florida, the IHRC is a Type I interdisciplinary research center focused on the mitigation of hurricane damage to people, the economy, and the built and natural environments. This designation makes the IHRC Florida's official hurricane research center for 11 universities comprising the state university system.

The citizens of the U.S. East and Gulf Coasts and Caribbean Islands are severely impacted by hurricanes, and IHRC promotes an interdisciplinary, large-scale disaster research agenda to address this vulnerability. Disciplines such as architecture, business, economics, engineering, finance, geosciences, insurance, political science, sociology, and urban planning are involved in a long-term, integrated research program that helps Florida, the nation, and its regional neighbors to mitigate hurricane exposure.

The Center developed as a result of a public-private partnership between the We Will Rebuild Foundation, an organization formed to spearhead the rebuilding of Dade County in 1992 after Hurricane Andrew, and FIU. The IHRC works in conjunction with the National Hurricane Center, which is also located at the FIU Modesto A. Maidique Campus in West Miami-Dade.

Lehman Center for Transportation Research (LCTR)

L. David Shen, P.E., T.E. *Director and Professor, Civil and Environmental Engineering*
Sylvan C. Jolibois, Jr., *Deputy Director and Associate Professor, Civil and Environmental Engineering*
Albert Gan, *Deputy Director and Associate Professor, Civil and Environmental Engineering*
Favian Cevallos, *Transit Program Director*

The Lehman Center for Transportation Research (LCTR) at Florida International University was established in 1993 in honor of Congressman Bill Lehman and his tireless efforts to make South Florida a better place for all of us. The center's vision is to become a 'state-of-the-art' transportation research and training facility. LCTR is committed to serve and benefit our society by conducting research to improve mobility, hence the quality of life issues, develop partnerships in the transportation industry, and educate a multidisciplinary workforce to plan, manage and implement transportation systems.

Faculty, staff and students at LCTR are involved in research related to the planning, design, operation and maintenance of transportation systems, including intelligent transportation systems, public transportation, highway transportation, aviation, and freight; as well as public policy, air pollution, and the application of geographic information systems and other advanced technologies such as artificial neural networks and scientific visualization in transportation. Future plans include networking with the public and private industry to collaborate on transportation related research. In addition, applied research will be conducted on, but not limited to intelligent vehicle and highway systems.

Motorola Nanofabrication Research Facility

Chunlei (Peggy) Wang, *Interim Director and Associate Professor, Mechanical and Materials Engineering*
Neal Ricks, *Lab Manager*

The first centralized facility of its kind in Florida, the Motorola Nanofabrication Research Facility is an open-access initiative in support of nano-scale devices, systems and materials research that encompasses a broad range of technologies and capabilities. The facility provides nanofabrication, analytical instrumentation, materials characterization and process-development laboratories for students, faculty and industrial researchers. This $15 million Research Facility is an integral part of the Advanced Materials Engineering Research Institute (AMERI), FIU's broader materials research program.

Harnessing the synergy inherent in the study and development of nanoscale technologies, the facility boasts:

- Specialized equipment required to develop new and novel fabrication techniques unique to the creation of functional materials and devices that are no greater than 100 nanometers (1,000 times smaller than the diameter of a human hair);
- A full complement of standard semiconductor processing equipment to leverage the capabilities of robust and proven techniques; and
- State-of-the-art analytical tools to study, and characterize these nano-sized devices, as well as the materials and processes used to make them.

The Nanotechnology Faculty Team

Chunlei (Peggy) Wang, *Interim Director and Associate Professor, Mechanical and Materials Engineering*
Arvind Agarwal, *Professor, Mechanical and Materials Engineering*
George Dulikravich, *Professor, Mechanical and Materials Engineering*
W. Kinzy Jones, *Professor, Mechanical and Materials Engineering*
Grover Larkins, *Professor, Electrical and Computer Engineering*
Watson Lees, *Associate Professor, Chemistry*
Chenzhong Li, *Associate Professor, Biomedical Engineering*
Wenzhi Li, *Associate Professor, Physics*
Anthony McGoron, *Associate Professor, Biomedical Engineering*
Surendra Saxena, *Professor, Mechanical and Materials Engineering*
Frank Urban, *Associate Professor, Electrical and Computer Engineering*
Yuriy Vlasov, *Research Engineer*

Structures and Construction Laboratory

Amir Mirmiran, *Director*
Nakin Suksawang, *Deputy Director*
Edgar Polo, *Lab Manager*

Structures and Construction Laboratory (SCL) is established to provide hands-on educational experience for students; to research and development of innovative hurricane-resistant and durable construction materials, structural systems and components; to serve the construction industry; to contribute to the engineering community in South Florida, and to advance the safety, durability, and economy of our civil infrastructure.

The Structures and Construction Laboratory was built through the help of a consortium of 21 industry partners who donated materials, services, and cash in excess of $250,000. It is one of the largest facilities in the State of Florida and is equipped with a full-scale structural testing system (FSST). The FSST consists of a 15 ft tall testing frame that stands above a 35 ft × 65 ft strong concrete floor with 4 ft thickness and 100,000 lbs capacity tie-downs on a 3 ft × 6 ft pattern. The steel frame is capable of testing full-scale structural members, such as a 65 ft bridge girder. The applied load is replicated using a fatigue rated tension/compression actuator that is capable of performing cyclic loading. In addition to the FSST, the SCL is also equipped with other material testing systems, including a universal testing machine, compression machine, and small-scale load frames.

Telecommunications and Information Technology Institute

Niki Pissinou, *Director and Professor, School of Computing and Information Sciences*

Florida International University (FIU) recognizes the need to nurture highly trained personnel for the nation's industry and business, develop research to support the rapidly expanding high-tech industry and become proactive in technology transfer. Thus, ensuring continued economic growth and prosperity in the region. In order to fully meet today's technological demands, FIU has established the Telecommunications and Information Technology Institute (IT^2). IT^2 promotes advanced multidisciplinary education and research focused on telecommunications and information technologies. IT^2's mission is to:

1. Deliver high quality telecommunications and information technology education and training.
2. Conduct and promote research to enhance Florida's role as a leader in telecommunications and information technology.
3. Offer training that is needed to foster business development and workforce preparedness.
4. Promote technology transfer to enhance the enabling technologies of the telecommunication and information technology industries.

In fulfilling its mission, IT^2 promotes multidisciplinary collaboration and serves as the catalyst to promote intellectual cross-fertilization among disciplines. This effort results in the synergistic enhancement of teaching and research, so critical in the telecommunications and information technology fields, where disciplinary barriers are falling and lines are blurred. An objective of the Institute is to infuse telecommunications and information technology content into the curriculum at all appropriate levels. To fill the urgent demand of industry, the institute is developing interdisciplinary telecommunication programs that provide certificate programs, Bachelors, Masters and Ph.D. degrees.

IT^2 constitutes an infrastructure that is viable for cutting edge research activities. Researchers at the institute conduct funded research and development targeted at solving complex problems conducive to the early identification of high impact opportunities. Of particular importance to the institute's research efforts is the emerging global wireless, optical and personal communications infrastructure and the ability to represent, store and access information to perform a variety of information related tasks. To provide an effective forum for original research results and to foster communication among researchers, industry leaders can collaborate on

education, training, and re-engineering the telecommunications workforce of the future. The alliance provides effective ways to educate the workforce of the 21st century. In accordance, the institute provides technical assistance and applied research services to transfer acquired knowledge and technologies to the commercial sector. The IT² team can work with industrial organizations to tap into some technological innovations that drive the industry to its strategic advantage.

For more information, contact Dr. Niki Pissinou, the director of the Telecommunications and Information Technology Institute, at (305) 348-3987 or visit our Website at **www.it2.fiu.edu**.

Core Faculty

Niki Pissinou, *Director and Professor*
Deng Pan, *Associate Professor*

Affiliated and Research Faculty

Kang Yen, *Professor, Electrical and Computer Engineering*
Jean Andrian, *Associate Professor, Electrical and Computer Engineering*
Shih-Ming Lee, *Associate Professor, Engineering Management Program*
Osama Mohammed, *Professor, Electrical and Computer Engineering*