

College of Engineering and Computing

Dean

John L. Volakis

Associate Dean for Academic

Affairs

Anthony J. McGoron

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Osama Mohammed

Distinguished University Professor of

Computer Science, Associate Dean, and Interim

Director

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 five schools: School of Biomedical, Mechanical and Materials Engineering, School of Computing and Information Sciences, School of Electrical, Computer and Enterprise Engineering, School of Universal Computing, Construction and Engineering Education and Moss School of Construction, Infrastructure and Sustainability, and five academic departments: Biomedical Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering, Construction Management and Mechanical and Materials Engineering. These academic units offer programs leading to the Bachelor of Arts, 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), Distributed Multimedia Information Systems Laboratory, Engineering Manufacturing Center (EMC), 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 houses 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.

Bachelor of Science degree programs in the College of Engineering and Computing are offered in the following fields of study:

Biomedical Engineering
Civil Engineering
Computer Engineering

Computer Science (also B.A.)
Construction Management
Electrical Engineering
Environmental Engineering
Information Technology (also B.A.)
Interdisciplinary Engineering
Internet of Things
Mechanical Engineering

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, biomedical devices and instrumentation, computer engineering, artificial intelligence, manufacturing, robotics, telecommunications, microelectronics, structural systems, biotechnology, systems modeling, information technology, environmental sciences and engineering, image processing engineering education, etc. Undergraduate students are given the opportunity to participate in many of these research projects.

Educational Objectives for Computer Science

The computer science program is designed to give our students an outstanding education. To illustrate the excellence of our program, please note the educational objectives below that are met in our program.

1. To provide our graduates with a broad-based education that will form the basis for personal growth and life-long learning.
2. To provide our graduates with a quality technical education that will equip them for productive careers in the field of Computer Science.
3. To provide our graduates with the communication skills and social and ethical awareness requisite for the effective and responsible practice of their professions.
4. To prepare students for BS level careers or continued graduate education.

Educational Objectives for Engineering

All engineering programs in the college are designed to give our students an outstanding education. To illustrate the excellence of our program, please note the educational objectives below that are met in every Engineering program.

1. Develop within our graduates a basic foundation in the fundamental areas of engineering and to provide the technical proficiency needed for the professional practice of engineering.

Our graduates will be able to:

- A. Design a system, component, or process to meet desired needs related to the major technical areas encompassed by engineering.
 - B. Design and conduct experiments and analyze and interpret data related to at least two of the major technical areas encompassed in engineering.
 - C. Identify, formulate, and solve a wide range of engineering problems.
 - D. Apply knowledge of mathematics, science and engineering to solve a wide range of engineering problems.
 - E. Utilize the techniques, skills, and modern scientific tools necessary for contemporary engineering practice.
2. Develop within our graduates the ability to communicate their ideas effectively within the technical community and to the general public.

Our graduates will demonstrate an acceptable level of proficiency in:

- A. Written communication
- B. Oral communication
- C. Working with others as part of a multidisciplinary team.

3. Prepare our graduates to take their places in society as responsible citizens.

Our graduates will demonstrate an appreciation for and an understanding of:

1. Contemporary issues facing society as a whole.
2. The local and global historical, social, economic, and political context and impact of engineering solutions to societal problems.

4. Provide our graduates with the basis for, and instill within them an appreciation for enthusiasm for life-long scientific inquiry, learning and creativity.

Our graduates will:

- A. Understand that graduation is but a beginning step in the development of professional engineering competency.
- B. Appreciate the need for life-long learning to maintain and enhance the professional practice of engineering.
- C. Be equipped with the basic knowledge and approach to learning that will allow them to benefit from continued scientific inquiry and learning.

5. Foster within our graduates the development of an understanding for the need to maintain the highest ethical standards in their personal and professional lives.

Our graduates will:

- A. Demonstrate an understanding of professional integrity and ethical responsibilities.
- B. Demonstrate an understanding of professional responsibility issues as they relate to public interest, health, and safety.

Educational Objectives for Construction Management

The construction management program is designed to give our students an outstanding education. To illustrate

the excellence of our program, please note the educational objectives below that are met in our program.

1. To educate undergraduate construction management majors through a program of academic learning designed to provide the management and technical knowledge required for entry level professional positions in the construction industry.
 - A. Have a good understanding of principles of management.
 - B. Have knowledge of economics, accounting and business law.
 - C. Have knowledge of building codes and standards.
 - D. Have technical knowledge and ability to identify and understand civil, electrical, mechanical and structural systems.
2. To furnish the graduate construction management majors an advanced level of education designed to provide the management and analytical knowledge required for managerial positions in the construction industry.
 - A. Have ability to analyze construction problems.
 - B. Have knowledge to solve construction problems.
 - C. Have ability to plan, estimate and schedule construction projects.
 - D. Have ability to manage construction projects and processes.
3. Develop within our graduates the ability to communicate their ideas effectively within the technical community and to the general public. Our graduates will have an acceptable level of proficiency in:
 - A. Written communication
 - B. Oral communication
 - C. Working with other in a project team
4. Foster within our graduates the development of an understanding for the need to maintain the highest ethical standards in their personal and professional lives.

Our graduates will:

 - A. Demonstrate an understanding of professional integrity and ethical responsibilities.
 - B. Demonstrate an understanding of professional responsibility issues as they relate to public interest, health, and safety.

Educational Objectives for Information Technology

1. To provide our graduates with a broad-based education that will form the basis for personal growth and life-long learning.
2. To provide our graduates with a quality technical education that will equip them for productive careers in the field of Information Technology.
3. To provide our graduates with the communication skills and social and ethical awareness requisite for the effective and responsible practice of their professions.

Accreditation for Computer Science

The School of Computing and Information Sciences offers curricula leading to the degree of Bachelor of Arts and Bachelor of Science in Computer Science, Bachelor of

Arts and Bachelor of Science in Information Technology. The Bachelor of Science in Computer Science is accredited by the Computing Accreditation Commission, ABET, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, Telephone: (410) 347-7700.

Accreditation for Engineering

The Engineering Accreditation Commission of ABET, Inc., accredits engineering programs on a nationwide basis. Students wishing more information about accreditation should consult their respective departmental office or the Office of the Dean. The following baccalaureate engineering programs in the college are currently accredited by the Engineering Accreditation Commission of ABET, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, Telephone: (410) 347-7700: Biomedical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Environmental Engineering, Mechanical Engineering. The College has started new online delivery paths for Computer Engineering and Electrical Engineering degrees. ABET has confirmed that although these programs are not among those listed as 100% online accredited programs at <https://www.abet.org/accreditation/find-programs/>, the accreditation for those programs is covered by the existing accreditation for Computer Engineering and Electrical Engineering. The 100% online pathways will be formally reviewed as part of reaccreditation during our next general review.

Accreditation for Construction Management

The American Council for Construction Education (ACCE) accredits construction management programs on a nationwide basis. The baccalaureate construction management program in the College is accredited by the ACCE.

The subjects basic to all fields of engineering are generally studied while the student is in the first two years of undergraduate study in a pre-engineering curriculum. Specialized or departmental courses are taken in the third or fourth years with additional interspersed mathematics and humanistic-social studies. To earn a bachelor's degree in engineering, a student must complete the approved curriculum requirements, and must have a cumulative GPA of at least 2.0 on all engineering courses taken at the University.

The engineering programs include a strong engineering core foundation designed to prepare the prospective engineer not only with a broad base of fundamental courses in mathematics, sciences and technical knowledge, but also with a solid cultural background in humanities, social sciences and English. In addition to the core subjects, the student must complete an engineering discipline specialization under the direction of the respective academic department.

Admission Preparation

Prospective students who are considering engineering should follow an academic program to meet engineering prerequisites. The student planning to transfer to the engineering program as a junior should follow a pre-engineering program in the first two years of college work. Many courses required by the engineering curriculum are specialized in their content and students need to select lower division courses with care. The normal maximum

number of credits transferred from a community college is 60 semester credits.

Freshman admission to the University is determined by the University and College admission standards. The freshmen should have had high school preparation of considerable depth and breadth. Specifically, students interested in engineering should have preparation in mathematics (algebra, geometry, trigonometry, analytical geometry, or pre-calculus) and chemistry. Physics and introduction to computers are recommended, but not required. Admitted freshmen students planning to major in an engineering program should contact an advisor in their respective discipline as early as possible.

Engineering and Computer Science Admission Policy

The student must be able to place in MAC 2281/2311 (Calculus I) or higher, in order to declare major in biomedical engineering, civil engineering, computer engineering, computer science (Bachelor's of Science), electrical engineering, environmental engineering, interdisciplinary engineering, or mechanical engineering. Students who desire to pursue these majors but are not able to place in MAC 2281/2311 (Calculus I) are conditionally admitted to the College but must meet the admission requirements for the major for which admission is being sought. If effective progress is not made by the student towards meeting the admission requirements the student may be redirected to another major that better fits to the student's skills, abilities and interests.

In order to enroll into upper division Engineering and Computer Science courses, a student must earn a grade of "C" or higher in all Calculus courses, Differential Equations, Physics I with Calculus, Physics II with Calculus, and Chemistry I.

The admission policy for freshmen and transfer students are different and the policies may vary in each department. (Refer to the Admission Policy in the department of your choice.)

FIU Freshmen

Freshmen applicants who have satisfied general University requirements for admission are accepted based on a pathway designed to fit their academic history and goals. Admission decisions are made on a space-available basis – if one pathway fills up the student may be accepted through the next. Detailed information regarding admission pathways for FIU admission can be found at <https://admissions.fiu.edu/admission-standards/freshman-pathways/index.html>.

Students admitted to the University through the Four Year Fall or Early Fall Pathways who have placed in Calculus I (MAC 2311 / MAC 2281) or higher according to FIU's math placement system will be able to declare major in biomedical engineering, civil engineering, computer engineering, computer science (Bachelor's of Science), electrical engineering, environmental engineering, interdisciplinary engineering, or mechanical engineering. Students admitted through other pathways or who have not placed in Calculus I according to the math placement system will be able to declare major once they have met the admission requirements for the specific program. Requirements vary from program to program and are not limited to Calculus I placement.

Transfer Students

All transfer students must meet the general University requirement for admission. The student must be able to place in MAC 2311 (Calculus I) or higher in order to declare major in biomedical engineering, civil engineering, computer engineering, computer science (Bachelor's of Science), electrical engineering, environmental engineering, interdisciplinary engineering or mechanical engineering. Students must have a grade of "C" or higher in all Calculus courses, Differential Equations, Physics I with Calculus, Physics II with Calculus, and Chemistry I. Requirements vary from program to program.

There is a two-step process in the evaluation of transfer credits.

- a. The Office of Admissions will make a preliminary evaluation of the student's background for general compliance and determination of applicable Core Curriculum courses taken.
- b. The specific department will determine the exact transfer of applicable credit. The departmental evaluation is the final word in this matter.

FIU adheres to the Florida Department of Education Articulation Agreement between the Universities and Community Colleges of the State of Florida. Therefore, transfer of credit from Florida Community Colleges is facilitated.

Preference is given to Associate of Arts degree holders from Florida Community Colleges. For holders of other degrees, it is suggested that application is made about three months prior to the beginning of the term.

For specific course requirements, see the departmental sections, shown later in the catalog.

College of Engineering and Computing Dismissal Policy

A student who has been dismissed from the University for the first time may see his/her advisor to begin the appeal procedure. The advisor 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. 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. If the chairperson determines that the student is worthy of reinstatement, he or she will prepare and sign a memo for the Dean's consideration stating the conditions for the student to be reinstated (the student will be readmitted on academic, probation). If the student does not meet these conditions, he or she will be dismissed a second and final time from the program.

Any student who is dismissed a second time from FIU will not be readmitted under any circumstances. Institutional policy is that students may appeal to the Dean's Office, but only a first dismissal appeal is considered in the College of Engineering and Computing; a second dismissal appeal will not be accepted.

The College of Engineering and Computing will uphold the following institutional policies:

Academic Salvage

A student who is dismissed and subsequently receives an AA degree from another Florida public institution of higher learning can appeal to the department and may be readmitted to the program. The student's GPA will be recalculated.

Academic Amnesty

After 6 years of NOT taking courses at any College or University, an FIU undergraduate may reapply to the program. If readmitted, a student's FIU GPA will be set at 0.0. However, credit for previous University courses in which the student received a minimum grade of "C" may be applied toward the degree, (not the GPA), subject to determination by the department through which the student is attempting to earn the degree.

For more information or to find out if you are eligible, see your advisor.

Transfer of Courses to Engineering Programs

Courses from ABET-accredited universities will be transferred under the discretion of the engineering department. Course equivalencies will be determined solely by the department advisor, associate chairperson, or chairperson. Any other faculty member in the Department, College, or University cannot officially grant transfer credits under any circumstances.

Courses from non-ABET accredited programs (including foreign institutions) will only be accepted as long as all of the following requirements are met:

- a. The College/University is recognized and accredited by the appropriate governing bodies (to be determined by our office of admissions)
- b. For courses that are not offered directly from the student's Engineering department at FIU, a memo must be obtained by the student from the appropriate FIU department stating that the course is equivalent to the required course at FIU.
- c. Any engineering course considered for transfer must be a 100% engineering science course at FIU. **If the course is partially or completely designated as an engineering design course at FIU, it cannot be transferred.** All transferred engineering courses must have the consent of the chairperson or associate chairperson of the student's department.
- d. The student must earn the equivalent grade to what is required in the courses here at FIU (i.e., if a department requires a "C" in Physics, then the student must have a grade equivalent to a "C" at their university of origin).
- e. **Technology credits and life experience credits will not be accepted as engineering credits under any circumstances.**

Student Success Services

The office of Student Success Services is responsible for the coordination of academic advising and student services activities at the University. This area is also responsible for keeping students informed of educational opportunities such as scholarships, tuition waivers, internships, Co-op studies and campus resources.

A student who has been accepted to a degree program in the College must obtain and consult an advisor prior to

the first class enrollment. An advisor may be seen by contacting the Department in which an academic major is desired. Continued contact (at least once per semester) with the advisor is required to review progress and select courses for each succeeding semester. Such contact is required until an approved program of study is completed.

In addition to the university wide scholarships the College of Engineering and Computing offers scholarships as listed below: Most are restricted to students who are United States citizens or permanent residents.

Apply for scholarships on the website fiu.academicworks.com/.

Adalio Sanchez Scholarship – All Engineering and Computing Majors: Up to \$2,000 per academic year / unmet need U.S. Citizens. Minimum 3.0 GPA.

Balfour Beatty Construction Scholarship – Construction Management Junior or Senior: Up to \$2,000 per academic year. U.S. Citizens or Permanent Residents. Resident of Miami Dade, Broward or Palm Beach Counties. Minimum 3.0 GPA.

Biomedical Engineering Excellence Scholarship – Biomedical Engineer – Merit-based scholarship is now available for FIU Undergraduates as well as transfer students with at least 60 credit hours. There are several \$5,000 scholarships for an allocation of \$1,250 over a period of four semesters. 3.0 GPA is required for eligibility and retaining of the award, while student's SAT score and a written statement will also be considered for the award. Before receiving the scholarship, students must declare Biomedical Engineering as their major. For more information, please call (305) 348-6950

Bruce A. Freiburger Scholarship – Electrical or Computer Engineering Major: Up to \$1,000 per academic year. U.S. Citizens or Permanent Residents. Minimum 3.0 GPA

Leonard Kauffman Endowed Scholarship: Graduate Engineering Management student. This is a one time award of \$500. There are two awards per academic year.

HNTB Scholarship in Civil Engineering – Civil Engineering Under-Represented Minority: Full-time Undergraduate or Graduate Civil Engineering students. Award: \$500 per academic year. U.S. Citizen or permanent resident of Miami Dade, Broward or Palm Beach Counties.

Sergio Martinez Endowed Scholarship: Graduate Engineering Management student. This is a one time award of \$500. There is one award per academic year.

Randall L. Nida Memorial/Cordis Corporation Scholarship – Undergraduate Engineering student, U.S. Citizen, Award: \$1,000 per academic year.

Chevron First Generation Scholarships – All Engineering and Computing Majors: Up to \$4,000 per academic year. Recipients must be the first generation in their family to attain a college degree (students whose siblings have attained or are pursuing a degree are also eligible). Recipients must demonstrate financial need by completing the national Free Application for Federal Student Aid (FAFSA) and be eligible for a Pell Grant. Resident of State of Florida. Visit cec.fiu.edu for other eligibility requirements. Minimum 3.3 GPA.

Condote-American/MDX: Requirements are a CM major, financial need, leadership, etc. Applications available at CM Department. Applications normally due by mid-April, award of scholarship for next academic year made in July. Amount of scholarship is currently \$2,000 for one academic year, and not automatically renewable.

Construction Association of South Florida Scholarship: Scholarships are awarded annually to students enrolled in construction schools throughout the country who are considering pursuing their careers in South Florida. Selections are conducted by the Scholarship committee on behalf of the membership and board of directors.

Consul-Tech/CSA Group Scholarship – Under-Represented Minority Civil Engineering Major: Up to \$1,000 per academic year. U.S. Citizens or Permanent Residents. Minimum 3.0 GPA.

Cordis Corporation- Randall Nida Memorial Scholarship – All Engineering Majors: Up to \$1,000 per academic year. Undergraduate. Minimum 3.0 GPA.

FACERS Skillman Civil Engineering Scholarship – Construction Management of Civil Engineering Junior or Senior: Up to \$1,000 per academic year. Resident of State of Florida. Minimum 3.0 GPA.

Florida-IT-Pathways to Success/FLIT-PATH – Computer Science, Computer Engineering and IT Majors: U.S. citizen. Visit cec.fiu.edu for eligibility requirements. Must file FAFSA and show financial need.

Keith and Schnars Civil Engineering Scholarship – Civil Engineering undergraduate: Up to \$1,000 per academic year. U.S. citizen or resident of Miami Dade, Broward or Palm Beach Counties. Minimum 2.5 GPA.

Kelly Foundation Construction and Engineering Scholarship – Construction Management of Civil Engineering Undergraduates: Up to \$2,000 per academic year. U.S. Citizens or Permanent Residents, or international students from the Caribbean Basin or South America. Minimum 2.5 GPA.

Mickey Dane/Walter Dane Memorial Scholarship – All Engineering and Computing Majors: Full-time undergraduate student. Up to \$2,000 per academic year. Minimum 3.2 GPA.

NACME – All Engineering and Computing Majors: Up to \$2,000 per academic year. Must be of African American, American Indian or Hispanic American descent. U.S. citizen or permanent resident. Visit cec.fiu.edu for eligibility requirements. Must file FAFSA and show financial need.

School of Construction - Construction Management Scholarship – Construction Management Junior or Senior: Up to \$1,000 per academic year. U.S. Citizens or Permanent Residents. Minimum 3.0 GPA.

Southern Gear Scholarship – Mechanical: Up to \$1,000 per academic year / unmet need U.S. Citizens or Permanent Residents. Resident of Miami Dade County All levels. Minimum 3.0 GPA. Scholarship applications are

available at the College of Engineering and Computing website (www.eng.fiu.edu).

Walter K. Brown Scholarship – Computer Science

Majors: Up to \$2,000 per academic year. Upper division. Minimum 3.0 GPA.

Please note that in most cases, neither the college nor the department administer the scholarship funds listed below nor do they select the recipients. Additionally, we need the contact info for these scholarship opportunities/applications.

Associated General Contractors of America Scholarship: Requirements are for a full time student. Applications are available online or from the Department. Applications are available in July and must normally be submitted by November 01. Award amounts are \$2,000 annually for undergraduate students, renewable up to \$8,000 total, and \$7,500 annually for graduate students. Graduate student scholarship is not renewable.

ASHRAE Scholarships – Mechanical Engineering: Scholarships are available to undergraduate engineering, engineering technology and graduate students enrolled full-time in a curriculum approved by the Accreditation Board for Engineering and Technology (ABET) or other accrediting agency recognized by ASHRAE.

SAE Scholarships – Mechanical Engineering: Money is available for both undergraduate and graduate engineering students through generous contributions from various corporations and universities. These scholarships are funded through the SAE Foundation.

ASME Scholarship – Mechanical Engineering: Through the efforts of the ASME Board of Governors, ASME Foundation, the ASME Auxiliary, ASME Councils on Education, Engineering and Member Affairs, over \$500,000 is awarded annually in low-interest student loans, scholarships and fellowships.

Astronaut Scholarship – Mechanical Engineering: Scholarship candidates must be nominated by faculty or staff, and they must be a junior, senior, or graduate student at one of a select group of schools. Students may not apply directly for the scholarship.

FGLSAMP – Florida Georgia Louis Stokes Alliance for Minority Participation (Legislature): Undergraduate, full time students in the areas of Physics, Biology, Computer Science, Mathematics, Chemistry, Engineering, minimum GPA 2.75, must be a U.S. citizen or resident.

Hispanic College Fund, Inc. – Must be a U.S. citizen of Hispanic background residing in the fifty states or Puerto Rico. Must be pursuing a bachelor's degree in business, computer science, engineering or business-related major.

Non-Residents and International Undergraduate Students – For more detailed information on these scholarships, applicants should contact the Office of Admissions, PC 140 Modesto A. Maidique Campus, (305) 348-4100.

FMI – Florida Mexico Institute – Out of state tuition waivers – Students Who Are Eligible: Students who have been admitted or who meet admission requirements to any university or community college of the public education system of the state of Florida. Preference will be given to graduate students. Mexican citizens studying in Florida with student visas. Students who make a commitment to return to Mexico after the completion of their studies for a length of time equal to their exemption period, as required by the scholarship program.

Academic Requirements: GPA (3.0) and SAT, ACT, CLAS, GRE, GMAT and/or TOEFL scores appropriate for admission to Florida community colleges and universities. Proof of test scores must accompany applications. Evidence of good academic standing for all previous and current levels of study, as well as a sufficiently good record to be admitted to intended educational program of study. Since this is a merit scholarship program, the level of academic achievement is important.

FCI – Florida Caribbean Institute – Out of state tuition waivers: The Florida Caribbean Institute (FCI) is a state-funded program co-directed by Florida International University and Daytona Beach Community College. Its purpose is to expand cultural, educational and commercial ties between the state of Florida and the countries of the Caribbean Basin. FCI offers out-of-state tuition waivers for qualified Caribbean students to attend any of Florida's public universities or community colleges. It also pursues exchange programs and sister university relationships between members of the Florida State University System and counterparts in the Caribbean, including the University of the West Indies (Jamaica and Trinidad campuses) and institutions in the Dominican Republic. In addition, and FCI scholarship program makes it possible for Florida school teachers to attend FIU's Haitian Summer Institute.

Non-Florida Residence Scholarship Award

Dean's Merit Scholarship – For residents and nonresidents. Must be a full-time student in junior standing with a minimum GPA of 3.5. All engineering disciplines welcomed.

Student Organizations and Clubs

Student organizations and clubs enrich the campus in so many ways. They provide an outlet for learning outside the classroom, for meeting other people, for sharing interests, for broadening one's horizons, for developing life, work & leadership skills, for gaining experience, and for engaging students as citizens of the campus community. At FIU College Engineering and Computing, we follow the philosophy that education is not something to be confined to the classroom. Students grow intellectually and socially by engaging in a broad range of activities. One of the best ways to start this exploration is by participating in student organizations. Our campus has deep traditions of active involvement and student leadership, and student organizations play a significant role in helping to nourish those traditions. By participating in these groups, students not only enrich their own experiences, but those of their peers, and that is the ideal of shared learning. Listed are some of our currently active student organizations and clubs.

AAEES- American Academy of Environmental Engineers & Scientists, Miami Student Chapter

ACM- Association for Computing Machinery

ACE – Association of Cuban-American Engineers

AGC – Associated General Contractors of America

AHMB – Alpha Eta Mu Beta Biomedical Engineering Honor Society

AER- Aerospace and Aviation Engineering Club

ANS – American Nuclear Society

ASCE – American Society of Civil Engineers

ASHRAE – American Society of Heating, Refrigeration & A/C Engineers

ASM/TMS/American Ceramic Society – American

Society of Metals, Minerals Metal and Materials (Materials Advantage)

ASME – American Society of Mechanical Engineers

BMES – Biomedical Engineering Society

ECE-GSA- Electrical & Computer Engineering, Graduate Student Association

EWB – Engineers Without Borders

FES – Florida Engineering Society

FWEA – Florida Water Environment Association

HKN – ETA KAPPA NU – Electrical Engineering Honor Society

IAARC- Int'l Associate for Automation and Robotics in Construction

IEEE – Institute of Electrical and Electronics Engineers

ITE – Institute of Transportation Engineers

NSBE – National Society of Black Engineers

PAST – Panther Astronautics and Space Technologies

SAE – Society of Automotive Engineers

SLX – SIGMA LAMBDA CHI – International Construction Honor Society

SHPE – Society of Hispanic Professional Engineers

SWE – Society of Women Engineers

TBPI – TAU BETA PI – National Engineering Honor Society

THETA TAU OMEGA- Co-ed Professional Engineering Fraternity

UPE- Upsilon Pi Epsilon, Computer Science Honors Society

WiCS- Women in Computer Science

All of these student organizations and clubs have a link on our CEC website,

<https://cec.fiu.edu/academics/student-resources/cd-ssec-home/student-organizations>

Women of CEC

Women of CEC is an initiative launched by the college to increase the number of women pursuing STEM careers, particularly in engineering. Additionally, the effort hopes to improve the overall graduation and retention rates of the college's existing female students. Although women fill nearly half of all jobs in the U.S. economy, they hold less than 25 percent of STEM jobs. The Women of CEC is an annual college-wide initiative that spans the entire academic year. The program encompasses pre-college programs that strengthen the pipeline for STEM-interested female students in grades K-12; community building within the College of Engineering and Computing; corporate-sponsored workshops and panel discussions; mentorship training for students, faculty, and staff; student organization support; and research opportunities for female students—all of which promote the recruitment, retention, and graduation of more female students in STEM. The program also features, Breaking Barriers: A monthly online feature highlighting women engineers, computer scientists, and construction professionals paving the way for women in the field.

International Students

Florida International University (FIU) is a multicultural environment where differences in culture are not only welcome but required. This allows all FIU students to be more culturally knowledgeable and prepared for global challenges in the work place. The International Student and Scholar Services provide information and services to

international students. It also provides helpful tips on registration, the cashiers office and even travel. Please visit our website at www.fiu.edu for more information.

General Requirements for a Baccalaureate Degree

In order to obtain a Bachelor's degree from the College, each student must satisfy the following minimum requirements:

1. Obtain the minimum number of semester credits required by the specific program. Specific requirements are described in the sections devoted to the various departments in the College.
2. Complete at least 35 semester credits in the upper-division at FIU.
3. Attain a minimum grade point average of 2.0 in all courses taken at the University.
4. Satisfy the core curriculum requirements of the State of Florida for the Bachelor's degree.
5. Satisfy the particular requirements for his or her own major and all University requirements for graduation.

Scientific Laboratory Fee

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 academic departments or University Financial Services.

Prerequisites

Students must have met the prerequisites and co-requisites to register for any course. Otherwise, the student will be dropped from the course before the end of the term, resulting in a grade of 'DR' or 'DF'. Students should refer to the Catalog or see an advisor to determine course prerequisites.

Course Repeats

This varies depending upon the particular program. For more information consult your advisor.

Policies, Requirements, and Regulations

The University, the 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, Graduate School, and College's graduate procedures. These procedures are described in the University's Student Handbook.

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 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.

Department-Specific Information

Please refer to your selected department in this catalog for additional information, or call the department:

Biomedical Engineering	(305) 348-6950
Civil and Environmental Engineering	(305) 348-2824
Moss School of Construction, Infrastructure and Sustainability	(305) 348-3172
Electrical and Computer Engineering	(305) 348-2807
Mechanical and Materials Engineering	(305) 348-2569
School of Computing and Information Sciences	(305) 348-2744
SUCCEED – School of Universal Computing Construction, and Engineering Education	(305) 348-9995

Important Contact Information

Web site: <http://www.cec.fiu.edu>

Admissions	(305) 348-2363
College of Engineering and Computing – Undergraduate Admissions	(305) 348-1635
Campus Resources	(305) 348-6929
Career Services	(305) 348-1281
Financial Aid	(305) 348-7000
Graduate School	(305) 348-2455
International Student Services	(305) 348-2942
Registrar's Office	(305) 348-2320
Scholarships	(305) 348-6929
Tuition Waivers	(305) 348-7000

Course Descriptions

Definition of Prefixes

EGN - Engineering General; EGS-Engineering Support; EIN - Engineering; Industrial; ESI - Engineering Systems Industrial; IDS-Interdisciplinary Studies.

F-Fall semester offering; S-Spring semester offering; SS-Summer semester offering.

Courses that meet the University's Global Learning requirement are identified as GL.

EGN 3124 Computer Assisted Drawing and Design (3). Application of computer assisted design technology to product design, feasibility study and production drawing. (F,SS)

EGN 3910 Socio-technical Systems Design (3). A collaborative, projects-based introduction to interdisciplinary design using systems thinking and human-centered design principles.

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.

EGS 3913 Research Methods in Engineering and Computing (3). Student will learn the foundations of research across disciplines, including developing a research question and hypothesis or objective, experimental design, and responsible conduct of research

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.

EIN 1396C Basic Industrial Shop and Manufacturing Practices (3). Fundamentals of basic capabilities and requirements for a modern shop or industrial manufacturing facilities. Rudiments of safety requirements, wood technology, metal technology and plastic technology.

EIN 2100 Introduction to Industrial and Systems Engineering (1). A historic review of ISE origins, definition of role, functions and contributions of the IE in industry. Professional development opportunities. Practice communication skills. Seminars.

EIN 3331 Quality Control (3). Modern concepts for managing the quality function of industry to maximize customer satisfaction at minimum quality cost. The economics of quality, process control, organization, quality improvement, and vendor quality. Prerequisite: EIN 3235. (S,SS)

EIN 3365 Facilities Planning and Materials Handling (3). Application of methods and work measurement principles to the design of work stations. Integration of work stations with storage and material handling systems to optimize productivity. Prerequisites: EGN 3124 and ESI 3321. (F)

EIN 3600 Industrial Automation (2). Basic concepts of industrial automation and robotics. Performance characteristics, criteria for use, planning, selection, and implementation of computer automated equipment. Open to non-majors. Prerequisite: ESI 3161. Corequisite: EIN 3600L. (F)

EIN 3600L Industrial Automation Lab (1). Experiments in the use of CNC machines and robots demonstrating performance characteristics of CNC equipment and robotic arms. Corequisite: EIN 3600. (Lab fees assessed). (F)

EIN 3949 Industrial Engineering Co-Op (1-3). Entry level work experience as an Industrial Engineering intern. Jointly supervised by IE and industry personnel. Written report required. Student must obtain approval from IE faculty and sign up for course before starting work. Prerequisite: Approval of advisor. (F,S,SS)

EIN 4102 Collective Bargaining in Industrial Systems (3). A comprehensive study of collective bargaining with emphasis upon the private sector. Included will be negotiations and scope of contracts, day-to-day contract administration, and major bargaining issues. Prerequisite: Senior Standing (SS)

EIN 4103 Fundamentals of Engineering Regulation (3). A survey of the legal and regulatory requirements encountered by engineers. Included will be patents, antitrust, safety environmental, compliance, labor laws, product liability and global issues. Prerequisite: Senior standing.

EIN 4104 Introduction to 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. Prerequisite: Permission of advisor.

EIN 4116 Industrial Information Systems (3). The integration of information flows and data bases with the production planning and control systems into productive and manageable systems. Prerequisite: Programming language. (S)

EIN 4122 Industrial Marketing (3). The performance of business activity that directs the flow of goods and services from producer to industrial user. Covers new product development, marketing research, sales engineering, pricing, distribution, and promotion. (F)

EIN 4214 Safety in Engineering (3). Introduces occupational safety and health hazards associated with mechanical systems, materials handling, electrical systems, and chemical processes. Illustrates controls through engineering revision, safeguarding, and personal protective equipment. Emphasis placed on recognition, evaluation and control of occupational safety and health hazards. Prerequisites: EIN 4314 or permission of the instructor. (S)

EIN 4220 Introduction to Total Quality Management (3). Fundamentals of TQM and its historical development. Integration of QC and management tools, QFD, Benchmarking for scientific management. Prerequisite: Permission of advisor.

EIN 4243 Human Factors Engineering (2). Examination of the ways to fit jobs and objects better to the nature and capacity of the human being. Lectures will review man's performance capability, singly and in groups, in interacting with his work environment. Stresses the practical application of human factors principles. Prerequisite: EIN 4314. Corequisite: EIN 4243L. (F)

EIN 4243L Human Factors in Engineering and Design Laboratory (1). Experiments are conducted which measure human factors indicators and differences by age, sex, and race, as well as physiological and anatomical differences. Corequisite: EIN 4243. (Lab fees assessed). (F)

EIN 4314 Work Design and Industrial Ergonomics (2). The analysis, design, and maintenance of work methods. Study of time standards, including Pre-Determined time standards and statistical work sampling. Prerequisites: EGN 3124, EIN 3235 or equivalent. Corequisite: EIN 4314L. (S)

EIN 4314L Work Design and Industrial Ergonomics Laboratory (1). Experiments in the different Work Design techniques including Performance Sampling, Time Studies, Pre-Determined Time Systems and Workplace Design. Corequisite: EIN 4314. (Lab fees assessed). (S)

EIN 4326 Industrial Research and Development (3). Research and development for new product strategies, technological assessment, patent and product liability, and sales engineering. An independent study product will be required by each student. Prerequisite: Senior status.

EIN 4328 Introduction to Engineering Entrepreneurship (3). Fundamentals of engineering entrepreneurship; entrepreneurial process, identification of opportunities, starting and managing the venture, and development of business plans.

EIN 4333 Productivity Planning (3). The improvement of productivity as a functional activity of the enterprise. Productivity definitions, measurement, methodologies, and reporting systems. Prerequisites: EIN 4314, ESI 3161, and statistics.

EIN 4334 Production Planning and Control (3). Production systems, demand forecasting, capacity planning, master production planning, material requirements planning, shop floor control, and assembly line balancing. Prerequisites: EGN 3613 and ESI 3321. (S)

EIN 4387 Technology Assessment (3). Development of systematic efforts to anticipate impacts on society that may occur when a technology is introduced, extended, or modified. Prerequisites: Senior standing in Engineering, ESI 3161 and Statistics.

EIN 4389 Technological Forecasting (3). Emphasis on forecasting future trends and specific developments in the area of capabilities and needs. Prerequisites: Senior standing in Engineering and EIN 4334.

EIN 4391 Concurrent Engineering (3). Overview of product and process design. Principles of design for manufacturing. Manufacturability evaluation methods. Computer aided design for manufacturing techniques and strategies. Prerequisites: EIN 3600 and EIN 3390.

EIN 4395 Computer Integrated Manufacturing (3). The integration of computer aided design and computer aided manufacturing. Development of a common data base for design and manufacturing. Developments of flexible manufacturing systems. Prerequisites: EIN 3600 and ESI 3523.

EIN 4440 Introduction to Technology Entrepreneurship (3). An introduction to theories, concepts, and practices of entrepreneurship. Students will produce feasibility analyses, learn to develop and analyze new ventures, and be introduced to business plans.

EIN 4451 Lean Production Systems (3). Design and analysis of lean manufacturing systems, small lot production, setup-time reduction, continuous improvement, six-sigma, push and pull manufacturing, production planning and scheduling. Prerequisites: ESI 3321, EIN 3235.

EIN 4933 Special Topics in Industrial Engineering (2-3). Permits in-depth study in areas relating to specific student interests, recent advances, and problems in industrial technology or systems. Prerequisites: Senior standing, consent of faculty advisor and approval of department chairman.

EIN 4941 Undergraduate Industrial and Systems Engineering Internship (1). To provide undergraduate students with work experience under approved industrial supervision. Prerequisite: Department chairperson's approval.

EIN 4949 Co-op Work Experience (1-3). Practical Co-op work experience under approved industrial supervision. Written report required at the conclusion of the work assignment. Prerequisite: Permission of department chairperson.

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

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: Consent of 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 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.

ESI 1622 Introduction to Engineering Software Applications (3). Hands-on experience with software packages such as Autocad, MS Word, Excel, PowerPoint, Access, Windows XP, and industrial applications of the Internet. Prerequisite: High school students in dual enrollment programs.

ESI 3161 Software Tools for ISE (3). Basic concepts of microprocessors; an overview of computer architecture, local area networks, micromainframe linking, and operating systems as they apply to industrial systems.

ESI 3215 Evaluation of Engineering Data I (3). Analysis of industrial data and subsequent characterization of industrial processes. Prerequisite: MAC 2312. (F,S,SS)

ESI 3321 Operations Research I: Deterministic Models (3). Modeling principles with emphasis on linear programming and extensions. The simplex procedure and its application through computer software packages. The analysis and interpretation of results in decision making. Prerequisites: MAC 2312, permission of the instructor. (F)

ESI 3523 Simulation Models of Industrial Systems (2). Simulation methodology, design of simulation experiments, implementation of simulation effort through computer software. Application to the solution of industrial and service system problems. Prerequisites: COP 2270 or equivalent, ESI 3161, ESI 3321 and EIN 3235 or equivalent. Corequisite: ESI 3523L. (S)

ESI 3523L Simulation Models of Industrial System Laboratory (1). Simulation Modeling on a microcomputer. Analyze and validate design models using both a general purpose programming language and a special-purpose simulation language. Corequisite: ESI 3523. (S)

ESI 4244 Evaluation of Engineering Data II (3). Application of statistical analysis in engineering practice, design of engineering experiments, and decision making. Study of prediction, tolerance intervals. Use of computer tools. Prerequisites: EIN 3235 or equivalent.

ESI 4322 Operations Research II: Stochastic Models (3). Modeling principles with emphasis on applications of Markov Chains, queuing models, systems reliability, Bayesian decision analysis. Prerequisites: ESI 3321, EIN 3235 or equivalent. (S)

ESI 4452 Project Management Systems Design (3). Project planning, scheduling and control using activity network logic. System development techniques and strategies. Prerequisite: Permission of the instructor. (F)

ESI 4554 ISE Systems Design (3). To integrate all prior ISE required courses into a cohesive and consistent professional philosophy. Prerequisite: Permission of instructor. (S)

ESI 4556 Industrial and Systems Engineering in the Office (3). Paperwork reduction, overhead and expense cost containment, and white collar productivity through office automation and systems analysis.

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. Prerequisites: 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 IDEFLx 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.

Research, Development and Training Centers

Advanced Materials Engineering Research Institute (AMERI)

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

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

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

The Institute consists of the **Motorola Nanofabrication Facility** which is supported by a class 100 clean room and nanofabrication capabilities including e-beam lithography and optical photolithography. Fabrication of nano/micro electromechanical systems (N/MEMS) 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, *Distinguished Professor, Chairperson and Director, Mechanical and Materials Engineering*

Chunlei (Peggy) Wang, *Professor and Dissertation Advisor Mechanical and Materials Engineering*

Benjamin Boesl, *Associate Professor, Assistant Director, Graduate Faculty and Dissertation Advisor, Mechanical and Materials Engineering*

Zhe Cheng, *Dissertation Advisor and Graduate Faculty, Mechanical and Materials Engineering*

Jiuhua Chen, *Dissertation Advisor and Graduate Faculty, Mechanical and Materials Engineering*

Alexander Franco, *Research Faculty and Electron Microscopy Specialist*

Jin He, *Associate Professor, Physics*

W. Kinzy Jones, *Professor Emeritus, Mechanical and Materials Engineering*

Chenzhong Li, *Professor and Dissertation Advisor, Biomedical Engineering*

Wenzhi Li, *Professor, Physics*

Norman Munroe, *Professor and Dissertation Advisor, Mechanical and Materials Engineering*

Daniela Radu, Associate Professor, Director NASA-CRE2DO, *Dissertation Advisor and Graduate Faculty, Mechanical and Materials Engineering*
P.M. Raj, Associate Professor, *Dissertation Advisor and Graduate Faculty, Biomedical Engineering*
Surendra Saxena, *Professor Emeritus, Mechanical and Materials Engineering*
Shekhar Bhansali, *Professor and Chairperson, Electrical and Computer Engineering*
Sakhrat Khizroev, *Courtesy Professor, Electrical and Computer Engineering and College of Medicine*
Nezih Pala, *Associate Professor, Dissertation Advisor and Graduate Faculty Electrical and Computer Engineering*
Yuriy Vlasov, *Instructor*
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, ARC 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 (DOE) 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: ARC is researching ways to improve technologies to use less electrical energy and natural resources in production and in operations while reducing waste and pollution. 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. ARC 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 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; web-based 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. FIU developed a radiochemistry Ph.D. track which launched in Aug. 2015 and a health physics specialty under the B.S. 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 (DOE EM). 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 & Data Science

ARC 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. ARC shares 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 research laboratories. 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 the Department of Defense (DOD) – Test Resource Management Center (TRMC) and the 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 the Cyber Fellows (Cyberspace Work Force Development) program. ARC also participates as an active member of the core team of *Cybersecurity@FIU*, which has been designated by FIU as an emerging preeminent program with high potential to demonstrate extraordinary success in providing unique learning opportunities, pioneering research and engagement while expanding FIU's financial base.

Enterprise Solutions: ARC has extensive experience in building custom enterprise systems in the areas of waste management, knowledge management, database management, content management and mobile systems, using the latest technologies for various clients like DOE-EM and DOD-TRMC.

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, engineers have focused research efforts on understanding how composite structures can be joined using adhesive bonding. In particular, ARC is 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 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 the 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 142 FIU underrepresented students have joined the program. The students are officially inducted into the program and vested with the name of DOE Fellows in a special induction ceremony celebrated during the fall semester. DOE Fellows also have internship opportunities at DOE national research laboratories and DOE sites around the country. Since the program's initiation in 2007, DOE Fellows have participated in over 136 research internships at locations such as Oak Ridge National Laboratory, Idaho National Laboratory, Pacific Northwest National Laboratory, and DOE-HQ in Washington DC. In addition, DOE Fellows directly support DOE contractors performing environmental remediation around the DOE Complex. DOE Fellows have presented over 210 technical research posters and oral talks at the Waste Management Symposia and other national/international conferences. Furthermore, this program enables undergraduate students to pursue M.S. and Ph.D. degrees by providing research assistantships.

ARC has also developed a Cyberspace Workforce Development Program as part of our support to the DOD to perform cyberspace technology research. This program trains FIU STEM undergraduate and graduate students with diverse technical backgrounds to develop and integrate new cyberspace systems for DOD test applications. The Cyberspace Workforce Development Program actively recruits top minority and underrepresented students at FIU to perform research, attend summer internships, and apply for job opportunities at DOD.

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 workforce development programs.

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. ARC's 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

Bioinformatics Research Center (BioRG)

Giri Narasimhan, *Director and Professor, School of Computing and Information Sciences*

The mission of this research group is to work on problems from the fields of Bioinformatics and Biotechnology. The group's research projects includes Pattern Discovery in sequences and structures, micro-array data analysis, primer design, probe design, phylogenetic analysis, image processing, image analysis, and more. The group builds on tools and techniques from Algorithms, Data Mining, Computational Statistics, Neural Networks, and Image Processing.

Center for Advanced Distributed Systems Engineering

Xudong He, *Director and Professor, School of Computing and Information Sciences*

Another of our research efforts is the Center for Advanced Distributed System Engineering (CADSE). Its mission is to establish a streamlined research, technology exploration and advanced training program in the field of distributed and Internet-based computing. The Center's R&D cover both theoretical and practical aspects of distributed software engineering, i.e. using engineering methods and technologies to tackle development problems of complex, reliable, and/or real-time distributed systems.

Center for Advanced Technology and Education (CATE)

Malek Adjouadi, *Professor and Dissertation Advisor
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

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,

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 I*

Coordinator, Student Recruitment, Broadening Participation in Computing 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.*

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 Diversity and Student Success in Engineering and Computing (CD-SSEC)

Andres Tremante, *Director and University Instructor, Mechanical & Materials Engineering*

Andrew Green, *Associate Director*

Francisco Fins, *Program Director, ENLACE*

Julieta Vallejos, *Program Coordinator*

Kristian Conculluela, *Program Assistant, ENLACE*

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.

The mission of the Center for Diversity and Student Success in Engineering and Computing (CD-SSEC) is to provide prospective and current students of the college with opportunities and services that will enhance their academic experiences and increase their rate of success in the school and their future careers. The Center will support the college through recruitment, retention and enrichment programs, such as mentorship and peer-to-peer tutoring, undergraduate research opportunities, dual enrollment, internships, and pre-college outreach activities. Currently the Center is actively engaged in a number of special programs as a service to the community and the University:

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.

ENLACE/MIAMI The Children Trust This program is funded by The Children Trust and provide after school and summer programs for 650 children (ages 7-17) residing in the Sweetwater, Doral and West Kendall areas. The after school program will offer literacy support through individualized software-based increasing intervention, social skills development, and health fitness education. The summer program will offer students the unique opportunity to attend classes on a university campus.

Opportunities for Undergraduate Research and Scholarship (OURS) Coordinated and overseen by the

Center for Diversity and Student Success within the College of Engineering and Computing, the Opportunities for Undergraduate Research and Scholarship (OURS) program serves as the umbrella organization for all undergraduate research within the college. OURS' mission is to foster a culture of research excellence within the College of Engineering and Computing that is committed to promoting opportunities for all students, especially those from underrepresented populations and disadvantaged backgrounds. A tiered program model with financial incentives encourages curriculum-related work opportunities and greatly reduces the need for students to find off campus jobs that do not align with their long-term career goals

Engineers on Wheels (EOW) The Engineers on Wheels program is an initiative which brings FIU engineering students to South Florida K-12 schools. EOW provides students with hands-on activities and engineering experiments while exposing them to career opportunities in STEM (science, technology, engineering and math). The program features grade-appropriate, interactive lessons and presentations led by FIU students and overseen by FIU faculty. Subjects include mechanical and materials engineering, computer science and information technology, biomedical engineering, civil and environmental engineering, construction and engineering management, and electrical and computer engineering.

Engineering Expo In its 19th year, the Engineering Expo is the college's premiere community outreach event. In 2019, the college welcomed more than 1,340 K-12 students from Miami-Dade and Broward County schools (elementary, middle, and high schools) to the FIU Engineering Center to engage FIU student organizations, researchers, and staff, and to discover the endless possibilities of pursuing a degree in engineering or computer science. In 2019, 30 labs and 18 student organizations represented each major within the college, and provided K-12 students with tours, demonstrations, and hands-on activities.

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

Jiuhua Chen, *Director and Professor, Mechanical and Materials Engineering*

Zhe Cheng, *Associate Professor, Mechanical and Materials Engineering*

Andriy Durygin, *Research Coordinator*

Vadym Drozd, *Research Assistant Professor*

Chunlei (Peggy) Wang, *Professor, Mechanical and Materials Engineering*

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 (DMIS)

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 External Programs

Mercedes Rueda Schott, *Director*

Kang K. Yen, *Director of International Programs, Business Development and Professor of Electrical and Computer Engineering*

Khokiat Kengskool, *Director of International Programs, Southeast Asia and Professor of Practice, Civil and Environmental Engineering*

The **Division of External Programs (DEP)** develops, promotes and manages academic programs offered under the rubric of international programs, weekend and professional graduate programs, continuing education, and distance learning, all within the **College of Engineering and Computing**.

The director and staff of DEP work with department chairs and faculty members to identify global partners and institutions interested in providing their undergraduate and/or graduate students an opportunity to complete their studies at FIU; manage continuing education courses that are taught by experts in their respective fields; develop, promote and manage weekend graduate programs for working professionals; manage all online courses offered by the different engineering departments which are delivered via streaming video; as well as identify any new markets or opportunities that contribute to the overall credit and non-credit enrollment for the College of Engineering and Computing

International Programs

The international dual-degree program allows undergraduate students from foreign universities to complete approximately 75% of their curriculum at their home institution and the remaining 25% at FIU and receive their undergraduate degree from both institutions.

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.

Graduates from international partner universities interested in pursuing a graduate degree from FIU may apply to the graduate pipeline program. Students complete anywhere between 30 – 36 credit hours (depending on the program) and upon completion of the degree requirements, receive a master's degree from FIU.

The overseas programs focus on the demonstrated educational 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.

Continuing Education Courses

Our continuing education courses are designed to meet the licensing and certification needs of individual professionals in the engineering and construction fields. The programs are delivered on-campus and/or at corporate sites. Currently, the College offers the following courses and programs: "Lean Six Sigma", "Six Sigma Green Belt", "Six Sigma Black Belt", "ISO 9001", "Supply Chain Management", "Florida General Contractor's Exam (GC) Review Course", and "LEED Exam Prep Course".

Weekend Graduate Programs

DEP offers professionals in South Florida the ability to complete their master's degree in the field of Engineering Management in an accelerated, one-year program that is conveniently offered on Saturdays in Broward County. This program is specifically designed for working professionals who aspire to a graduate degree without interrupting their careers. The Professional MS in Engineering Management is available to any qualified student who has a background in business or engineering.

Distance Learning

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 online via streaming video over the Internet.

ODE 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. Currently, select undergraduate and graduate courses are available from the following departments: Civil and Environmental Engineering, Construction Management, Electrical and Computer Engineering, and Computing and Information Sciences.

Engineering Information Center (EIC)

Steven Luis, Executive 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, Director and Professor, Mechanical and Materials Engineering

Mario Sanchez, Senior Engineer and Manager

Richard Zicarelli, Senior Engineer II and 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/>.

Florida Center for Cyber Infrastructure Education and Research for Trust and Assurance

S. S. Iyengar, Director and Ryder Distinguished University Professor, School of Computing and Information Sciences

Cyberspace, the ubiquitous collection of interconnected IP networks and hosts that has proliferated over the last two decades, has become the nervous system of the country. Healthy functioning of Cyberspace is essential for the proper operation of numerous critical infrastructures, such as telecommunication, energy and transportation. It is also necessary to support the ever-expanding business infrastructure, including commerce and banking. The increasing reliance on Cyberspace has been paralleled by a corresponding increase in the variety, frequency and impact of attacks from a range of assailants. Both commercial companies and government agencies face continuous and increasingly more sophisticated cyber-attacks ranging from data exfiltration and spear phishing to sophisticated worms and logic bombs. The targets include not only computer information systems, but also the network communication infrastructure and power grids. Moreover, commercial companies and government agencies are themselves engaging in information gathering whose implications for privacy are disturbing.

Therefore, there is an increasing need of a concerted and cooperative effort on the part of the government and the private sector to address these attacks and threats. Research and education are the main ways to help detect, react, and reduce the impact of cyber threats and attacks. There is a dearth of educational cyber security programs at universities, despite a very strong demand for qualified graduates. Moreover, Miami's status as a gateway for international commerce, tourism, and immigration, especially with Latin America, makes it a particularly appropriate host location for a research and education consortium focusing on cyber infrastructure.

Our goal of this center is two-fold—first, to inspire a new generation of cyber research warriors and cyber savvy intelligence agents to take up the torch, to better understand our need for smart intelligence, and to defend the homeland. Since their work cannot be done alone, our second goal is to advance technology through the concept of subliminal contextual information in the production of subliminal contextual intelligence.

High Performance Database Research Center (HPDRC)

Naphtali Rishe, *Director and Eminent Scholar Chaired 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.

Industry-University Cooperative Research Center (I/UCRC) for Advanced Knowledge Enablement (CAKE)

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

The National Science Foundation's (NSF) FIU-FAU-Dubna Industry/University Cooperative Research Center for Advanced Knowledge Enablement (CAKE) was established to develop long-term partnerships among industry, academe and government. The Center is supported primarily by industry center members, with NSF taking a supporting role in its development, evolution, and core funding. The Center hosts the NSF "AIR" Ecosystem to Pipeline Research at FIU.

The Center's mission is to conduct industry-relevant studies and deployments in the representation, management, storage, analysis, search and social aspects of large and complex data sets, with particular applications in geospatial location-based data, disaster mitigation, healthcare, transportation, and town planning.

International Hurricane Research Center (IHRC)

Richard Olsen, *Director*

Kegi Zhang, *Laboratory for Coastal Research, 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*

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)

Mohammed Hadi, *Director and Professor, Civil and Environmental Engineering*

Albert Gan, *Deputy Director and Professor, Civil and Environmental Engineering*

Fabian Cevallos, *Transit Program Director*

Xia Jin, *Professor, Demand Forecasting and Discrete Choice Analysis*

Priyanka Alluri, *Professor, Traffic Safety*

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, transportation system management and operation (TSM&O), multi-resolution modeling and simulation, connected and automated vehicles, decision support systems, signal control, transportation system safety, shared mobility, electric vehicles, micro-mobility, public transportation, freight; as well as public policy, air pollution, and the application of geographic information systems and other advanced technologies such as machine learning/data mining, statistical analysis, optimization, and scientific visualization in transportation.

Titan America Structures and Construction Testing Laboratory

Atorod Azizinamini, *Director, Vasant Surti Professor of Civil Engineering and Director, Moss School of Construction, Infrastructure and Sustainability*

David Garber, *Deputy Director and Assistant Professor, Civil and Environmental Engineering,*

Armin Mehrabi, *Associate Professor, Civil and Environmental Engineering,*

Francisco Jimenez, *Lab Manager*

The Titan America Structures and Construction Testing Laboratory was established in the Department of Civil and Environmental Engineering 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 Titan America Structures and Construction Testing 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 x 65 ft strong concrete floor with 4 ft thickness and 100,000 lbs capacity tie-downs on a 3 ft x 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

Motorola Nanofabrication Research Facility

Arvind Agarwal, *Distinguished Professor, Chairperson and Director, Mechanical and Materials Engineering*
Patrick Roman, *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

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

George Dulikravich, *Professor, Mechanical and Materials Engineering*

Jin He, *Associate Professor, Physics*

W. Kinzy Jones, *Emeritus Professor, Mechanical and Materials Engineering*

Cheng-Yu Lai, *Associate Professor, Mechanical and Materials Engineering*

Grover Larkins, *Professor, Electrical and Computer Engineering*

Chenzhong Li, *Professor, Biomedical Engineering*

Wenzhi Li, *Professor, Physics*

Anthony McGoron, *Associate Dean and Professor, Biomedical Engineering*

Daniela Radu, *Associate Professor, Director NASA-CRE2DO, Mechanical and Materials Engineering*

P.M. Raj, *Associate Professor, Biomedical Engineering*

Surendra Saxena, *Emeritus Professor, Mechanical and Materials Engineering*

Frank Urban, *Associate Professor, Electrical and Computer Engineering*

Yuriy Vlasov, *Instructor*

Chunlei (Peggy) Wang, *Professor, Mechanical and Materials Engineering*

Shekhar Bhansali, *Professor and Chairperson, Electrical and Computer Engineering*

Nezih Pala, *Associate Professor, Electrical and Computer Engineering*

Telecommunications and Information Technology Institute (IT²)

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 (IT²). IT² promotes advanced multidisciplinary education and research focused on telecommunications and information technologies. IT²'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, IT² 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.

IT² 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 Eminent Scholar Professor*

Deng Pan, *Associate Professor*

Affiliated and Research Faculty

Kang Yen, *Director and Professor, Electrical and Computer Engineering*

Jean Andrian, *Associate Chair and Associate Professor, Electrical and Computer Engineering*

Shih-Ming Lee, *Professor of Practice, Engineering Management Program*

Osama Mohammed, *Associate Dean and Distinguished University Professor, Electrical and Computer Engineering*