

# FLORIDA ATLANTIC UNIVERSITY™

UGPC APPROVAL \_\_\_\_\_  
 UFS APPROVAL \_\_\_\_\_  
 CATALOG \_\_\_\_\_

## Graduate Programs—PROGRAM CHANGE REQUEST

DEPARTMENT: COMPUTER/ELECTRICAL ENGINEERING AND  
 COMPUTER SCIENCE (CEECS)

COLLEGE: ENGINEERING AND COMPUTER SCIENCE

PROGRAM NAME:

**EFFECTIVE DATE**

(PROVIDE TERM/YEAR)

MS AND PHD PROGRAMS IN THE CEECS DEPARTMENT

FALL 2016

PLEASE EXPLAIN THE REQUESTED CHANGE(S) AND OFFER RATIONALE BELOW AND/OR ATTACHED:

TO SATISFY SACS REQUIREMENTS, THE FOLLOWING CHANGES WERE MADE:

- MS PROGRAMS MUST CONTAIN AT LEAST 30 CREDITS OF 5000 AND 6000 LEVEL COURSES
- FOR THE COMBINED BS AND MS PROGRAMS, UP TO 9 CREDITS CAN BE DOUBLE COUNTED AS LONG AS THE FOLLOWING TWO CRITERIA ARE MET: A) MINIMUM 120 CREDITS FOR BS DEGREE, AND B) MINIMUM 30 CREDITS (5000-LEVEL OR HIGHER) FOR MS DEGREE. THEREFORE A MAXIMUM OF 9 CREDITS CAN BE DOUBLE COUNTED IF THE MINIMUM NUMBER OF CREDITS FOR THE COMBINED BS AND MS EXCEED 150 CREDITS.

Faculty contact, email and complete phone number:  
 Frederick Bloetscher, Ph.D., P.E.  
 239-250-2423

Consult and list departments that might be affected by the change and attach comments.  
  
 None

**Approved by:**

Department Chair: \_\_\_\_\_  
 College Curriculum Chair: \_\_\_\_\_  
 College Dean: \_\_\_\_\_  
 UGPC Chair: \_\_\_\_\_  
 Graduate College Dean: \_\_\_\_\_  
 UFS President: \_\_\_\_\_  
 Provost: \_\_\_\_\_

**Date:**

2/23/2016  
 2/25/16  
 2/25/16

Email this form and syllabus to [UGPC@fau.edu](mailto:UGPC@fau.edu) one week before the University Graduate Programs Committee meeting so that materials may be viewed on the UGPC website prior to the meeting.



## COMBINED PROGRAMS

### B.S.C.E. or B.S. to M.S. Degree Programs

The Department offers a combined Bachelor of Science and Master of Science degrees in Computer Engineering and Computer Science. Both the bachelor and the M.S. must be in the same area. Students in either combined program may count up to 9 credits of approved graduate coursework toward both their bachelor's and master's degrees as long as the following two criteria are met: (a) minimum 120 credits for the B.S. degree, and (b) minimum 30 credits (5000-level or higher) for the M.S. degree. Therefore a maximum of 9 credits can be double counted if the number of credits for both BS and MS exceeds 150. With an approximate duration of five years, these combined programs provide attractive ways for students to continue their graduate work.

#### Prerequisite Coursework for Transfer Students

Students transferring to Florida Atlantic University must complete both lower-division requirements (including the requirements of the Intellectual Foundations Program) and requirements for the college and major. Lower-division requirements may be completed through the A.A. degree from any Florida public college, university or community college or through equivalent coursework at another regionally accredited institution. Before transferring and to ensure timely progress toward the baccalaureate degree, students must also complete the prerequisite courses for their major as outlined in the [Transfer Student Manual](#).

All courses not approved by the Florida Statewide Course Numbering System that will be used to satisfy requirements will be evaluated individually on the basis of content and will require a catalog course description and a copy of the syllabus for assessment.

#### Admission Requirements

To be eligible for the joint programs, computer science and computer engineering students should:

1. Have a cumulative GPA of 3.25 or better at the end of their junior year;
2. Formally apply to one of the joint programs, completing the admissions process at least one semester prior to the beginning of the M.S. portion of their program.

Once admitted to the program of their choice, students begin taking graduate courses (5000-level or higher) in their senior year that would apply to both the bachelor's and master's degree programs. A maximum of 9 credits can be applied to both programs. Students in the joint programs must maintain continuous enrollment to remain in good standing. Students must also meet all the degree requirements of the graduate program they have chosen, including core courses and prerequisites. Those students who complete the M.S. degree program within one year after completing their B.S.C.E. or B.S. degree program will be presented with a certificate of recognition.



### B.S.E.E./M.S.Cp.E. Degree Program

The Department offers a five-year Bachelor of Science in Electrical Engineering/Master's in Computer Engineering (M.S.Cp.E.) degree program. [Program details](#) are listed in the Electrical Engineering section under Combined Programs.

## MASTER'S PROGRAMS

[Link to Master of Science with Major in Computer Science](#)

[Link to Internet Engineering Graduate Specialty](#)

[Link to Software Engineering Graduate Specialty](#)

[Link to Master of Science with Major in Computer Science with Focus in Internet and Web Technologies](#)

[Link to Master of Science with Major in Computer Science or Computer Engineering with a Business Minor](#)

[Link to Master of Science with Major in Information Technology and Management](#)

### Master of Science with Major in Computer Engineering

The non-thesis option for this degree requires a minimum of 33 credits. The thesis option requires a minimum of 30 credits, including 6 credits of thesis. All students must take at least one course from each of the three groups listed in **Option A**.

With approval of the advisor, substitution can sometimes be made among similar courses. See the Department of Computer & Electrical Engineering and Computer Science [website](#) for updates.

#### Admission Requirements

Applications for admission to the master's program are approved by the University upon the recommendation of the Department. All applicants must submit with their applications the official transcripts from previous institutions attended and have official GRE scores forwarded to the University. Applications for admission are evaluated on an individual basis. As a minimum, applicants are expected to meet the following requirements. Students with non-engineering bachelor's degrees, click [here](#) for additional requirements.

1. A baccalaureate degree in Engineering or a related field. (Students who do not have a computer engineering background will be expected to take additional courses; see link above);
2. At least a 3.0 (of a 4.0 maximum) GPA in the last 60 credits attempted prior to graduation;
3. A combined score (verbal + quantitative) of at least 295 on the Graduate Record Examination (GRE). GRE scores more than five years old are normally not acceptable;
4. A score of 213 or higher in the Test of English as a Foreign Language (TOEFL).

Applicants are expected to have taken the following prerequisite courses (or equivalents) before pursuing a master's degree. In some cases, prerequisite courses may be taken after admission to the graduate program. Equivalent FAU courses follow.

|  |             |
|--|-------------|
| Introduction to Microprocessor Systems | CDA 3331C   |
| Structured Computer Architecture       | CDA 4102 or |
| CAD-Based Computer Design              | CDA 4204    |
| Electronics 1                          | EEE 3300 or |
| Introduction to VLSI                   | CDA 4210    |
| Data Structures and Algorithm Analysis | COP 3530    |
| Calculus with Analytic Geometry 1      | MAC 2311    |
| Calculus with Analytic Geometry 2      | MAC 2312    |
| Stochastic Models for Computer Science | STA 4821    |

#### Submission of Plan of Study

Students are required to submit a Plan of Study when they have completed between 9 and 15 credits of coursework with a minimum cumulative GPA of 3.0. All courses must be approved by the student's advisor. A student may not register for thesis credits prior to submitting a Plan of Study.

**Top**

#### Option A (Changes below effective spring 2015.)

| <b>Group 1: Computer Architecture and Design</b> |          |
|--|----------|
| Advanced Computer Architecture                   | CDA 6155 |
| Embedded System Design 1                         | CDA 6316 |
| Multiprocessor Architecture                      | CDA 6132 |
| Structured VLSI Design                           | CDA 6214 |

| <b>Group 2: Software Development</b> |          |
|--------------------------------------|----------|
| Multimedia Programming               | CAP 6018 |
| Software Engineering                 | CEN 5035 |
| Software Maintenance and Evolution   | CEN 6027 |
| Software Requirements Engineering    | CEN 6075 |
| Software Testing                     | CEN 6076 |
| Software Architecture and Patterns   | CEN 6085 |
| Object-Oriented Software Design      | COP 5339 |
| Component Programming with .NET      | COP 5595 |

| <b>Group 3: Computer Systems</b> |          |
|----------------------------------|----------|
| Computer Performance Modeling    | CEN 6405 |
| Computer Data Security           | CIS 6370 |

|  |          |
|--|----------|
| Theory and Implementation of Database Systems  | COP 6731 |
| Mobile Computing                               | CNT 6517 |
| Data Mining and Machine Learning               | CAP 6673 |
| Multimedia Systems                             | CAP 6010 |
| Evaluation of Parallel and Distributed Systems | CDA 6122 |
| Introduction to Neural Networks                | CAP 5615 |
| Wireless Networks                              | EEL 6591 |
| Advanced Data Mining and Machine Learning      | CAP 6778 |
| Video Communication                            | CNT 6885 |
| Foundations of Vision                          | CAP 6411 |
| Vehicular Networks                             | CNT 6528 |
| Advanced Computer Networking                   | CNT 6516 |

**Top**

### Master of Science with Major in Computer Science

The non-thesis option for this degree requires a minimum of 33 credits. The thesis option requires a minimum of 30 credits, including 6 credits of thesis. All master's degree students must take at least one course from each of the three groups listed in **Option B**.

With approval of the advisor, substitution can sometimes be made among similar courses. See the Department of Computer & Electrical and Computer Science [website](#) for updates.

#### Admission Requirements

Applicants for admission to the master's program are approved by the University upon the recommendation of the Department. All applicants must submit with their applications the official transcripts from previous institutions attended and have official GRE scores forwarded to the University. Applications for admission are evaluated on an individual basis. As a minimum, applicants are expected to meet the following requirements. Students with non-engineering bachelor's degrees, click [here](#) for additional requirements.

1. A baccalaureate degree in Computer Science or a related field (Students without a computer science background will be expected to take additional courses);
2. At least a 3.0 (of a 4.0 minimum) GPA in the last 60 credits attempted prior to graduation;
3. A combined score (verbal + quantitative) of at least 295 on the Graduate Record Examination (GRE). GRE scores more than five years old are normally not acceptable;
4. A score of 213 or higher in the Test of English as a Foreign Language (TOEFL).

Applicants are expected to have taken the following prerequisite courses (or equivalents) before pursuing a master's degree. In some cases, prerequisite courses may be taken after admission to the graduate program. Equivalent FAU courses follow.

The two courses crossed out below are no longer required as prerequisites, effective spring 2015.

|  |              |
|--|--------------|
| Structured Computer Architecture       | CDA 4102 or  |
| Introduction to Microprocessor Systems | CDA 3331C or |
| CAD-Based Computer Design              | CDA 4204     |
| Data Structures and Algorithm Analysis | COP 3530     |
| Computer Operating Systems             | COP 4610     |
| Design and Analysis of Algorithms      | COT 4400     |
| Calculus with Analytic Geometry 1      | MAC 2311     |
| Calculus with Analytic Geometry 2      | MAC 2312     |
| Stochastic Models for Computer Science | STA 4821     |

#### Submission of Plan of Study

Students are required to submit a Plan of Study when they have completed between 9 and 15 credits of coursework with a minimum cumulative GPA of 3.0. All courses must be approved by the student's advisor. A student may not register for thesis credits prior to submitting a Plan of Study.

### Degree Requirements

The **degree without thesis option** requires a minimum of 33 credits of coursework in relevant technical areas. The following rules apply to the selection of courses.

1. A minimum of 3 credits must be selected from each of the three groups listed in **Option B**.
2. A minimum of 18 credits of 6000-level courses must be completed.
3. No more than 3 credits of Directed Independent Study may be taken.
4. No course can be counted toward the degree that is more than ten years old at the time the degree is awarded.
5. A maximum of one 4000-level course may be allowed toward the degree with prior approval of the student's advisor. This course must be passed with a minimum grade of "B." Courses taken to make up for the deficiencies will not be counted toward the degree.
6. Must have a GPA of 3.0 (out of 4.0 max.) or better.
7. All courses in the degree program must be completed with a grade of "C" or better.

The **degree with thesis option**, ~~in addition to the above rules~~, requires a minimum of 24 credits of graduate coursework (5000-level or higher) and a minimum of 6 credits of thesis work. All the above rules apply, except rule 5 which changes to:

5. No 4000-level course is allowed toward the degree. Courses taken to make up for the deficiencies will not be counted toward the degree.

**Top**

### Transfer Credits

Any transfer credits toward the requirements for a master's degree in Computer Science must be approved by the Department, the College and the University. The transfer credits must correspond to equivalent requirements and performance levels expected for the degree. Normally no more than 6 credits of coursework (that have not been applied to a degree) can be transferred from another institution.

### Option B

| <b>Group 1: Theory</b>    |          |
|---------------------------|----------|
| Analysis of Algorithms    | COT 6405 |
| Queueing Theory           | MAP 6264 |
| Philosophy of Computation | COT 6200 |

| <b>Group 2: Software Development</b> |          |
|--------------------------------------|----------|
| Multimedia Programming               | CAP 6018 |
| Software Engineering                 | CEN 5035 |
| Software Maintenance and Evolution   | CEN 6027 |
| Software Requirements Engineering    | CEN 6075 |
| Software Testing                     | CEN 6076 |
| Software Architecture and Patterns   | CEN 6085 |
| Object-Oriented Software Design      | COP 5339 |
| Component Programming with .NET      | COP 5595 |

| <b>Group 3: Computer Systems</b>               |          |
|--|----------|
| Computer Performance Modeling                  | CEN 6405 |
| Computer Data Security                         | CIS 6370 |
| Theory and Implementation of Database Systems  | COP 6731 |
| Mobile Computing                               | CNT 6517 |
| Data Mining and Machine Learning               | CAP 6673 |
| Multimedia Systems                             | CAP 6010 |
| Evaluation of Parallel and Distributed Systems | CDA 6122 |

|   |          |
|---|----------|
| Introduction to Neural Networks           | CAP 5615 |
| Wireless Networks                         | EEL 6591 |
| Advanced Data Mining and Machine Learning | CAP 6778 |
| Video Communication                       | CNT 6885 |
| Foundations of Vision                     | CAP 6411 |
| Vehicular Networks                        | CNT 6528 |
| Advanced Computer Networking              | CNT 6516 |



**Internet Engineering Graduate Specialty**  
**An Option in Computer Science or Computer Engineering**

**Prerequisites**

Same as for master's degree in Computer Science or master's degree in Computer Engineering.

**Degree Requirements for Non-Thesis Option**

Requires a minimum of 33 credits as follows:

1. Same requirements as specified in degree requirements for non-thesis option for master's degree with major in Computer Engineering or master's degree with major in Computer Science;
2. At least four elective courses (12 credits) selected from a group of Internet-based courses that include (a) Internet software, (b) Internet networking and (c) Internet technologies, as specified by academic advisor.

**Degree Requirements for Thesis Option**

Requires a minimum of 30 credits as follows:

1. Same requirements as specified in degree requirements for non-thesis option for master's degree with major in Computer Engineering or master's degree with major in Computer Science;
2. At least three elective courses (9 credits) selected from a group of Internet-based courses that include (a) Internet software, (b) Internet networking and (c) Internet technologies, as specified by academic advisor;
3. A minimum of 6 credits of thesis work.

**Software Engineering Graduate Specialty**  
**An Option in Computer Science**

**Prerequisites**

Same as non-thesis programs plus:

Principles of Software Engineering (CEN 4010)  
Introduction to Object-Oriented Design and Programming (COP 4331)

Students who have not had COP 4331 may take COP 5339 to satisfy this requirement.

**Group 1 Fundamentals**

Courses in this group emphasize general fundamentals of software engineering. Included in this group are courses in object-oriented methods, software testing and requirements engineering.

**Group 2 Development**

Courses in this group address specific issues and techniques more closely related to actual software development. Included in this group are courses in user-interface design, CASE, formal methods and advanced object-oriented topics.

**Group 3 Quantitative and Experimental**

Courses in this group deal with quantitative and experimental approaches. Included in this group are courses in the areas of reliability, metrics and modeling.

For specific course numbers that belong to the above three groups, consult an advisor in the Department.

Thesis option students must take at least six of the above software engineering courses, two from each group.

Non-thesis-option students must take at least eight of the above software engineering courses, at least two from each group. Appropriate special topics courses may also be used to meet these requirements with approval of the student's advisor.

### Other Electives

Thesis option students: Two other 5000-level or 6000-level Computer Science and Computer Engineering courses and 6 credits of COT 6970 (Thesis). No 4000-level course is allowed toward the degree.

Non-thesis-option students: Three other 5000-level or 6000-level Computer Science and Computer Engineering courses. Also, one 4000-level course may be allowed toward the degree with approval of the student's advisor.

All students must complete at least one-half of their credits at the 6000 level. Also, one 4000-level course may be allowed toward the degree with approval of the student's advisor.

**Top**

### Master of Science with Major in Computer Science with Focus in Internet and Web Technologies

This program is designed specifically for working professionals. Students attend formal classes for two Saturdays per month for 11 months. The remaining instruction is delivered through the latest distance-learning technologies, including FAU's Blackboard system.

The program requires the 11 FAU courses below, totaling 33 credits categorized as software, networking and applications. Special review modules can be arranged for students who lack the required prerequisites. Admission requirements and prerequisites are the same as for the master's degree with major in Computer Science.

|   |          |
|---|----------|
| Multimedia Systems  | CAP 6010 |
| Data Mining and Machine Learning  | CAP 6673 |
| Computer Networks   | CNT 5008 |
| Mobile Computing  | CNT 6517 |
| Computer Data Security  | CIS 6370 |
| Theory and Implementation of Database Systems   | COP 6731 |
| Wireless Networks   | EEL 6591 |
| Internet Application Programming  | ISM 4052 |
| Queueing Theory   | MAP 6264 |
| Topics in Computer Science<br>(Topics include Web Services, Web Project Development, Network Programming)           | COT 5930 |
| Topics in Computer Science<br>(Topics include Advanced Internet Engineering, Ad Hoc Networks, Video Communications) | COT 6930 |

For fees and other details, contact the Department at 561-297-3855 or visit the Computer & Electrical Engineering and Computer Science [website](#).

### Master of Science with Major in Computer Science or Computer Engineering with a Business Minor

Those students electing to receive a minor in Business must complete 36 credits, of which 21 are to be from the Computer Science and Engineering courses described in this section of the catalog and 15 are to be from the courses approved by the College of Business for the [Business minor](#). Such students will have to satisfy the prerequisite and core requirements of the appropriate degree program of the Department. In addition, students should also satisfy the University requirements for graduate programs. For more information, students should consult their faculty advisor.

**Top**

### Master of Science with Major in Information Technology and Management

The Master of Science with Major in Information Technology and Management (MSITM) is jointly offered by the Department of Computer & Electrical Engineering and Computer Science (CEECS) in the College of Engineering and Computer Science and the Department of Information Technology and Operations Management (ITOM) in the College of Business. Designed for highly motivated individuals with computing and/or managerial backgrounds, the program aims to prepare students for a management career in the area of information technology in organizations. To allow for maximum flexibility in career aspirations, students can select from two options: Advanced Information Technology, emphasizing the technical aspect of organizational IT systems; and Information Technology Management, focusing on the management issues of IT in organizations.

#### Admission Requirements

To be admitted to the MSITM program applicants must have:

1. An undergraduate degree in Computer Science, Information Engineering Technology or an IT-related field of study. Applicants with another undergraduate degree and documented work experience of two or more years in an IT function will be evaluated as well;

2. An undergraduate GPA of 3.0 or higher;
3. A combined score (verbal + quantitative) of at least 295 and 4 (analytical writing) on the Graduate Record Examination (GRE) or a GMAT score of 500 or higher. Scores more than five years old are normally not acceptable;
4. A satisfactory score on the Test of English as a Foreign Language (TOEFL) or the International Language Testing System (IELTS) for international students;
5. Met other requirements of the FAU Graduate College.

#### Curriculum Requirements

Students are required to complete 33 graduate level credits, or 11 three-credit courses, with a 3.0 GPA or better to graduate. Students in Advanced Information Technology will be awarded the degree by the College of Engineering and Computer Science, while those in Information Technology Management will have their degrees awarded by the College of Business. For more information about the Master of Science in Information Technology and Management degree program, call the Department of Computer & Electrical Engineering and Computer Science at 561-297-3482, or email [ceecs@fau.edu](mailto:ceecs@fau.edu).

#### Advanced Information Technology

Students are required to take the following four courses:

|  |          |
|--|----------|
| Software Engineering                             | CEN 5035 |
| Object-Oriented Software Design                  | COP 5339 |
| Data Mining and Machine Learning                 | CAP 6673 |
| Management of Information Systems and Technology | ISM 6026 |

In addition, students need to take five electives from the following CEecs courses:

|                                    |          |
|------------------------------------|----------|
| Data Mining and Machine Learning   | CAP 6673 |
| Software Maintenance and Evolution | CEN 6027 |
| Software Testing                   | CEN 6076 |
| Computer Data Security             | CIS 6370 |
| Mobile Computing                   | CNT 6517 |
| Component Programming with .NET    | COP 5595 |
| Topics in Computer Science         | COT 5930 |
| Topics in Computer Science         | COT 6930 |
| Computer Performance Modeling      | CEN 6405 |
| Video Communication                | CNT 6885 |
| Software Architecture and Patterns | CEN 6085 |
| Wireless Networks                  | EEL 6591 |

The last two electives can be chosen from the following ITOM courses:

|  |          |
|--|----------|
| Information Technology Project and Change Management | ISM 6316 |
| Information Security Management                      | ISM 6328 |
| Enterprise Information Technology Service Management | ISM 6368 |
| Web-Based Business Development                       | ISM 6508 |
| Information Technology Sourcing Management           | ISM 6509 |



#### Information Technology Management

Students are required to take the following eight courses offered by the College of Business:

|  |          |
|--|----------|
| Management of Information Systems and Technology | ISM 6026 |
| Information Technology Project and Change        | ISM 6316 |



|  |          |
|--|----------|
| Management   |          |
| Advanced Business Analytics                            | ISM 6405 |
| Information Security Management                        | ISM 6328 |
| Enterprise Information Technology Service Management   | ISM 6368 |
| Electronic Commerce and Internet Business Applications | ISM 6508 |
| Information Technology Sourcing Management             | ISM 6509 |
| Graduate Business Communication Applications           | GEB 6215 |

In addition, students need to take three electives from the following courses offered by the College of Engineering and Computer Science:

|   |          |
|---|----------|
| Data Mining and Machine Learning              | CAP 6673 |
| Software Maintenance and Evolution            | CEN 6076 |
| Software Testing                              | CEN 6076 |
| Computer Data Security                        | CIS 6370 |
| Computer Network Programming                  | CNT 5715 |
| Mobile Computing                              | CNT 6517 |
| Object-Oriented Software Design               | COP 5339 |
| Component Programming with .NET               | COP 5595 |
| Theory and Implementation of Database Systems | COP 6731 |
| Topics in Computer Science                    | COT 5930 |
| Wireless Networks                             | EEL 6591 |

**Top**

## DOCTORAL PROGRAMS

### Doctor of Philosophy with Major in Computer Engineering or in Computer Science

The Department offers a program of advanced graduate study leading to the Doctor of Philosophy degrees in Computer Engineering and in Computer Science. The graduate of this program will be able to meet the highest standards of preparation for leadership in the computer science or engineering profession, including research, teaching and leadership in high-technology industry and governmental agencies. A Ph.D. Applicant's Guide is available from the Department.

#### Admission Requirements

Application for admission to doctoral study will be evaluated on an individual basis by the Department's graduate programs committee. Usually, the following four criteria must be met:

1. The applicant should have a combined score (verbal + quantitative) of at least 300 on the Graduate Record Examination (GRE) and a GPA of at least 3.3 (out of 4.0 maximum) in previous graduate work. GRE scores more than five years old are normally not acceptable;
2. The applicant must have a master's degree in Engineering, Computer Science or a related discipline awarded by a recognized institution. Thesis option is preferred. This requirement may be waived under exceptional circumstances (see B.S. to Ph.D. programs earlier in the College of Engineering and Computer Science section of the catalog).
3. The applicant must provide three reference letters (at least two from academia) that address the student's research potential, motivation, relative academic achievement and personality. Forms are supplied with applications for admission.
4. Applicants whose native language is not English must produce evidence of proficiency in written and spoken English. A score of 213 or more on the Test of English as a Foreign Language (TOEFL) is considered satisfactory.

#### Qualifying Examination

Note: The Qualifying Exams for PhD in [Computer Science](#) and [Computer Engineering](#) are the same except for the course selections (see the [application form](#)).

The Qualifying Exam is a written exam intended to assess whether a student is ready to conduct research at the doctoral level and is able to publish in international conferences and journals. This exam must be passed for formal admission into the doctoral program. Students seeking the PhD degree are expected to take the exam during the second semester of their doctoral studies, excluding the Summer semester.

The exam addresses the student's knowledge of graduate and undergraduate course material and basic mathematical concepts and engineering methods required for research and professional practice at the doctoral level. The exam consists of six problems (one from each course) related to material covered in recent FAU graduate and undergraduate CS/CE courses. The exam is administered two times a year, in the Fall and Spring semesters. Two 3-hour sessions, morning and afternoon, cover three courses each. The student can bring three 2-sided pages of notes and a simple calculator to each session, but no books, computers, or phones. An overall minimum score of 70% or better is required to pass. A student failing the written exam may, upon re-application, take it a second time. Two failures will normally result in the student's dismissal from the PhD program.

#### **Application for Qualifying Exam**

Students need to fill out and submit an [application for the Qualifying Exam](#). In filling out the form, the student should list six courses, at most four of which may be at the graduate level and at least two of which must be at the undergraduate level, selected from one of the lists below. All courses must have been offered by the Department of Computer and Electrical Engineering and Computer Science during the preceding three years (courses from other departments may be accepted if approved by the student's advisor and the Graduate Committee), but the student may have taken them anywhere or prepared them on their own. The student will also list a primary area of research and at least one secondary area.

The application must be approved by the student's advisor and then submitted to the Graduate Committee. Upon approving the application, the Graduate Committee will arrange for preparation of the exam.

#### **Undergraduate courses for Computer Engineering students:**

1. CDA 3201C Introduction to Logic Design
2. CDA 3331C Introduction to Microprocessor Systems
3. COP 3530 Data Structures and Algorithm Analysis
4. CDA 4102 Structured Computer Architecture
5. COP 4610 Computer Operating Systems
6. STA 4821 Stochastic Models for Computer Science

#### **Undergraduate courses for Computer Science students:**

1. CDA 3201C Introduction to Logic Design or CDA 4102 Structured Computer Architecture
2. COP 3530 Data Structures and Algorithm Analysis
3. COP 4610 Computer Operating Systems
4. COT 4400 Design and Analysis of Algorithms
5. COT 4420 Formal Languages and Automata Theory
6. STA 4821 Stochastic Models for Computer Science



#### **Admission to Candidacy**

Students should apply for candidacy as soon as they become eligible. To be eligible, a student must:

1. have passed the Qualifying Exam, and
2. have maintained a minimum of 3.0 GPA in all courses attempted as a doctoral student.

Students may not register for dissertation credits until their admission to candidacy.

#### **Degree Requirements**

A minimum of 84 graduate credits (including a minimum of 33 dissertation credits) is required beyond a bachelor's degree. **No 4000-level courses may be counted in the PhD degree.** A master's degree in a related field is considered equivalent to 30 credits. A minimum of 21 credits of coursework is required beyond a master's degree. All courses must be approved by the student's advisor. Students lacking proper background may have to take additional courses to make up for the deficiencies. In addition to meeting the course requirement, a doctoral student must pass the Qualifying Examination, complete the dissertation under the supervision of the student's advisor and dissertation committee and pass the oral dissertation examination. Also, a written dissertation proposal must be accepted by the dissertation committee at least six months prior to the oral dissertation examination. A doctoral candidate is expected to have at least one research paper published or accepted for publication in a fully refereed conference or journal prior to graduation. Every doctoral student must maintain a Research Portfolio containing research papers (book chapter, conference, or journal publications accepted or published, patents, non-refereed publications) done throughout the student's PhD degree studies. The dissertation will be added to the Research Portfolio prior to graduation. The portfolio must be approved by a graduate advisor prior to graduation certification. The following rules apply to the courses taken (beyond the master's degree):

1. Of the 21-credit minimum of coursework, a minimum of 15 credits must be in Computer Science and Engineering courses and a minimum of 15 credits of 6000-level courses must be completed.

2. No more than 3 credits of Directed Independent Study may be used to satisfy the minimum of 21 credits. In that case, the subject matter may not overlap the student's dissertation.
3. A course that is more than ten years old at the time the degree is awarded cannot be counted toward the degree. This rule does not apply to the courses transferred from the master's degree.
4. A maximum of one No 4000-level course may be allowed toward the degree with the approval of the student's advisor. This course must be passed with a minimum grade of "B-." The courses taken to make up the deficiencies will not be counted toward the degree.
5. Students must register for a minimum of 33 credits of dissertation.
6. Students must have a GPA of 3.0 (out of 4.0 maximum) or better.
7. All courses in the degree programs must be completed with a grade of "C" or better.

#### **Transfer Credits**

Any transfer credits (from other institutions) toward the requirements for the Ph.D. degree must be approved by the Department, the College and the University. The transfer credits must correspond to equivalent requirements and performance levels expected for the degree. A maximum of 30 credits can be transferred from a master's degree. In addition to the credits for a master's degree, no more than 6 credits of coursework can be transferred from another institution.

#### **Residency Requirements**

After passing the Qualifying Examination, a doctoral student must spend two consecutive semesters at FAU, i.e., must register for a minimum of 9 credits for each of those semesters, and at least one of those semesters must occur while the student holds candidacy status.

#### **Time Limitation**

A Ph.D. student who enters the program with a master's degree has no more than ten years to complete all requirements for the Ph.D. degree.

#### **Dissertation Committee**

Students are encouraged to interact with faculty members of the Department to select a dissertation advisor and research area/topic for their dissertation. After a student has passed both parts of the Qualifying Examination, a dissertation committee shall be formed to supervise the student's research work. The committee will consist of at least four faculty members who are familiar with the research area, at least three of whom are regular faculty members of the Department. At least one member of the committee must be from outside the Department (could also be from another institution or industry), and this member should have an academic or professional level compatible with the rest of the committee. The committee is chaired by the student's dissertation advisor. The chair of the committee must be from the Department. Students are expected to work in close cooperation with their dissertation committee and to keep the committee members informed about their progress on a regular basis. The dissertation committee should meet with the student at least once a semester to review the progress of the research work.

#### **Dissertation and Oral Defense**

The dissertation must be written in the format specified by the Graduate College. A copy of the dissertation must be submitted to the Graduate College for approval of the dissertation format. Dissertations must be defended orally. A dissertation should be submitted to the members of the dissertation committee for their review at least two weeks before the oral defense. After an oral defense, the members of the dissertation committee vote on acceptance or rejection of the dissertation. The committee may also suggest that the student do some additional work so as to make the dissertation acceptable. The decision of the dissertation committee will be reported in the form of a satisfactory/unsatisfactory grade for dissertation credits.

## COMBINED PROGRAMS

### B.S.E.E. to M.S. Degree Program

This program enables qualified FAU undergraduate EE students to obtain both their B.S.E.E. and M.S. degrees in approximately five years by allowing up to 9 credits of approved coursework to apply toward both degrees as long as the following two criteria are met: (a) minimum 120 credits for the B.S. degree, and (b) minimum 30 credits (5000-level or higher) for the M.S degree. Therefore a maximum of 9 credits can be double counted if the number of credits for both BS and MS exceeds 150. This essentially takes away approximately one semester of coursework and offers an attractive option for enthusiastic students planning for their graduate education. Students who have a cumulative GPA of 3.25 or better after completing 96 credits toward the B.S.E.E. are eligible for admission to the program.

#### Prerequisite Coursework for Transfer Students

Students transferring to Florida Atlantic University must complete both lower-division requirements (including the requirements of the Intellectual Foundations Program) and requirements for the college and major. Lower-division requirements may be completed through the A.A. degree from any Florida public college, university or community college or through equivalent coursework at another regionally accredited institution. Before transferring and to ensure timely progress toward the baccalaureate degree, students must also complete the prerequisite courses for their major as outlined in the *Transfer Student Manual*.

All courses not approved by the Florida Statewide Course Numbering System that will be used to satisfy requirements will be evaluated individually on the basis of content and will require a catalog course description and a copy of the syllabus for assessment.

#### Program Process

1. Eligible students apply to the department for acceptance into the program during the term in which they will complete 96 credits toward their B.S.E.E. degree.
2. Eligible students take the Graduate Record Exam (GRE, verbal and quantitative) during the term in which they will complete 96 credits toward their B.S.E.E. degree.
3. Eligible students normally apply for graduate admission after obtaining a combined score of 1000 or more on the GRE.
4. Eligible students take courses in their senior year that will apply to both their B.S.E.E. and M.S. degrees. ~~A maximum of 9 credits of approved coursework can be applied to both degrees.~~
5. Students participating in this program may opt for the thesis or non-thesis option in their M.S. degree.
6. Students planning for the thesis option need a letter of recommendation from their potential thesis advisor.
7. Students must be admitted to the joint B.S.E.E./M.S. program at least one semester prior to the start of their M.S. degree program.
8. Students who are successful in completing their M.S. degree within one year will be presented a certificate of recognition.

#### Degree Requirements

Students participating in this program must satisfy the degree requirements for a B.S.E.E. and M.S. as outlined in this catalog. ~~The unique feature of this program is that 9 credits of approved coursework can be applied toward both degrees.~~



### Five-Year Bachelor of Science in Electrical Engineering/Master of Science in Computer Engineering

The B.S.E.E./M.S.Cp.E. program is intended for students who wish to take advantage of the broader systems orientation of the B.S.E.E. degree and then specialize in Computer Engineering. Selection of specific technical elective courses and an upper-division math elective in the B.S.E.E. program qualifies the graduate to enter the

M.S.Cp.E. program with no deficiencies, provided that GPA, GRE and other computer engineering admission requirements are met. It should be noted that the student must satisfy the 33-credit requirement for a M.S.Cp.E. Typically this will take one calendar year beyond the completion of the requirements for a B.S.E.E.

**Prerequisite Coursework for Transfer Students**

Students transferring to Florida Atlantic University must complete both lower-division requirements (including the requirements of the Intellectual Foundations Program) and requirements for the college and major. Lower-division requirements may be completed through the A.A. degree from any Florida public college university, or community college or through equivalent coursework at another regionally accredited institution. Before transferring and to ensure timely progress toward the baccalaureate degree, students must also complete the prerequisite courses for their major as outlined in the [Transfer Student Manual](#).

All courses not approved by the Florida Statewide Course Numbering System that will be used to satisfy requirements will be evaluated individually on the basis of content and will require a catalog course description and a copy of the syllabus for assessment.

**Degree Requirements**

The following specific technical elective and math courses should be taken as part of the requirements for a B.S.E.E. degree:

| Technical Electives (10 credits required) |           |    |
|---|-----------|----|
| Foundations in Computer Science           | COP 3014  | 3  |
| Foundations in Computer Science Lab       | COP 3014L | 1  |
| Data Structures and Algorithm Analysis    | COP 3530  | 3  |
| Structured Computer Architecture          | CDA 4102  | or |
| CAD-Based Computer Design                 | CDA 4204  | 3  |

| Mathematics Elective (3 credits required) |          |   |
|---|----------|---|
| Discrete Mathematics                      | MAD 2104 | 3 |

**Top**

**MASTER'S PROGRAM**

**Master of Science with Major in Electrical Engineering**

The Department offers thesis and non-thesis options at the master's level. Students may specialize in several areas: telecommunications; digital signal processing; systems and robotics, including control systems and machine vision; electromagnetics and RF, antennas, microwave systems, EMC/EMI and HF RF circuit design; alternative energy systems, including photovoltaic and fuel cell systems; bioengineering; neural networks; and optics and photonics.

**Admission Requirements**

All applicants must submit GRE scores and official transcripts from all previous postsecondary institutions attended. Applicants for admission will be

evaluated on an individual basis and must satisfy the following requirements. Students with non-engineering bachelor's degrees, click [here](#) for additional requirements.

1. An applicant whose native language is not English must obtain a score of 550 or more (CBT-213) on the Test of English as a Foreign Language (TOEFL);
2. A baccalaureate degree in Engineering, Natural Science or Mathematics;\*
3. A minimum GPA of 3.0 (of a possible 4.0 maximum) in the last 60 credits of undergraduate work;
4. A combined score (verbal + quantitative) of at least 295 on the Graduate Record Examination (GRE). GRE scores more than five years old are normally not acceptable;

\* Students whose backgrounds are not in electrical or computer engineering should expect to take additional coursework to satisfy deficiencies.

#### Admission to Candidacy

Graduate students are required to submit a Plan of Study when they have completed between 9 and 15 credits of coursework with a minimum cumulative GPA of 3.0. A student may not register for thesis credits prior to approval of a submitted Plan of Study.

#### Degree Requirements

Students must satisfy all of the University graduate requirements. In addition, the following specific degree requirements apply, depending on the choice of degree program:

##### Master of Science Degree Thesis Option (30 credits)

1. Requires 6 credits of orally defended written thesis.
2. Requires 24 credits of approved coursework with the following constraints:
  - a. Minimum of 15 credits at the 6000 level;
  - b. Minimum of 12 credits in EE courses;
  - c. ~~Maximum of 6 credits at the 4000 level with a maximum of 6 EE credits and 3 credits in math; No 4000-level course is allowed toward the degree.~~
  - d. A 3-credit course with math prefix or one of the following courses: EEL 5613, Modern Control; EEL 5502, Digital Processing of Signals; EEL 6482, Electromagnetic Theory 1; EOC 5172, Mathematical Methods in Ocean Engineering 1.
3. Every student must maintain a Research Portfolio containing research papers (book chapter, conference, or journal publications accepted or published, patents, DIS based research papers, graduate course based research papers, technical reports) done throughout the student's MS degree studies. The MS thesis will be added to the Research Portfolio prior to graduation. The portfolio must be approved by a graduate advisor prior to graduation certification.

**Note:** No more than 3 credits of Directed Independent Study may be applied toward the master's degree.

##### Master of Science Degree Non-Thesis Option (33 credits)

1. Requires 33 credits of approved coursework with the following constraints:
  - a. Minimum of 18 credits at the 6000 level;
  - b. Maximum of ~~6~~ 3 credits at the 4000 level, ~~with a maximum of 3 credits in EE and a maximum of 3 credits in math;~~
  - c. A 3-credit course with math prefix or one of the following courses: EEL 5613, Modern Control; EEL 5502, Digital Processing of Signals; EEL 6482, Electromagnetic Theory 1; EOC 5172, Mathematical Methods in Ocean Engineering 1;
  - d. A minimum of 18 credits must be completed in EE;
2. One 3-credit research oriented Directed Independent Study course must be taken after completion of 18 credits of coursework. At the end of the DIS course the student is expected to submit a paper or a technical report, to be placed in the student's Research Portfolio.
3. Every non-thesis student must maintain a Research Portfolio containing research papers (book chapter, conference, or journal publications accepted or published, patents, DIS based research papers, graduate course based research papers, technical reports) done throughout the student's MS degree studies. Every non-thesis student is expected to have at least one research paper in the Research Portfolio before graduation. The portfolio must be approved by a graduate advisor prior to graduation certification.

**Note:** No more than 6 credits of Directed Independent Study may be applied toward the master's degree.

#### Deficiency Requirements in both M.S. and Ph.D. Programs

From the following list of deficiency EE courses, students must take the Electronics Laboratory 1 course and at least four more courses:

|                                  |           |
|----------------------------------|-----------|
| Intro. to Microprocessor Systems | CDA 3331C |
|----------------------------------|-----------|

|                                  |           |
|----------------------------------|-----------|
| Electromagnetic Fields and Waves | EEL 3470  |
| Electronics 2                    | EEE 4361  |
| Introduction to DSP              | EEL 4510  |
| Communications Systems           | EEL 4512  |
| Control Systems 1                | EEL 4652  |
| Analysis of Linear Systems       | EEL 4656  |
| Electronics Laboratory 1         | EEL 3118L |

An insufficient number of the above courses will be considered a deficiency. Students are expected to take the necessary deficiency courses during their course program as an extra load beyond the regular graduate coursework.

Students with engineering technology degrees are expected to first satisfy the FAU EE undergraduate graduation requirements before being admitted to the graduate program.

## DOCTORAL PROGRAM

### Doctor of Philosophy with Major in Electrical Engineering

#### Admission Requirements

Applicants for admission to doctoral study will be evaluated on an individual basis by the departmental graduate admissions committee. As a rule, the applicant must have:

1. At least a 3.3 (of a possible 4.0 maximum) grade point average in the last 60 credits attempted in the relevant field;
2. A combined score (verbal + quantitative) of at least 300 on the Graduate Record Examination (GRE). GRE scores more than five years old are normally not accepted.
3. A Master's degree in Engineering or a related discipline awarded by a recognized institution (thesis options are preferred);
4. Two reference forms that document the applicant's research potential, motivation, relative academic achievement and personality;

Applicants whose native language is not English must be proficient in written and spoken English as evidenced by a score of 550 or more (CBT-213) on the Test of English as a Foreign Language (TOEFL).

It is possible that access to the program may be limited by available resources in the Department.

#### Admission to Candidacy

To be considered for the doctoral candidacy:

1. The student must pass the Qualifying Examination (QE) administered semiannually by the Department. The examination is based on electrical engineering course works as outlined in the brochure: CEECS/EE Program Ph. D. Qualifying Examination. This QE and must be taken by all students after completion of 9 credits of Ph.D. coursework. A student who fails the examination may be allowed a second attempt subject to departmental approval.
2. Following successful completion of the QE, the student must find a qualified faculty member in the Department willing to chair the doctoral (dissertation) committee. The dissertation committee chair will then consult with the student to form the complete committee. Working with this dissertation committee chair, the student must complete the official Admission to Candidacy application along with the approved Plan of Study.

Candidacy approval will be based on:

1. The academic record of the student;
2. An approved (tentative) dissertation topic.

A student may not register for dissertation credit until the application for candidacy has been approved.

#### Degree Requirements

1. A minimum total of 84 credits, including 33 dissertation credits, is required beyond the Bachelor's degree level. These must include at least 21 credits of coursework beyond the Master's degree. At least 12 of these credits should be taken in the Electrical Engineering program at FAU.

2. No 4000-level course is allowed toward the degree.

2. No more than two courses at the 4000 level may be taken as part of the overall 84-credit Ph.D. program, limited to the following:

- a. No more than one 4000-math course as approved by the CEECS Department;
- b. No more than one 4000-EE elective from the list of approved courses;
- c. No more than one of any 4000-level courses, excluding EE undergraduate core courses.

3. At least 21 credits above the master's program requirement should be at the 5000 and 6000 levels.
4. Specific Focus Area coursework will be required. At least 12 of these credits should be taken in the Electrical Engineering program at FAU.
5. At least 6 credits in courses with math prefix are required as part of coursework beyond the Bachelor's degree. These may include EEL 5613, Modern Control; EEE 5502, Digital Processing of Signals; EEL 6482, Electromagnetic Theory 1; EOC 5172, Mathematical Methods in Ocean Engineering 1.
6. A written dissertation proposal must be accepted by the dissertation committee, at least six months prior to defending the dissertation.
7. When the candidate submits the Application for Graduation, he/she must indicate the following as a check-list: (i) Date of QE taken and Candidacy filed; (ii) Date of Dissertation Proposal presented and approved by the Ph. D. Committee and (iii) Status on the Plan of Study.
8. Draft copy of the dissertation must be submitted for review by the Ph. D. Committee at least 15 days prior to the date of defending the dissertation. And, the dissertation must be completed and orally defended.

It is expected that all doctoral candidates have at least one research paper published or accepted for publication in a fully refereed conference or journal prior to graduation. Patent relevant to the Ph. D. research topic/dissertation as approved by USPO with an assigned number can substitute the journal or conference publication requirement. Every doctoral student must maintain a Research Portfolio containing research papers (book chapter, conference, or journal publications accepted or published, patents, non-refereed publications) done throughout the student's PhD degree studies. The dissertation will be added to the Research Portfolio prior to graduation. The portfolio must be approved by a graduate advisor prior to graduation certification.

#### **Transfer Credits**

Any transfer credit toward requirements for the Ph.D. program must be approved by the Department and the University. A maximum of 30 credits (which may include credits taken toward the master's degree with no more than 6 credits for the M.S. thesis) can be transferred into the student's program of study.

#### **Residency Requirements**

A student must spend at least two consecutive semesters as a full-time student at Florida Atlantic University registered for a minimum of 9 credits each semester.



# Bioengineering

Bioengineering stands at the intersection of the revolution taking place in advanced medical treatments as a result of applying the principles and practice of the engineering and computer science disciplines to the biological, biomedical and medical sciences. Bioengineering is a broad and emerging field that impacts drug delivery, surgery, diagnosis, prevention and treatment. Students successfully completing the Master of Science in Bioengineering degree program will be prepared for professional careers in businesses related to medical diagnostics, prosthetic devices and neural and other implants; the pharmaceutical and biotechnology industries; and consulting in health-related fields, as well as other positions in industry, commerce, education and government. Students will also be prepared to continue their formal education at the Ph.D. level in a variety of science and engineering disciplines and at the M.D. level in certain cases.

## **Combined Bachelor of Science in Engineering and Computer Science/ Master of Science with Major in Bioengineering**

Bachelor of Science candidates in any College of Engineering and Computer Science program with a cumulative GPA of at least 3.25 at the end of their junior year are eligible to apply to the combined program, which allows students to complete their bachelor's, as well as a master's in Bioengineering, within approximately five years. After application and admittance to the graduate program at the beginning of their senior year, up to nine credits of approved graduate-level courses may be taken and counted toward both the B.S. and M.S. degrees as long as the following two criteria are met: (a) minimum 120 credits for B.S. degree, and (b) minimum 30 credits (5000-level or higher) for M.S. degree. Therefore a maximum of 9 credits can be double counted if the number of credits for both BS and MS exceeds 150. Students must retain a cumulative GPA of 3.25 GPA by the time of graduation. Thesis and Non-Thesis options are available. See below for master's program admission and degree requirements.

## **Master of Science with Major in Bioengineering**

### **Admission Requirements**

All applicants must submit GRE scores and official transcripts from all previous postsecondary institutions attended. Applicants for admission will be evaluated on an individual basis and must satisfy the following requirements. Students with non-engineering Bachelor's degrees, click [here](#) for additional requirements.

1. An applicant whose native language is not English must obtain a score of 550 or more (CBT-213) on the Test of English as a Foreign Language (TOEFL);
2. A Baccalaureate degree in Biology, Chemistry, Physics, Computer Science or Engineering with a mathematics background through Calculus 2 or calculus with basic differential equations;\*
3. A minimum GPA of 3.0 (of a possible 4.0 maximum) in Science, Mathematics and Engineering courses;
4. A combined score (verbal + quantitative) of at least 295 on the Graduate Record Examination (GRE). GRE scores more than five years old are normally not acceptable;

\* Students whose backgrounds are not in the disciplines noted should expect to take additional coursework.

### **Submission of Plan of Study**

Graduate students are required to submit a Plan of Study when they have completed between 9 and 15 credits of coursework with a minimum cumulative GPA of 3.0. A student may not register for thesis credits prior to submitting a Plan of Study.

### **Degree Requirements**

Students must satisfy all of the University graduate requirements. In addition, the following specific degree requirements apply, depending on the choice of degree program:

#### **Master of Science Degree Thesis Option (30 credits)**

1. Requires 6 credits of orally defended thesis.
2. Requires 24 credits of approved graduate coursework (5000-level or higher) of which 12 credits are program core courses and the remaining 12 credits are approved elective courses offered by the College of Engineering & Computer Science and the Charles E. Schmidt College of Science.
3. Every student must maintain a Research Portfolio containing research papers (book chapter, conference, or journal publications accepted or published, patents, DIS based research papers, graduate course based research papers, technical reports) done throughout the student's MS degree studies. The MS thesis will be added to the Research Portfolio prior to graduation. The portfolio must be approved by a graduate advisor prior to graduation certification.

**Note:** No more than 3 credits of Directed Independent Study may be applied toward the master's degree with thesis option.

#### **Master of Science Degree Non-Thesis Option (33 credits)**

1. Requires 3 credits of research project taken as Directed Independent Study with one of the College of Engineering and Computer Science faculty. As a minimum the student must submit a technical report at the conclusion of the course. The technical report will be added to the Research Portfolio.

2. Requires 30 credits of approved coursework of which 12 credits are program core courses and the remaining 18 credits are approved elective courses offered by the College of Engineering & Computer Science and the Charles E. Schmidt College of Science.

**Note:** No more than 6 credits of Directed Independent Study may be applied toward the master's degree non-thesis option.

3. Every non-thesis student must maintain a Research Portfolio containing research papers (book chapter, conference, or journal publications accepted or published, patents, DIS based research papers, graduate course based research papers, technical reports) done throughout the student's MS degree studies. Every non-thesis student is expected to have at least one research paper in the Research Portfolio before graduation. The portfolio must be approved by a graduate advisor prior to graduation certification.

**Deficiency Requirements in the M.S. in Bioengineering Program**

It is expected that students successfully complete a course in Genetics or Molecular Genetics (PCB 4522 or PCB 3063 at FAU or equivalent) at any time during their MSBE studies. The lack of this course will be considered a deficiency. Students are expected to take the necessary course during their course program as an extra load beyond the regular graduate coursework. A Genetics course must be completed prior to enrollment to the Biotechnology Lab core course.

Students who have had no computer programming coursework during their BS studies are required to take any undergraduate programming course (such as COP 2220 Introduction to C or EEL 2161 C for Engineers) as a deficiency. The requirement must be satisfied prior to taking any of the following core courses: BME 5742 Biosystems Modeling and Control or BME 6762 Bioinformatics: Bioengineering Perspectives.

Furthermore, an advisor's approval is required for students not having the required mathematics background.

**Program Core Courses (12 Credits)**

| Course No. | Course Name                                 |
|------------|---|
| BME 5000   | Introduction to Bioengineering              |
| BME 5742   | Biosystems Modeling and Control             |
| BME 6762   | Bioinformatics: Bioengineering Perspectives |
| BSC 6935   | Biotechnology Lab                           |

Students who pursue a non-thesis option must take 3 credits of research-oriented directed independent study (BME 6905).

**Deficiency Requirements (Not counted in the total program credits)**

| Course No. | Course Name               |
|------------|---------------------------|
| PCB 3063   | Genetics (4 credits)      |
| EEL 2161   | C for Engineers           |
| <b>OR</b>  | <b>OR</b>                 |
| COP 2220   | Intro to Programming in C |

**Electives:**

**Thesis Option:** 12 credits of elective courses, as follows

At least 9 credits from the Advising Sheet list of Engineering and Computer Science or Science Bioengineering courses (such as Tissue Engineering, Stem Cell Engineering, Biomaterials, Introduction to Microfluidics and BioMEMS, Introduction to Robotics, NanoBiotechnology, Robotic Applications and Orthopedic Biomechanics, Medical Imaging, Bio-Signal Processing and Bioinformatics).

Up to 3 elective credits of approved Engineering and Computer Science or Science coursework may be added (courses such as Digital Signal Processing, Digital Image Processing, Machine Learning and Artificial Intelligence, Modern Control, Advanced Database Systems, Nanotechnology, Neuroscience 1 and 2, ~~Immunology, Biology of Cancer~~, or a directed independent study course).

No 4000-level courses are allowed for Thesis Option students.

**Non-Thesis Option:** 18 credits of elective courses, as follows

At least 9 credits from the Advising Sheet list of Engineering and Computer Science or Science Bioengineering courses (such as Tissue Engineering, Stem Cell Engineering, Biomaterials, Introduction to Microfluidics and BioMEMS, Introduction to Robotics, NanoBiotechnology, Robotic Applications and Orthopedic Biomechanics, Medical Imaging, Bio-Signal Processing and Bioinformatics).

Up to 9 elective credits of approved Engineering and Computer Science or Science coursework may be added (courses such as Digital Signal Processing, Digital Image Processing, Machine Learning and Artificial Intelligence, Modern Control, Advanced Database Systems, Nanotechnology, Neuroscience 1 and 2, Immunology, Biology of Cancer, or an additional directed independent study course). Non-thesis students may take no more than one 4000-level elective.

Up to 6 elective credits may be free elective courses (not included on the Bioengineering advising Sheet) subject to approval of the Bioengineering Program Advisor.

### **Bioengineering Certificate**

The College offers a graduate non-degree-seeking certificate in Bioengineering.

This certificate program is a practice-oriented, part-time graduate program designed to assist engineers, scientists, technical professionals and qualified senior undergraduates in the launch and/or development of their careers and to provide the technical expertise needed in the rapidly changing business, government and industrial environments.

### **Program Highlights**

This is a 15-credit non-degree-seeking graduate certificate program focused on the application of engineering and computer science principles to biotechnology, bioinformatics and biosystems. It is designed for engineers and scientists working in the biotechnology, pharmaceutical, health care, drug discovery, biomedical, medical instrumentation and allied sectors.

### **Admission Requirements**

The applicant must satisfy the following criteria:

1. A Bachelor's degree in biology, chemistry, physics or engineering with a mathematics background through Calculus 2 or calculus with basic differential equations. Qualified senior undergraduates may be accepted into the graduate certificate program with appropriate committee recommendation;
2. GPA of 3.0 in science, mathematics and engineering courses;
3. No GRE scores are necessary. Student transcripts should demonstrate competency in science, mathematics and engineering coursework.

Interested individuals should complete an application form available from the Department's [website](#).

### **Certificate Requirements**

PCB 3063 Genetics (or an equivalent course) as a deficiency requirement, with a minimum grade of C.

9 credits of Bioengineering courses, such as Introduction to Bioengineering, Biosystems Modeling and Control, Bioinformatics: Bioengineering Perspectives, Tissue Engineering, Stem Cell Engineering, Biomaterials, Introduction to Microfluidics and BioMEMS, Introduction to Robotics, NanoBiotechnology, Robotic Applications and Orthopedic Biomechanics, Medical Imaging and Bio-Signal Processing.

6 credits of Science courses relevant to Bioengineering, such as Biotechnology Lab, Bioinformatics and Neuroscience 1 and 2.

All courses must be at the 5000 and 6000 levels.

The grade point average of the above 15 credits must be 3.0 or better.