FAU
FLORIDA ATLANTIC UNIVERSITY

PROGRAM CHANGE REQUEST
Graduate Programs

Department Computer & Electrical Eng. and Computer Sci.

College Engineering and Computer Science

UGPC Approval _____
UFS Approval _____
Banner Posted _____
Catalog _____

Program Name	Effective Date (TERM & YEAR)
MS in Computer Science, MS in Computer Engineering, MS in Electrical Engineering, MS in Bioengineering	SPRING 2018

Please explain the requested change(s) and offer rationale below or on an attachment

This proposal requests updating the catalog for MS in Computer Science, MS in Computer Engineering, MS in Electrical Engineering, MS in Bioengineering:

- No 4000-level course is allowed toward the degree for MS non-thesis students

Faculty Contact/Email/Phone	Consult and list departments that may be affected by the change(s) and attach documentation
Dr. Mihaela Cardei, mcardei@fau.edu	NA

Approved by

		Date
Department Chair	*[signature]*	08/21/2017
College Curriculum Chair	*[signature]*	10 - 2 - 2017
College Dean	*[signature]*	10/2/2017
UGPC Chair	*[signature]*	10-18-17
Graduate College Dean	*[signature]*	10 -18 -17
UFS President		
Provost		

Email this form and attachments to UGPC@fau.edu one week before the UGPC meeting so that materials may be viewed on the UGPC website prior to the meeting.

GRADUATE COLLEGE

OCT 0 2 2017

Received

Computer Science and Computer Engineering

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

The department offers a combined Bachelor of Science in Computer Engineering (B.S.C.E.) to Master of Science (M.S.) program. In the computer science area, it offers a combined Bachelor of Science (B.S.) to Master of Science (M.S.) degree program. The bachelor's degrees and the master's degrees must be in the same area. Students in either combined program may count up to 9 credits of approved graduate coursework (5000 level or higher) toward both their bachelor's and master's degrees as long as the following criteria are met the combined program includes a minimum of 150 credits:

1. The student has met the minimum 120 credits for the bachelor's degree; and

2. The student has taken a minimum of 30 credits in 5000 level or higher courses for the master's program.

A maximum of 9 graduate credits may then be counted for both the bachelor's and master's programs if the total number of credits exceeds 150.

With an approximate duration of five years, these combined programs provide attractive ways for students to continue their graduate work. Students complete the undergraduate program first.

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; and

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. 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.

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

The department offers a Bachelor of Science in Electrical Engineering/Master of Science in Computer Engineering degree program. Program details are listed in the Electrical Engineering section under Combined Programs.

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. The GRE requirement is waived for any student who has a baccalaureate degree from FAU's Department of Computer & Electrical Engineering and Computer Science with a GPA of at least 3.25 (out of a possible 4.0) in the last 60 credits attempted prior to graduation;

4. International students from non-English-speaking countries must be proficient in written and spoken English as evidenced by a score of at least 500 (paper-based test) or 213 (computer-based test) or 79 (Internet-based test) on the Test of English as a Foreign Language (TOEFL) or a score of at least 6.0 on the International English Language Testing System (IELTS).

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.

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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 programs.

Master of Science with Major in Computer Engineering, 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. A minimum of 3 credits must be selected from each of the three groups listed in Option A.

b. A minimum of 18 credits of 6000-level courses must be completed.

c. No more than 3 credits of directed independent study may be taken

d. No course can be counted toward the degree that is more than 10 years old at the time the degree is awarded.

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

3. Must have a GPA of 3.0 (out of 4.0) or better.

4. All courses in the degree program must be completed with a grade of "C" or better.

5. Every thesis student must maintain a Research Portfolio containing research papers (book chapter, conference or journal contributions accepted or published, patents, directed independent study-based research papers,-technical reports) done throughout the student's master's degree studies. The master's thesis is added to the Research Portfolio prior to graduation. The portfolio must be approved by a graduate advisor prior to graduation certification.

Master of Science with Major in Computer Engineering, Non-Thesis Option (33 credits)
1. Requires 33 credits of approved coursework with the following constraints:

a. A minimum of 3 credits must be selected from each of the three groups listed in Option A.

b. A minimum of 18 credits of 6000-level courses must be completed.

c. No more than 6 credits of directed independent study may be taken.

d. One 3-credit, research-oriented directed independent study course must be taken after completion of 18 credits of coursework. At the end of the directed independent study course, the student is expected to submit a paper or technical report to be placed in the student's Research Portfolio.

e. No course can be counted toward the degree that is more than 10 years old at the time the degree is awarded.

f. ~~A maximum of one 4000-level course may be allowed toward the degree with prior approval of the student's adviser. This course must be passed with a minimum grade of "B."~~ No 4000-level course is allowed toward the degree. Courses taken to make up for the deficiencies will not be counted toward the degree.

2. Must have a GPA of 3.0 (out of 4.0) or better.

3. All courses in the degree program must be completed with a grade of "C" or better.

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

Transfer Credits

Any transfer credits toward the requirements for a master's degree in Computer Engineering 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 A

Group 1: Computer Architecture and Design	
Advanced Computer Architecture	CDA 6155
Embedded System Design 1	CDA 6316
Multiprocessor Architecture	CDA 6132
Structured VLSI Design	CDA 6214

Group 2: Software Development	
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

Group 3: Computer Systems	
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
Advanced Computer Networking	CNT 6516
Vehicular Networks	CNT 6528

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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. The GRE requirement is waived for any student who has a baccalaureate degree from FAU's Department of Computer & Electrical Engineering and Computer Science with a GPA of at least 3.25 (out of a possible 4.0) in the last 60 credits attempted prior to graduation; and

4. International students from non-English-speaking countries must be proficient in written and spoken English as evidenced by a score of at least 500 (paper-based test) or 213 (computer-based test) or 79 (Internet-based test) on the Test of English as a Foreign Language (TOEFL) or a score of at least 6.0 on the International English Language Testing System (IELTS).

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.

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

Master of Science with Major in Computer Science, 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. A minimum of 3 credits must be selected from each of the three groups listed in Option B.

b. A minimum of 18 credits of 6000-level courses must be completed.

c. No more than 3 credits of directed independent study may be taken.

d. No course can be counted toward the degree that is more than 10 years old at the time the degree is awarded.

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

3. Must have a GPA of 3.0 (out of 4.0) or better.

4. All courses in the degree program must be completed with a grade of "C" or better.

5. Every thesis student must maintain a Research Portfolio containing research papers (book chapter, conference or journal contributions accepted or published, patents, directed independent study-based research papers, technical reports) done throughout the student's master's degree studies. The master's thesis is added to the Research Portfolio prior to graduation. The portfolio must be approved by a graduate advisor prior to graduation certification.

Master of Science with Major in Computer Science, Non-Thesis Option (33 credits)
1. Requires 33 credits of approved coursework with the following constraints:

a. A minimum of 3 credits must be selected from each of the three groups listed in Option B.

b. A minimum of 18 credits of 6000-level courses must be completed.

c. No more than 6 credits of directed independent study may be taken.

d. One 3-credit, research-oriented directed independent study course must be taken after completion of 18 credits of coursework. At the end of the directed independent study course, the student is expected to submit a paper or technical report to be placed in the student's Research Portfolio.

e. No course can be counted toward the degree that is more than 10 years old at the time the degree is awarded.

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

2. Must have a GPA of 3.0 (out of 4.0) or better.

3. All courses in the degree program must be completed with a grade of "C" or better.

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

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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

Group 1: Theory	
Analysis of Algorithms	COT 6405
Queueing Theory	MAP 6264
Theory and Philosophy of Computation	COT 6200
Randomized Algorithms	COT 6446

Group 2: Software Development	
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

Group 3: Computer Systems	
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
Advanced Computer Networking	CNT 6516
Vehicular Networks	CNT 6528

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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 counted 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 count 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.

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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 (Topics include Web Services, Web Project Development, Network Programming)	COT 5930
Topics in Computer Science (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.

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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 on the Graduate Record Examination (GRE) or a GMAT score of 500 or higher. GRE scores more than five years old are normally not acceptable;

4. International students from non-English-speaking countries must be proficient in written and spoken English as evidenced by a score of at least 500 (paper-based test) or 213 (computer-based test) or 79 (Internet-based test) on the Test of English as a Foreign Language (TOEFL) or a score of at least 6.0 on the International English Language Testing System (IELTS); and

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 (5000 level or higher), 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.

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:

Advanced Data Mining and Machine Learning	CAP 6778
Software Maintenance and Evolution	CEN 6027
Software Testing	CEN 6076
Computer Data Security	CIS 6370
Mobile Computing	CNT 6517
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
Information Retrieval	CAP 6776
Cloud Computing	CEN 5086
Theory and Implementation of Database Systems	COP 6731
Cyber Security: Measurement and Data Analysis	CTS 6319

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

Information Technology Project and Change Management	ISM 6316
Management of Information Assurance and Security	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 Management	ISM 6316
Advanced Business Analytics	ISM 6405
Management of Information Assurance and Security	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
Theory and Implementation of Database Systems	COP 6731
Topics in Computer Science	COT 5930
Wireless Networks	EEL 6591
Information Retrieval	CAP 6776
Cloud Computing	CEN 5086
Cyber Security: Measurement and Data Analysis	CTS 6319

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Electrical Engineering

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 graduate coursework (5000 level or higher) to apply toward both degrees as long as the following criteria are met the combined program includes a minimum of 150 credits:

1. The student has met the minimum 120 credits for the bachelor's degree; and

2. The student has taken a minimum of 30 credits in 5000 level or higher courses for the master's program.

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. Students complete the undergraduate degree first.

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.

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.

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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 in the B.S.E.E. program qualifies the graduate to enter the M.S.Cp.E. program with no deficiencies, provided that the GPA and other computer engineering admission requirements are met. Up to 9 credits of approved graduate coursework (5000 level or higher) can apply toward both degrees as long as the following criteria are met the combined program includes a minimum of 150 credits:

1. The student has met the minimum 120 credits for the bachelor's degree; and

2. The student has taken a minimum of 30 credits in 5000-level of higher courses for the master's 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.

Degree Requirements
The following specific technical elective 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

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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. International students from non-English-speaking countries must be proficient in written and spoken English as evidenced by a score of at least 500 (paper-based test) or 213 (computer-based test) or 79 (Internet-based test) on the Test of English as a Foreign Language (TOEFL) or a score of at least 6.0 on the International English Language Testing System (IELTS).

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. The GRE requirement is waived for any student who has a

baccalaureate degree from FAU's Department of Computer & Electrical Engineering and Computer Science with a GPA of at least 3.25 (of a possible 4.0) in the last 60 credits attempted prior to graduation.

* 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. No 4000-level course may be counted toward the degree;

d. A 3-credit course with math prefix or one of the following courses: EEL 5613, Modern Control; EEE 5502, Digital Processing of Signals; EEL 6482, Electromagnetic Theory 1; EOC 5172, Mathematical Methods in Ocean Engineering 1;

3. Every master's student must maintain a Research Portfolio containing research papers (book chapter, conference or journal contributions accepted or published, patents, directed independent study-based research papers, technical reports) done throughout the student's M.S. degree studies. The M.S. 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 3 credits at the 4000 level;~~ No 4000-level course is allowed toward the degree. Courses taken to make up for the deficiencies will not be counted toward the degree;

c. A 3-credit course with math prefix or one of the following courses: EEL 5613, Modern Control; EEE 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 directed independent study 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 contributions accepted or published, patents, directed independent study-based research papers, technical reports) done throughout the student's M.S. degree studies. Every non-thesis student is expected to

have at least one research paper in the Research Portfolio prior to 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
From the following list of deficiency EE courses, students must take the Electronics Laboratory 1 course and at least four more courses.

Introduction to Microprocessor Systems	CDA 3331C
Electromagnetic Fields and Waves	EEL 3470
Electronics 2	EEE 4361
Introduction to Digital Signal Processing	EEE 4510
Communications Systems	EEL 4512
Controls 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 deficient 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.

Master of Science with Major in Electrical 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 Electrical 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.

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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 any major in the College/
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 9 credits of approved graduate-level courses (5000 level or higher) may be taken and counted toward both the B.S. and M.S. degrees as long as ~~the following criteria are met~~ the combined program includes a minimum of 150 credits:

1. The student has met the minimum 120 credits for the bachelor's degree; and

2. The student has taken a minimum of 30 credits in 5000 level or higher courses for the master's program.

~~A maximum of 9 credits may then be counted for both the bachelor's and master's programs if the total number of credits exceeds 150.~~

Students must retain a cumulative GPA of 3.25 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. International students from non-English-speaking countries must be proficient in written and spoken English as evidenced by a score of at least 500 (paper-based test) or 213 (computer-based test) or 79 (Internet-based test) on the Test of English as a Foreign Language (TOEFL) or a score of at least 6.0 on the International English Language Testing System (IELTS);

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) or an MCAT score of 500 or higher. GRE scores more than five years old normally are not acceptable. The GRE requirement is waived for any student who has a baccalaureate degree from FAU's Department of Computer & Electrical Engineering and Computer Science with a GPA of at least 3.25 (out of a possible 4.0) in the last 60 credits attempted prior to graduation.

* 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 and Computer Science and the Charles E. Schmidt College of Science.

3. No 4000-level course is allowed toward the degree. Courses taken to make up for the deficiency ~~GRADUATE COLLEGE~~ counted toward the degree.

4̶3̶. Every student must maintain a Research Portfolio containing research papers (book chapter, conference or journal contributions accepted or published, patents, directed independent study-based research papers, technical reports) done throughout the student's M.S. degree studies. The M.S. 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 24 credits of approved coursework of which 12 credits are program core courses and the remaining 12 credits are approved elective courses offered by the College of Engineering and Computer Science and the Charles E. Schmidt College of Science.

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

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 contributions accepted or published, patents, directed independent study-based research papers, technical reports) done throughout the student's M.S. degree studies. Every non-thesis student is expected to have at least one research paper in the Research Portfolio prior to 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 into the Special Topics (Advanced Biotechnology Lab) core course.

Students who have had no computer programming coursework during their B.S. studies are required to take any undergraduate programming course (such as COP 2220, Introduction to Programming in C, to satisfy this 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)

Introduction to Bioengineering	BME 5000
Biosystems Modeling and Control	BME 5742
Bioinformatics: Bioengineering Perspectives	BME 6762
Special Topics (Advanced Biotechnology Lab)	BSC 6936

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)

| Genetics | PCB 3063 |
| Introduction to Programming in C | COP 2220 |

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, or a directed independent study course).

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

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

At least 9 credits from the Advising Sheet of Engineering and Computer Science or Science Bioengineering courses (such as Tissue Engineering, Stem Cell Engineering, Biomaterials, Introduction to Microfluidics and BioMEMSs, 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.

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