environmental impact assessment.

**TTE 3004 Transportation Engineering** (3). Prereq: CEG 2202C; EGN 2212; junior standing. An introductory study of all modes of transportation in the United States with special emphasis on highway planning and design, construction, operation, management, and safety.


**TTE 4271 Intelligent Transportation Systems (ITS)** (3). Prereq: EGN 3443; TTE 3004. Course covers advanced traffic management systems (ATMS), advanced traveler information systems (ATIS), advanced vehicle control systems, commercial vehicle operations, rural ITS, human factors, institutional issues, architecture and standards, simulation and modeling.

**TTE 4804 Highway Geometric Design** (3). Prereq: CEG 2202C; TTE 3004. Principles and procedures for the geometric design of highways and streets; consideration of traffic, land use, and aesthetic factors.

**TTE 4830 Hot Mix Asphalt Mixture Design** (3). Prerequisite: CCE 3101. The course covers aggregate properties and tests, tests of asphalt and asphalt concrete mixes, fundamental engineering characteristics of hot-mix asphalt concrete, mix design methods for asphalt concrete, as well as Superpave-mix design methodology and production and placement of hot-mix asphalt.

**Graduate Courses**

- CCE 5035. Construction Planning and Scheduling (3).
- CCE 5036. Project Controls in Construction (3).
- CEG 5015. Advanced Soil Mechanics (3).
- CEG 5115. Foundation Engineering (3).
- CEG 5127 Highway and Airport Pavement Design (3).
- CEG 5705 Environmental Geotechnics (3).
- CES 5105 Advanced Mechanics of Materials (3).
- CES 5106 Advanced Structural Analysis (3).
- CES 5144 Matrix Methods for Structural Analysis (3).
- CES 5209 Structural Dynamics (3).
- CES 5218 Fundamentals of Structural Stability Theory (3).
- CES 5325 Bridge Engineering (3).
- CES 5585 Earthquake/Wind Engineering (3).
- CES 5606 Advanced Steel Design (3).
- CES 5706 Advanced Concrete Design (3).
- CES 5715 Prestressed Concrete (3).
- CES 5845 Composites in Civil Engineering (3).
- CES 6116 Finite Elements in Structures (3).
- CGN 5310 Engineering Data Systems (3).
- CGN 5905 Directed Individual Study (1–6). (S/U grade only.)
- CGN 5910 Supervised Research (1–6). (S/U grade only.)
- CGN 5920 Special Topics in Civil Engineering (1–6).
- CGN 5935 Civil Engineering Seminar (0). (S/U grade only.)
- CGN 6942 Supervised Teaching (3). (S/U grade only.)
- CWR 5125 Groundwater Hydrology (3).
- CWR 5205 Hydraulic Engineering II (3).
- CWR 5305 Urban Stormwater Runoff (3).
- CWR 5516 Numerical Models in Hydraulics (3).
- CWR 5635 Water Resources Planning and Management (3).
- CWR 5824 Coastal and Estuarine Hydraulics (3).
- ENV 5028 Remediation Engineering (3).
- ENV 5030 Applied Environmental Engineering Microbiology (3).
- ENV 5045 Environmental Systems Analysis (3).
- ENV 5055 Chemical Fate and Transport in the Environment (3).
- ENV 5105 Air Pollution Control (3).
- ENV 5407 Water Reuse Engineering (3).
- ENV 5504 Environmental Engineering Processes and Operations (3).
- ENV 5565 Design of Water Quality Management Facilities (3).
- ENV 5615 Environmental Impact Analysis (3).
- TTE 5205 Traffic Engineering (3).
- TTE 5206 Advanced Traffic Flow Analysis (3).
- TTE 5256 Traffic Operations (3).
- TTE 5270 Intelligent Transportation Systems (3).
- TTE 5805 Highway Geometric Design (3).

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**Electrical and Computer Engineering**

**Description:** The mission of the Department of Electrical and Computer Engineering is to provide an innovative academic undergraduate program of excellence to its majors; to produce graduates whose academic achievements match or exceed those of recognized state supported engineering colleges; to produce a greater number of graduates from groups traditionally underrepresented (especially, for historical reasons, African American and female graduates) in electrical and computer engineering; and to achieve national and international recognition through the excellence of its faculty and student research and scholarly pursuits, as well as their professional and service endeavors.

**Bachelor of Science in Electrical Engineering - Program Educational Objectives**

The bachelor of science in electrical engineering (BSEE) degree program prepares its graduates for a successful career in the rapidly evolving and intellectually challenging field of electrical engineering. The Department requires its graduates to develop a strong understanding of the relevant mathematics, computer programming and natural science concepts needed by practicing electrical engineers.

Graduates must demonstrate an ability to apply this knowledge in several fundamental areas of electrical engineering including analog circuit design, digital logic design, electromagnetics, signal and linear system analysis, communications, and microprocessor based design. They also must successfully demonstrate sufficient knowledge and the technical skills needed to complete a major design experience and to function as a member of a multi-disciplinary team.

With the addition of electrical engineering technical electives, graduates have an opportunity to prepare for advanced graduate-level training or a professional career in a variety of electrical engineering application areas including digital systems, communication systems, digital signal processing, control systems, microelectronics, power systems, or electromagnetics.

In addition, in the several years after graduation graduates are expected to accomplish the following:

1. Participate in either the research, development or application of engineering solutions that have a positive impact on society;
2. Make contributions to workforce diversity;
3. Show a commitment to lifelong learning and continuous self-improvement; and
4. Become proficient in the oral and written communication of their work and ideas.

**Bachelor of Science in Computer Engineering - Program Educational Objectives**

The bachelor of science in computer engineering (BSCpE) degree program prepares its graduates for a successful career in the interdisciplinary field of computer engineering. The program is built firmly on the foundation of the department’s well established bachelor of science in electrical engineering (BSEE) degree program. Consequently, graduates from the BSCpE degree program complete all of the required core coursework of BSEE majors, additional core computer engineering coursework, and a set of specialized courses offered through the Department of Computer and Information Sciences at the Florida A&M University. BSCpE graduates have an opportunity to prepare for advanced graduate-level training or a professional career in or built upon a variety of computer engineering application areas including digital systems, digital signal processing, computer networks and VLSI design.
Graduates from the BSCpE degree program must develop a strong understanding of relevant mathematics, programming and physical science concepts needed by practicing computer engineers. They also must demonstrate an ability to apply this knowledge in several fundamental areas of electrical engineering (e.g. analog circuit design, electromagnet-ics, signal and linear system analysis, communications), computer engi-neering (e.g. digital logic design, microprocessor-based system design, and computer architecture), and computer science (e.g. object-oriented programming, data structures, computer algorithms and operating sys-tems.) Graduates also must demonstrate successfully sufficient knowl-edge and the technical skills needed to complete a major design experi-ence and to function as a member of a multi-disciplinary team.

In addition, in the several years after graduation graduates are expected to accomplish the following:

1. Participate in either the research, development or application of engineering solutions that have a positive impact on society;
2. Make contributions to workforce diversity;
3. Show a commitment to life-long learning and continuous self-improvement; and
4. Become proficient in the oral and written communication of their work and ideas.

Program Review

The department faculty has established a process to periodically review and revise its two program educational objectives after obtaining feedback from its primary constituent groups. The faculty also is committed to teaching professional and ethical responsibility by example and by practice. The active sponsored research activities of the faculty ensure the program curriculum remains contemporary and motivates the need for life-long learning.

Technical Electives

Electrical Engineering technical electives provide the student an opportunity to achieve a greater breadth of knowledge and some degree of specialization in selected areas of special interest. Electives are offered in computer engineering and the following five electrical engineering application areas:

1. Microelectronics deals with all aspects of (primarily solid-state) electronic devices, the analysis and design of analog and digital circuits, their implementation and fabrication using microelectronic techniques, and their application in a wide variety of system;
2. Digital signal processing and control systems concentrate on the design and analysis of systems in which discrete and continuous signals are used for conveying information and controlling physical systems and processes. Included are the encoding, decoding, and representation of information in both the time and frequency domain;
3. Communications is concerned with the preparation, transmission, and reception of encoded information via media ranging from wires to fiber optic cables and space. Included are topics such as AM, FM, and pulse modulation techniques; telecommunication systems; satellite telemetry; and computer networks;
4. Electromagnetics in the broadest sense is the study of the relationship between electric current, electric and magnetic fields, and their interactions. It is the foundation of electrical and electronic technology. The practical applications of this theory include the design of antennas, transmission lines, RF, microwave and optical transmission facilities, and radar;
5. Power systems engineering is concerned with the design and operation of electric power generation, transmission, and distribution for an increasing customer demand. It involves the modeling, analysis, and design of power system components including power transformers, electric motors, synchronous generators, and high voltage power transmission and distribution networks. Power system engineering also includes: the investigation of alternative methods for generating electrical energy, the control and reliability of complex power networks, power quality, economic factors, and environmental effects.

The department maintains well-equipped, dedicated instructional laboratory facilities for each required laboratory course and research laborato ries in each major area of interest. The department has access to a large number of personal computers, advanced workstations, and specialized CAD systems. Open-access facilities are also available for design projects and preparation of technical documentation.

Honors in the Major

The Department of Electrical and Computer Engineering offers a program of honors in electrical engineering to encourage the talented student to extend his or her undergraduate experience by participating in directed or independent research on a topic relative to electrical engineering that is not included in the regular curriculum. For requirements and other information, see the “University Honors Program, Honors-Undergraduate” sections of this General Catalog.

Faculty

Chairman: DeBrunner, Victor E.
Associate Chairman: Harvey, Bruce A.
Eminent Scholar: Thagard, Norman E.
Professors: Arora, Rajendra K.; DeBrunner, Victor E; Foo, Simon Y.; Perry, Reginald J.; Roberts, Rodney G.; Thagard, Norman E.; Zheng, Jim P.
Associate Professors: Arora, Krishna; Baldwin, Thomas L.; DeBrunner, Linda S.; Harvey, Bruce A.; Kwan, Bing W.; Li, Hui; Meyer-Baese, Anke D.; Meyer-Baese, Uwe H.; Tung, Leonard J.
Assistant Professors: Andrei, Petru; Edrington, Chris S.; Weatherspoon, Mark H.; Yu, Ming;
Associate in Electrical Engineering: Brooks, Geoffrey W.
Assistants in Electrical Engineering: Rajagopalan, Ramesh; Skinner, Dave

Common Required Courses for Bachelor of Science Degrees and Dual Majors

All candidates for bachelor of science degree in electrical engineering (BSEE) and bachelor of science degree in computer engineering (BSCpE) are required to complete a total of one hundred (100) semester hours of common required courses, of which twenty-four (24) hours are English, social science and humanities courses (General Studies Courses), forty-two (42) hours are engineering core courses (listed below), and thirty-four (34) hours are required electrical and computer engineering courses (listed below).

<table>
<thead>
<tr>
<th>General Education Courses (24 Credits)</th>
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</thead>
<tbody>
<tr>
<td>ENC 1101 Freshman Communication Skills I</td>
<td>................. (3)</td>
</tr>
<tr>
<td>ENC 1102 Freshman Communication Skills II</td>
<td>............... (3)</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>.................................. (6)</td>
</tr>
<tr>
<td>XXX xxxx Humanities</td>
<td>................................ (6)</td>
</tr>
<tr>
<td>XXX xxxx Social Sciences or Humanities</td>
<td>............................... (6)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Engineering Core Courses (42 Credits)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM 1045 General Chemistry I</td>
<td>................................ (3)</td>
</tr>
<tr>
<td>CHM 1045L General Chemistry I Laboratory</td>
<td>.......................... (1)</td>
</tr>
<tr>
<td>COP 2221 Programming in C Language</td>
<td>................................ (3)</td>
</tr>
<tr>
<td>EGM 3512 Engineering Mechanics</td>
<td>................................ (4)</td>
</tr>
<tr>
<td>EML 3100 Thermodynamics</td>
<td>................................ (2)</td>
</tr>
<tr>
<td>MAC 2311 Calculus with Analytical Geometry I</td>
<td>..................... (4)</td>
</tr>
<tr>
<td>MAC 2312 Calculus with Analytical Geometry II</td>
<td>................... (4)</td>
</tr>
<tr>
<td>MAC 3313 Calculus with Analytical Geometry III</td>
<td>................... (5)</td>
</tr>
<tr>
<td>MAP 3305 Engineering Mathematics I</td>
<td>................................ (3)</td>
</tr>
<tr>
<td>MAP 3306 Engineering Mathematics II</td>
<td>........................... (3)</td>
</tr>
<tr>
<td>PHY 2048 General Physics I</td>
<td>................................ (4)</td>
</tr>
<tr>
<td>PHY 2048L General Physics I Laboratory</td>
<td>.......................... (1)</td>
</tr>
<tr>
<td>PHY 2049 General Physics II</td>
<td>................................ (4)</td>
</tr>
<tr>
<td>PHY 2049L General Physics II Laboratory</td>
<td>.......................... (1)</td>
</tr>
</tbody>
</table>
### Required Electrical Engineering Courses (34 Credits)
- EEL 3111 Introduction to Circuit Analysis .................................................(3)
- **EEL 3112 Advanced Circuits with Computers** ........................................(3)
- EEL 3112L Advanced Circuits with Computers Laboratory ..........................(1)
- EEL 3135 Signal and Linear Systems Analysis ...........................................(3)
- EEE 3300 Electronics .................................................................................(3)
- EEE 3300L Electronics Laboratory ..............................................................(1)
- EEE 3472 Electromagnetic Fields I ..............................................................(3)
- EEL 3512 Introduction to Communications ...............................................(3)
- EEL 3705 Digital Logic Design ..................................................................(3)
- EEL 3705L Digital Logic Laboratory ...........................................................(1)
- EEL 4021 Statistical Topics in Electrical Engineering .................................(3)
- EEL 4714 Computer Architecture ...............................................................(3)
- EEE 3300L Electronics Laboratory ..............................................................(1)
- EEL 3713 Computer Architecture (3), and six (6) semester hours of technical electives, and three (3) semester hours of EEL 4915C Electrical Engineering Senior Design Project II.

### Requirements for a Major in Electrical Engineering

Students majoring in electrical engineering are required to complete a total of 128 semester hours of course work, of which one hundred (100) are Common Required Courses, twelve (12) are required Tier-2 electrical engineering course, thirteen (13) semester hours are technical elective courses, and three (3) semester hours of EEL 4915C Electrical Engineering Senior Design Project II.

#### Technical Electives for Electrical Engineering Major

- One (1) semester hour must be an electrical engineering (EE) laboratory elective;
- Twenty-one (21) semester hours must be EE technical electives, and
- Three (3) credits may be an EE or a non-EE elective.

The non-EE technical elective must be selected from a list of departmentally approved courses offered by other departments at Florida A&M University. Courses not on the list may be taken with prior approval of the department.

### Requirements for a Major in Computer Engineering

Students majoring in computer engineering require 128 semester credit hours to graduate, of which one hundred (100) hours are Common Required Courses listed above. The other twenty-eight (28) semester credit hours include thirteen (13) semester hours of CIS courses (listed below), six (6) semester hours of required computer engineering courses: EEE 4710 Introduction to Field Programmable Logic Devices (3) and EEE 1313 Computer Architecture (3), and six (6) semester hours of technical electives, and three (3) semester hours of EEL 4914C, Computer Engineering Senior Design Project II.

#### Required CIS Courses

- COT 3100 Discrete Structures I .................................................................(3)
- COP 3014 Fundamentals of Programming ..............................................(3)
- COP 3014L Fundamentals of Programming Laboratory .......................(1)
- COP 3530 Program, Data and File Structures .......................................(3)
- COP 3610 Operating Systems ...............................................................(3)
- MAP 3305 Engineering Math I .................................................................(3)
- EEL 3112 Advanced Circuits with Computers ...........................................(3)
- EEL 3112L Advanced Circuits with Computers Laboratory .......................(1)
- EEL 3705 Digital Logic Design ...............................................................(3)
- EEL 3705L Digital Logic Design Laboratory ...........................................(1)
- EGE 3512 Engineering Mechanics .........................................................(4)

### Suggested Course Sequence for Electrical Engineering Major (starting with Calculus I)

**(Note: This is an example which shows how degree requirements can be satisfied in eight regular and one summer term. Other course sequences are possible and allowable as long as course prerequisites are observed. Students should verify their plan of study with their advisors.**

#### First Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Sem. Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENC 1101 Freshman Communicative Skills I</td>
<td>3</td>
</tr>
<tr>
<td>MAC 2311 Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>CHM 1045 General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHM 1045L General Chemistry I Lab</td>
<td>1</td>
</tr>
<tr>
<td>Humanities Elective I (Gordon Rule)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

#### Second Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Sem. Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENC 1102 Freshman Communication Skills II</td>
<td>3</td>
</tr>
<tr>
<td>MAC 2312 Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>PHY 2048 General Physics I</td>
<td>4</td>
</tr>
<tr>
<td>PHY 2048L General Physics I Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Humanities Elective II (Gordon Rule)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
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</table>

#### Third Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Sem. Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAP 3305 Engineering Math I</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>

#### EEL 4713 (each three [3] semester hours) plus sixteen (16) semester hours of electrical engineering technical electives and special requirements.

#### Technical Electives and Special Requirements for a Dual Major

- Three (3) semester hours must be EEL 4914C Computer Engineering Senior Design Project II; and
- Three (3) semester hours must be EEL 4915C Electrical Engineering Senior Design Project II

#### Suggested Course Sequence for Electrical Engineering Major

**(Note: This is an example which shows how degree requirements can be satisfied in eight regular and one summer term. Other course sequences are possible and allowable as long as course prerequisites are observed. Students should verify their plan of study with their advisors.**

#### First Year

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<td>ENC 1101 Freshman Communicative Skills I</td>
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<tr>
<td>MAC 2311 Calculus I</td>
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<tr>
<td>CHM 1045L General Chemistry I Lab</td>
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<tr>
<td>Humanities Elective I (Gordon Rule)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
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#### Second Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
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<tbody>
<tr>
<td>ENC 1102 Freshman Communication Skills II</td>
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</tr>
<tr>
<td>MAC 2312 Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>PHY 2048 General Physics I</td>
<td>4</td>
</tr>
<tr>
<td>PHY 2048L General Physics I Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Humanities Elective II (Gordon Rule)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
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</table>

#### Third Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Sem. Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAP 3305 Engineering Math I</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
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</table>
EML 3100 Thermodynamics ............................................ 2
EEL 3135 Signals and Linear Systems Analysis ......................... 3
EEL 4746 Microprocessors ............................................. 3
EEL 4746L Microprocessors Laboratory ................................ 1

Spring Semester
EEL 4021 Statistical Topics in Electrical Engineering ...................... 3
EEE 3300 Electronics I ................................................. 3
EEE 3300L Electronics I Laboratory .................................... 1
EEL 3472 Electromagnetic Fields I ...................................... 3
EEE 3512 Introduction to Communications ................................ 3
EEL Tier-2 Course I .................................................. 3

Total Semester Hours ................................................... 12

Fourth Year
Fall Semester
EEL Tier-2 Course II and III ............................................ 6
EEL 4911C Senior Design Project I .................................... 3
Humanities Elective IV (Gordon Rule) ................................... 3
EE Elective Laboratory .................................................. 1
EEL Tier-2 Course IV .................................................... 3

Spring Semester
EE Technical Electives I, II, III and IV ................................ 12
EEL 4915C Electrical Engineering Senior Design Project II ............... 3

Total Semester Hours ................................................... 16

Suggested Course Sequence for Computer Engineering Major (starting with Calculus I)
First Year
Fall Semester
ENC 1101 Freshman Communicative Skills I ............................ 3
MAC 2311 Calculus I .................................................... 4
CHM 1045 General Chemistry I ........................................ 3
CHM 1045L General Chemistry Lab .................................... 1
Humanities Elective I (Gordon Rule) .................................... 3

Spring Semester
ENC 1102 Freshman Communicative Skills II ............................ 3
COP 2221 Programming in C Language ................................ 3
MAC 2312 Calculus II .................................................... 4
PHY 2048 General Physics I ............................................. 4
PHY 2048L General Physics I Laboratory ................................ 1

Summer Semester
AMH 2091 Introduction to African American-History (Soc. Sci. I) ........ 3

Humanities Elective II (Gordon Rule) .................................... 3

Second Year
Fall Semester
CPHY 2049 General Physics II ......................................... 4
PHY 2049L General Physics II .......................................... 1
COT 3100 Discrete Structures I ........................................ 3
MAC 3313 Calculus III .................................................. 5

EEL 3111 Introduction to Circuit Analysis ................................ 3

Spring Semester
COP 3014 Fundamentals of Programming ................................ 3
MAP 3305 Engineering Math I .......................................... 1
EEL 3112 Advanced Circuits w/Computers ................................ 3
EEL 3705 Digital Logic Design .......................................... 3
EEL 3705L Digital Logic Design Laboratory ................................ 1

Third Year
Fall Semester
COP 3530 Program, File and Data Structures .......................... 3
MAC 3306 Engineering Math II ......................................... 3
EEL 3100 Thermodynamics ............................................. 3
EEL 4746 Microprocessors ............................................. 3
EEL 4746L Microprocessors Laboratory ................................ 1

Spring Semester
COP 3610 Operating Systems .......................................... 3
EEE 3300 Electronics ................................................... 3
EEE 3300L Electronics Laboratory ...................................... 1
EEL 3472 Electromagnetic Fields I ...................................... 3
EEL 4710 Introduction to FPLDs ........................................ 3

Social Science Elective II (Non-History) ................................ 3

Fourth Year
Fall Semester
EEL 4021 Statistical Topics in Electrical Engineering ...................... 3
EEL 4732 Introduction to Communications ................................ 3
EEL 4713 Computer Architecture ....................................... 3
EEL 4911C Senior Design Project I .................................... 3
Humanities Elective III (Gordon Rule) ................................... 3

Spring Semester
EEL 4914C Computer Engineering Senior Design Project II ............... 3
EE Technical Elective ................................................... 3
EE or Non-EE Technical Elective ....................................... 3
EGM 3512 Engineering Mechanics ...................................... 4

Humanities Elective IV (Gordon Rule) .................................... 3

Total Semester Hours ................................................... 16

Academic Requirements and Policies

In accordance with ABET criteria, all engineering students are subject to a uniform set of academic requirements agreed to by both FAMU and FSU. These requirements have been established to ensure that program graduates receive a quality education and make reasonable progress toward satisfying engineering major degree requirements. Students are directed to “FAMU-FSU College of Engineering” Chapter of this Catalog and the departmental website for a list of all academic requirements and policies.
ECE Course Prerequisite Requirement

In addition to the college course prerequisite requirements, the Department of Electrical and Computer Engineering requires students to have obtained a grade in the range of "C" in all courses listed as prerequisites for the department's engineering core courses.

Definition of Prefix

EEL - Electrical Engineering

Course Descriptions

EEL 3003 Introduction to Electrical Engineering (3). Prerequisites: MAC2312; PHY2049; PHY 2049L; Corequisite: EEL3003L. Introduction to electrical engineering concepts for non-electrical engineering majors. Covers a broad range of topics including basic circuit theory, semiconductor devices, instrumentation, amplifiers, and machines.

EEL 3003L Introduction to Electrical Engineering Laboratory (1) Prerequisites: MAC2312; PHY2049; PHY 2049L; Corequisite: EEL 3003. Laboratory in support of EEL 3003. Must be taken concurrently with the first enrollment in EEL 3003. Must be dropped if EEL 3003 is dropped.

EEL 3111 Introduction to Circuit Analysis (3) Prerequisite: EEL3112; Corequisite: PHY 2049; PHY 2049L; MAC 3313. Current, voltage, and power; resistors, inductors, and capacitors; network theorems and laws; phasors; impedance; sinusoidal steady-state analysis.

EEL 3112 Advanced Circuits with Computers (3) Prerequisite: EEL3111; Corequisite: MAP3305. Sinusoidal steady-state power analysis; three-phase circuits; operational amplifier; transient and forced response; frequency response; two-port networks; circuit analysis with computers.

EEL 3112L Advanced Circuits with Computers Laboratory (1) Prerequisite: EEL3111; Corequisite: MAP3305; EEL3112. Instrumentation and measuring techniques; current, voltage, and power measurements; response of passive circuits; AC and DC design; computer applications.

EEL 3135 Signal and Linear System Analysis (3) Prerequisite: EEL3112; MAP 3305. Classification and representation of signals and systems; Laplace transform; Z-transform; convolution; state variable techniques; stability and feedback.

EEL 3216 Fundamentals of Power Systems (3) Prerequisite: EEL3112. Introduction to the fundamentals of energy conversion; structure of power systems; and power system components: transformers, rotating machines, and transmission lines. The operation and analysis of power systems are presented.

EEE 3300 Electronics (3) Prerequisite: EEL3112. Diode models and circuits; DC biasing of bipolar-junction and field-effect transistors; small- and large-signal transistor models; frequency analysis of single-stage AC amplifiers.

EEE 3300L Electronics Laboratory (1) Prerequisites: EEL3112; EEL3112L; Corequisite: EEL 3300. Laboratory in support of EEL3300.

EEE 3472 Electromagnetic Fields I (3) Prerequisites: EEL 3112; MAP 3306; PHY2049; PHY 2049L. Corequisite: COP2221. Vector analysis – orthogonal coordinate system, vector operators (gradient, divergence, curl, Laplacian); electrostatics electric charge and current, Coulomb’s law, Gauss’ law, electric potential and field gradient, Poisson’s equations, resistance, permittivity, capacitance, electrostatic energy, magnetostatics - magnetic force and torque, Biot-Savart law, Ampere’s law, vector potential, magnetic moment, permeability, hysteresis, inductance, magnetic potential, time-varying fields: induction. Faraday’s law, displacement current, Maxwell’s equations, boundary conditions; transmission lines – propagation equations, characteristic impedance, reflections, input impedance, lossless lines, power flow, losses, the Smith chart, impedance matching.

EEE 3473 Electromagnetic Fields II (3) Prerequisite: EEL3472. Maxwell’s equations, plane waves – time-harmonic fields and Maxwell's equation propagation in free space and in lossy media current flow in conductors. Power density, polarization, wave reflection and transmission – Snell’s law, reflection and transmission guided waves; radiation and antennas – basic antenna properties and parameters (radiation pattern, beam width, directivity, effective aperture), short dipoles, antenna arrays, large-aperture antennas; applications in satellite communication, wireless systems, and remote sensing.

EEE 3512 Introduction to Communications (3) Prerequisites: EEL3112; MAP3306. Signal analysis, Fourier series/Fourier transform, sampling theorem, distortions in signal transmission, and analog modulation - AM, FM, pulse modulation, pulse-code modulation and pulse shaping.

EEE 3705 Digital Logic Design (3) Prerequisite: COP2221. Fundamental topics in digital logic design, algorithms, computer organization, assembly-language programming, and computer engineering technology.

EEE 3705L Digital Logic Design Laboratory (1) Prerequisite: COP2221; Corequisite: EEL3705. Laboratory in support of EEL3705.

EEE 3949r Cooperative Work Experience (0) (SU grade only.)

EEE 4213 Power System I (3) Prerequisite: EEL3216. Analysis of electric power systems using system modeling for large-scale power network admittance and impedance matrix format; power flow; optimal dispatch; symmetrical components; balanced and unbalanced fault analysis, and transient stability studies.

EEE 4220 Electromechanical Dynamics (3). Prerequisites: EEL 3216; EEL 3472. Corequisite: EEL3473. The study of magnetic circuits, electromagnetic torques and induced voltages. Topics covered include induction motors, variable speed drives, Park’s transforms, synchronous machines and generator controls DC machine, controls and drives.

EEE 4243 Power Electronics (3). Prerequisites: EE: 3135; EEL 3300. The purpose of this course is to develop a basic understanding of using switched electronic circuits for the conversion and regulation of power. The course focuses on the basic converters and their steady analysis. Dynamic modeling analysis, controller design, power semiconductor device, and simulation also are covered.

EEE 4301 Electronic Circuits and Systems Design (3) Prerequisite: EEL3300; EEL3300L. Multistage amplifier analysis and design including feedback and operational amplifiers, A-to-D and D-to-A converters, waveshaping and waveforming generators including oscillators, voltage regulators, and power circuits. Includes use of computer-aided-design programs.

EEE 4301L Electronic Circuits and Systems Laboratory (1) Prerequisites: EEL3300; EEL3300L. Corequisite: EEL4301. Laboratory in support of EEL4301.

EEE 4313 Introduction to Digital Integrated Circuit Design (3) Prerequisite: EEL3300. Semiconductor device physics, digital logic fundamentals, static inverter analysis, static logic gate analysis, dynamic switching analysis, combinational logic design.

EEE 4330 Microelectronics Engineering (3) Prerequisite: EEL3300; EEL 3300L. Design and fabrication of solid-state devices. Topics include oxidation, diffusion, metallization, photolithography, and device characterization.


EEE 4363 Feedback Amplifier Principles (3). Prerequisite: EEL 3300. This course introduces basic concepts of multi-stage audio-frequency amplifiers, including feedback and stability principles and power supply criteria.

EEE 4376c Introduction to Analog Integrated Circuit Design (3) Prerequisite: EEL4301. Design and analysis of bipolar and MOS analog integrated circuits. Topics include operational amplifier design, analog multipliers, active loads, current sources, and active filters.
EEE 4377 Mixed Signal ICs (3). Prerequisite: EEL 4313 or EEL 4376C. This course introduces mixed signal processing using analog and digital integrated circuits. Topics include fundamentals of sampled data systems, nonlinear and dynamic analog circuits, Nyquist-rate data converters, over-sampling data converters, and digital filters, as well as the use of computer-aided-design programs.

EEE 4400 Optoelectronics and Optical Systems (3). Prerequisites: EEL 3300; EEL3473. Theory and applications of optical techniques in modern electronics and communications. Includes a study of optical fibers, sources, detectors, optical communication systems, integrated optics, holography, and principles of optical signal processing.

EEE 4415 Sonar (3). Prerequisites: EEL 3473; EEL 3512. This course introduces basic concepts of sonar systems including acoustic propagation, transducers and projectors, target strength, reverberation, beam steering, beamforming, beam-patterns, and synthetic aperture sonar.

EEE 4435 Electromagnetics Laboratory (1). Prerequisite: EEL3473. Applications of electromagnetic field theory. Experiments include field mapping, transmission lines, spectrum analysis, impedance matching, waveguides, antennas, radar, and fiber optics.

EEE 4450 Modeling and Simulation of Semiconductor Devices (3) Prereq.: EEL 3300. This course covers various numerical techniques for modeling and simulating of semiconductor devices, such as pn-junctions, metal-oxide semiconductor contacts, metal-oxide-semiconductor field effect transistors, and bipolar devices. Special emphasis is on the description and simulation of electron and hole transport in semiconductor devices.

EEE 4450 Optical Sensors (3). Prerequisites: EEL 3473; EEL 3512. This course examines the basic concepts of optical sensors and essential optics. Topics include intensity, phase, and frequency modulated optical fiber sensors and their applications, distributed sensing systems and optical fibers in signal processing.

EEE 4461 Antenna Systems (3). Prerequisite: EEL3473. Antenna theory, including Hertzian dipoles, thin linear antennas, aperture antennas, array, loop antennas, slots, horns, and waveguides.


EEE 4540 Radar (3). Prerequisites: EEL 3512; EEL 3473. Basic concepts of radar systems including: radar range equation, radar cross section calculations, random processes and noise, array antennas, beam steering, dropper and range processing, FM and CW systems, pulse compression, synthetic aperture radar, clutter.

EEE 4566 Optical Fiber Communications (3). Prerequisites: EEL 3473; EEL 3512. This course offers a review of the characteristics of basic optical components for optical communications systems. Topics include optical fibers, light sources, optical detectors and fiber connectors, signal degradation in optical fibers, optical analog and digital communication systems; and coherent optical fiber communications.

EEE 4595 Wireless Communications and Networking (3). Prerequisites: CGS 3408 or equivalent; EEL 3135; EEL 3512, EEL 4021. This course covers the fundamentals of wireless communications and systems. The core topics include radio-wave propagation characteristics of wireless channels; modulation and demodulation techniques for mobile radio; reception techniques for wireless systems; fundamentals of cellular communications; multiple access techniques; wireless networking; and hybrid networking of a wireless system and the Internet.

EEE 4596 Advanced Topics in Communications (3). Prerequisites: EEL 3512; EEL 4021. This course is designed to provide an in-depth knowledge of some of the advanced topics in communications, Topics covered include ideal communication systems, signal to noise ratio (SNR), and angle modulation, design of systems to improve SNR, satellite communication, and mobile communication.

EEE 4635 Digital Control Systems (3). Prerequisite: EEL 4652. Discrete time systems; Z-transform; sampling and reconstruction; system time-response characteristics; stability analysis; digital controller design.

EEE 4652 Analysis and Design of Control Systems (3). Prerequisite: EEL3135. Continuous system modeling; stability of linear systems; frequency response methods; the root locus method; state-space methods.

EEE 4658 Instrumentation for Measurement and Control (3). Prerequisites: EEL 3112; EEL 4562. Design and application of sensors and transducers commonly used in industrial control and laboratory automation. Concepts and application of statistical process control are introduced.

EEE 4710 Introduction to Field Programmable Logic Devices (3). Prerequisites: EEL 3705; EEL 3705L. Overview of PLD, CPLD and FPGA devices; introduction to hardware description languages (HDLs); combinational, sequential and FSM design using HDLs; introduction to top down design methodologies.

EEE 4713 Computer Architecture (3). Prerequisites: COP 2221; EEL 4746. Modern computer architectures are presented by studying the relationships between hardware and software impact performance, machine language definition, processor data path and control designs, interfacing, and advanced topics, such as caching and pipelining.

EEE 4746 Microprocessor-Based System Design (3). Prerequisites: EEL3705; EEL3705L. Fundamental topics in basic computer design, structured assembly-language software design, RTL, CPU design, pipelining and superscaling, computer arithmetic, memory and I/O organization and interface, cache, and design tools.

EEE 4746L Microprocessor-Based System Design Laboratory (1). Prerequisites: EEL3705; EEL3705L. Corequisite: EEL4746. Laboratory software development, hardware projects, and experiments in support of EEL4746.

EEE 4748 Embedded Microcomputer Design Project (3). Prerequisites: EEL4746; EEL4746L. Individual projects selected with consent of instructor. Selected lectures and an "open-door" Motorola 68000 laboratory.

EEE 4810 Introduction to Neutral Networks (3). Prerequisites: EEL3135; EEL3300. Fundamentals of neutral networks: dynamical systems, associative memories, perceptions, supervised/unsupervised learning algorithms. Applications in signal processing, pattern recognition, control, optimization and communications.

EEE 4905r Directed Individual Study (1-3). Prerequisite: Junior-level standing and "B" average in electrical engineering courses. Normally may be repeated to a maximum of six (6) semester hours. Requires department approval.

EEE 4906r Honors Work in Electrical Engineering (1-6). Prerequisite: Acceptance in honors program. Independent or directed research in a specialized area beyond the current curriculum in electrical engineering. May be repeated to a maximum of six (6) semester hours.

EEE 4911C Senior Design Project I (3). Senior standing; completion of all required EE courses; permission of instructor. Introduction to design for electrical and computer engineers. System design concepts of specifications, analysis, synthesis, and manufacturability are introduced. Project management skills and team dynamics concepts are developed. Oral and written presentations are required.

EEE 4914C Computer Engineering Senior Design Project II (3) Prerequisite: EEL 4911. This course consists of a major multi-disciplinary design project in computer engineering which involves hardware, software, and/or theoretical design. Project should incorporate engineering standards and realistic constraints. Formal oral and written presentations of the project are required.

EEE 4915C Electrical Engineering Senior Design Project II (3) Prerequisite: EEL 4911. This course consists of a major multi-disciplinary design project in electrical engineering which involves hardware, software, and/or theoretical design. Project should incorporate engineering standards and realistic constraints. Formal oral and written presentations of the project are required.

EEE 4930r Special Topics in Electrical Engineering (1–3). Prerequisite: Instructor consent. Special topics in electrical engineering with emphasis on recent developments. Topics and credit vary; consult the instructor. May be repeated to a maximum of twelve (12) semester hours.