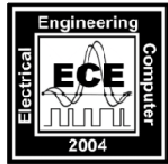


CATALOG YEAR 201010

2009-2010



**Electrical & Computer
Engineering Department**

School of Engineering & Applied Science

**ELECTRICAL ENGINEERING
MIAMI UNIVERSITY**

BACCALAUREATE PROGRAM

**Degree Awarded: Bachelor of Science in Engineering
with a major in Electrical Engineering**

Electrical Engineering encompasses analysis, design, and synthesis of products and processes in a variety of areas. Such areas include electrical power, electromechanical devices, and electronic systems, computers and their associated components, as well as development of processes needed in such areas as audio, video, and image enhancement and recognition. The field of electrical engineering requires the ability to: understand and apply math, science, and engineering science; to research concepts and apply modeling methods; to simulate and test working conditions and their impact on the designed systems; and to synthesize different elements in order to obtain the optimum design of a specific product.

Graduates have the opportunity to work in a diverse spectrum of professional fields. These vary from research to design, from development to manufacturing, from technical sales to production. Many electrical engineers work in manufacturing-related areas such as in the analysis and design of varied products and computer-related fields such as computer hardware and chip design, as well as in non-technical sectors of the economy such as business, law, and management. Graduates will also be prepared to continue their education at the graduate level.

Students interested in a double major must choose an additional 18 elective hours of adviser approved courses and cannot use a required course in one major as an elective in the other major.

For information, contact the Electrical and Computer Engineering office, 260 EGR Bldg. (513-529-0740) and visit our web site: <http://www.eas.muohio.edu/ece>.

ELECTRICAL ENGINEERING MAJOR REQUIREMENTS

Total Degree Requirements is 128 Hours

Catalog Year 201010 (2009-2010)

General Education (27 hrs) 21%

English (9 hrs)

- ENG 111 College Composition (3)
- ENG 112 Composition and Literature (3)
- ENG 313 Technical Writing (3)

Fine Arts, Humanities, and Social Science (12 hrs)

- ECO 201 Principles of Microeconomics (3)
- Miami Plan Foundation II A Fine Arts Elective (3)
- Miami Plan Foundation II B Humanities Elective (3)
- Miami Plan Foundation II Elective (3)

US and World Cultures (6 hrs)

- Miami Plan Foundation III A US Cultures Elective (3)
- Miami Plan Foundation III B World Cultures Elective (3)

Thematic Sequence (built-in)

The MTH-3 thematic sequence is fulfilled by ECE requirements:

- MTH3-Almost Linear Structures-Models for Physical Science: MTH 222, MTH 252, and MTH 347**

Mathematics & Science (37 hrs) 29%

- MTH 151, 251 Calculus I, II (5,4)
- MTH 222 Linear Algebra (3)
- MTH 252 Calculus III (4)
- MTH 347 Differential Equations (3)
- PHY 181, 183 Physics I and Lab (4,1)
- PHY 182, 184 Physics II and Lab (4,1)
- CHM 141, 144 College Chemistry and Lab (3,2)
- Miami Plan Foundation IVA Biological Science (3)

Computer Science & System Analysis (3 hrs) 3%

- CSA 153 Intro to C/C++ (3)

General Engineering (8 hrs) 6%

- EAS 101 Computing, Engineering and Society (1)
- EAS 102 Problem Solving and Design (3)
- ECE/MME 448 Senior Design Project I (2)
- ECE/MME 449 Senior Design Project II (2)

Electrical Engineering (35-36 hrs) 27%

- ECE 205 Electric Circuit Analysis I (3)
- ECE 287 Digital Systems Design (4)
- ECE 304 Electronics (3)
- ECE 305 Electric Circuit Analysis II (3)
- ECE 306 Signals and Systems (3)
- ECE 325 Applied Electromagnetics (3)
- ECE 345* Random Signal Processing (3)
- ECE 387 Embedded Systems Design (4)
- ECE 425 Digital Signal Processing (3)
- ECE 436 Control of Dynamic Systems (3)
- ECE 453 Communication Systems *or*
- ECE 461 Network Performance Analysis (3)

Professional EE Electives (9 hrs) 7%

- ECE 414 Introduction to VLSI Circuit and System Design (3)
- ECE 426 Biomedical Signal Analysis (3)
- ECE 427 Radar Signal Processing (3)
- ECE 428 Real-Time Digital Signal Processing (3)
- ECE 429 Digital Image Processing (3)
- ECE 430 Electromagnetics in Wireless Sensing and Communications (3)
- ECE 453 Communication Systems (3)
- ECE 461 Network Performance Analysis (3)
- ECE 491 Power Systems Engineering (3)

General Technical Electives (9 hrs) 7%

- Additional courses from the Professional EE Elective List
- ECE 278
- CSA 174, 271, 274, 283
- MTH 331, 432, 438, 441, 451, 453
- PHY 286, 291/293, 341, 421, 423, 441
- MME 211 or PCE 219 (but not both), MME/PCE 314,
- EGM/MGT 311

General technical electives are subject to the following rules:

- At least 3 credits of General Technical Electives must be 300-level or above.
- Courses cannot be double-counted as both Professional EE Electives and General Technical Electives.
- Other courses such as ECE 470 may be approved by petition.

*STA 301 or 368 can be substituted for ECE 345

ELECTRICAL ENGINEERING MAJOR (SAMPLE) FOUR-YEAR PLAN

Catalog Year – 201010 (2009-2010)

Freshman Year

<u>First Semester</u>		<u>Second Semester</u>					
EAS 101	Computing, Engineering and Society	1		EAS 102	Problem Solving and Design	3	
ENG 111	College Composition	3		ENG 112	Composition and Literature (MPF I)	3	
MTH 151	Calculus I	5		MTH 251	Calculus II	4	
PHY 181	Physics I	4		PHY 182	Physics II	4	
PHY 183	Physics I Lab	1		PHY 184	Physics II Lab	1	
CSA 153	Introduction to C/C++ Programming	3		MPF II	Miami Plan Foundation	3	
		17				18	

Sophomore Year

<u>First Semester</u>		<u>Second Semester</u>					
ECE 205	Electric Circuit Analysis I	3		CHM 141	College Chemistry	3	
ECE 287	Digital Systems Design	4		CHM 144	Chemistry Lab	2	
MTH 222	Linear Algebra	3		ECE 305	Electric Circuit Analysis II	3	
MTH 252	Calculus III	4		MTH 347	Differential Equations	3	
MPF III A	US Cultures	3		MPF IV A	Biological Science	3	
		17		MPF III B+	World Cultures	3	
						17	

Junior Year

<u>First Semester</u>		<u>Second Semester</u>					
ECE 304	Electronics	3		ECE 387	Embedded Systems Design	4	
ECE 306	Signals and Systems	3		ECE 425	Digital Signal Processing	3	
ECE 325	Applied Electromagnetics	3		ECE ___	Professional EE Elective	3	
ECE 345*	Random Signal Processing	3		XXX___	General Technical Elective	3	
ENG 313	Technical Writing	3		ECO 201	Microeconomics	3	
		15				16	

Senior Year

<u>First Semester</u>		<u>Second Semester</u>					
ECE/MME 448	Senior Design Project I	2		ECE/MME 449	Senior Design Project II	2	
ECE/MME 436	Control of Dynamics Systems	3		ECE ___	Professional Elective	3	
ECE 453†	Communication Systems	3		XXX___	General Technical Elective	3	
ECE ___	Professional Elective	3		MPF II A	Fine Arts Elective	3	
XXX___	General Technical Elective	3		MPF II B	Humanities Elective	3	
		14				14	

128 total hours required for the degree.

The Miami Plan for Liberal Education Foundation (MPF) requirement includes 6 hours of English Composition (ENG 111-112 fulfills this requirement); 12 hours in Fine Arts, Humanities, and Social Science (ECO 201 fulfills 3 hours of Social Science) with a minimum of 3 hours in each; 6 hours in U.S. and World Cultures; 9 hours of Natural Science, including one laboratory course with a minimum of 3 hours in Biological Science and 3 hours in Physical Science (PHY 181-182, 183-184 and CHM 141-144 more than fulfills the Physical Science requirement; however, a biological science course is still required); 3 hours of Mathematics, Formal Reasoning, or Technology (MTH 151 fulfills this requirement). At least one of these foundation courses must provide a historical perspective (H). You must take an approved Thematic Sequence (MPT) and a 4 hour Senior Capstone Experience (MPC) (ECE/MME 448 and 449 fulfill the capstone requirement). The actual order in which you take these courses is up to you subject to prerequisite/co-requisite requirements. The outline above is just one sample of how the courses might be arranged.

The thematic sequence MTH3-Almost Linear Structures-Models for Physical Science is fulfilled by ECE requirements. The form to "declare" a thematic sequence must be submitted through the department offering the sequence.

+The School of Engineering & Applied Science and its Industrial Advisory Council suggest you consider taking IDS 159, Strength Through Cultural Diversity, to meet the World Cultures (MPF IIIB) requirement.

*STA 301 or 368 can be substituted for ECE 345

† ECE 461 may be substituted for ECE 453

ELECTRICAL & COMPUTER ENGINEERING - COURSE DESCRIPTIONS 201010 (2009-2010)

ECE 205 Electric Circuit Analysis I (3) Study of electric circuits and networks. Includes resistive circuits, first-order transients and sinusoidal steady state. Emphasis on basic principles and their application to circuit analysis using linear algebra and complex numbers. Laboratory component included. *Prerequisite: PHY 182 and Co-requisite: MTH 249 or MTH 251 or MTH 257H)*

ECE 278 Computer Architecture (3) Principles of Von Neumann computer architecture. Data representation and computer arithmetic. Memory hierarchy. CPU structure and instruction sets. Assembly language programming to better understand and illustrate computer architecture concepts. Performance considerations and alternative computer architectures. *(Prerequisite: CSA 271 or equivalent)*

ECE 287 Digital Systems Design (4) Design of digital systems. Topics include switching algebra and switching functions, logic design of combinational and sequential circuits using TTL, combinational logic design with MSI and LSI, bussing, flip-flops, registers, counters, programmable logic devices, memory devices, register-level design, and microcomputer system organization. Students must show competency in computer-aided design (CAD) and laboratory implementation of digital systems. *(Prerequisite: none)*

ECE 291 Energy Systems Engineering (3) Study of energy systems which utilize various energy sources including both renewable and non-renewable fuel. System components and operations of thermal, hydropower, and nuclear generating stations, as well as biofuel reactor, fuel cell, wind turbine, solar electric and solar thermal power are investigated. Sustainability of energy sources, cost-benefits and their social acceptability as well as environmental impacts are addressed. *(Prerequisite: PHY 121 or PHY 172 or PHY 182)*

ECE/MME 303 Computer-Aided Experimentation (4) Study of theory and application of instrumentation and experimentation; components and concepts of computer-machine interface systems; design of computer-controlled experimentation for real-time industrial measurement, monitoring, and control; electric power analysis and polycircuits. Laboratory component included. Not open to electrical or computer engineering majors. *(Prerequisites: ECE 205, MME 211, and STA 301 or STA 368)*

ECE 304 Electronics (3) Analysis and design of electronic circuits and subsystems. Frequency response and circuit models for amplifiers; non-ideal operational amplifier circuits; bipolar junction transistors (BJTs); BJT amplifiers; small signal operation and models. Laboratory component included. *(Prerequisite: ECE 305 or ECE/MME 303)*

ECE 305 Electric Circuit Analysis II (3) In-depth study of electric circuits and networks with an emphasis on practical applications. Includes AC power analysis, poly-phase and magnetically coupled circuits, electric machines, frequency response and filters, Laplace transform, and two-port networks. Laboratory component included. *(Prerequisites: ECE 205 or PHY 292/294 and Co-requisite: MTH 245 or MTH 347)*

ECE 306 Signals and Systems (3) Study of the basic principles of signals and systems. Lectures, simulation exercises, and design projects expose students to the theories and concepts of both continuous-time and discrete-time forms of signals and systems, as well as applications of the theories and concepts in communication systems, control systems, and signal processing. Laboratory component included. *(Prerequisite: ECE205 or PHY 292/294 and Co-requisites: ECE 305 or ECE/MME 303 and MTH 245 or MTH 347)*

ECE 325 Applied Electromagnetics (3) Study of theories and applications of electromagnetic fields and waves; including electrostatics, magnetostatics, Maxwell equations, plane wave propagation and reflection, transmission lines, waveguides, and antennas. Laboratory component included. *(Prerequisites: ECE 305 or ECE/MME 303 and MTH 245 or MTH 347)*

ECE 345 Random Signal Processing (3) Introduction to probability and statistics, including applications relevant to electrical and computer engineering. Includes extensive coverage of random variables. Introduces random processes and illustrates their importance in communications, signal processing, and networking. *(Prerequisites: MTH 249 or MTH 251 and MTH 222 or MTH 231)*

ECE 387 Embedded Systems Design (4) Fundamentals of computer systems design, interfacing and basics of embedded computers (microprocessors). Laboratory projects will require students to successfully design, implement, debug, and document computer solutions requiring a mix of hardware and software. Models and methodologies for designing systems containing both hardware and software components, or co-design, will be introduced. Substantial design projects will be required of each student. *(Prerequisites: ECE 287 and CSA 153 or CSA 274)*

ECE 414/514 Introduction to VLSI Circuit and System Design (3) Fundamentals of modern VLSI IC design. Introduction of three main aspects of CMOS IC engineering: device operation, circuit design and circuit layout, as well as three main aspects of VLSI system engineering: system-level simulation, interconnect analysis, and basics of high-volume manufacturability. Hands-on experience with modern IC design software. *(Prerequisites: ECE 287 and ECE 304)*

ECE 425/525 Digital Signal Processing (3) Study of the relationship between continuous-time and discrete-time signals. Time-sampling, signal representation, transformation and manipulation of digital signals, digital filter structure and design. (Prerequisites: ECE 306 and ECE 345 or STA 301 or STA 368)

ECE 426/526 Biomedical Signal Analysis (3) Physiological origin, characterization, modeling, and analysis of biomedical signals, including EEG, MEG and ECG signals. Noise and artifact reduction; nonparametric and model-based spectral estimation; joint time-frequency analysis. (Prerequisites: ECE 306 and ECE 345 or STA 301 or STA 368)

ECE 427/527 Radar Signal Processing (3) Principles, theories and techniques of radar signal processing. Elements of radar systems; radar equation; sampling and quantization of pulse radar signals; radar waveforms; Doppler processing; target detection; and concepts of synthetic aperture imaging and beamforming. (Prerequisites: ECE 306, and ECE 345 or STA 301 or STA 368)

ECE 428/528 Real-Time Digital Signal Processing (3) Study of real-time digital signal processing techniques. Design and implementation of real-time digital signal processing algorithms with an industry-standard DSP microprocessor. Several structured laboratory exercises, such as spectrum analysis and digital filtering, followed by an extensive final project. (Prerequisite: ECE 425)

ECE 429/529 Digital Image Processing (3) Study of digital image processing techniques. Digital image fundamentals, digital image spatial filtering, digital image frequency filtering, image restoration, inverse filtering, Wiener filtering, and color image processing fundamentals. (Prerequisite: ECE 425)

ECE 430/530 Electromagnetics in Wireless Sensing and Communications (3) Electromagnetic aspects of modern wireless sensing and communications. Fundamentals of EM wave propagation in various media, antenna design, and wireless system analysis. Hands-on experience with computational modeling and contemporary EM software. (Prerequisite: ECE 325)

ECE/MME 436 Control of Dynamic Systems (3) In-depth study of the theory, design, and analysis of feedback control of dynamic systems. Integration of problem-solving techniques and concepts of electric circuits and computer-aided experimentation into the design and construction of programmable-logic based control systems and application to modern manufacturing systems. Design methodologies applied in laboratory exercises and short-term design projects. (Prerequisite: ECE/MME 303 or ECE 305)

ECE/MME 448 Senior Design Project I (2) and ECE/MME 449 Senior Design Project II (2) Student teams, with varied academic backgrounds, conduct major open-ended research/design projects. Elements of the design process are considered as well as real-world constraints, such as economic and societal factors, marketability, ergonomics, safety, aesthetics, and ethics. 448:

feasibility studies performed; 449: implementation, testing, and production of design. Nonmajors can register for 3-4 credits. (Prerequisite: senior standing in student's major.)

ECE 453/553 Communication Systems (3) Basic communication systems principles and practice. Modulation, demodulation, multiplexing techniques, system design, and performance analysis. (Prerequisites: ECE 306 and ECE 345 or STA 301 or STA 368 and Co-requisite: ECE 304)

ECE 461/561 Network Modeling and Performance Analysis (3) Modeling and performance analysis of computer and communication networks including delay and occupancy models in networks, architectures, transmission media, multiple-access, switching, and protocols. Emphasis on lower layer network performance. (Prerequisites: ECE 345 or STA 301 or STA 368)

ECE 470/570 Special Topics (3) Advanced special topics in electrical and computer engineering. (Prerequisite: Permission of instructor.)

- **470.G. Introduction to Global Positioning Systems:** Study of the Global Positioning System (GPS). Basic principles of satellite navigation systems, measurement coordinate systems, satellite signal structure, basic GPS receiver principles, GPS data processing, measurement errors, differential receivers, GPS augmentation systems, and GPS applications.
- **470.N Introduction to Navigation:** Study of basic theories, techniques (including animal navigation), components, and systems required in determining a user's position, velocity, and attitude for navigation purposes. Discussion of recent developments in navigation techniques and methods. Hands-on experience with navigation models.
- **470.S Software GPS Receivers:** Study of software-based Global Positioning System (GPS) receivers, including GPS signal structure, radio frequency front end design, GPS signal acquisition, tracking methods and navigation data extraction, and software algorithms to implement traditional hardware-based functionalities.

ECE 491 Power Systems Engineering (3) Study of electric power generation, utility load flow, fault analysis, system stability, surge protection, and the interconnection of the electrical grid system. (Prerequisite: ECE/MME 303 or ECE 305)