EECE 615: High-Frequency Design Techniques

Prerequisites: EECE 417, PHYS 204C

Required for all MSEE majors

Catalog Description: Study of the problems associated with passive components at high frequencies, high-frequency measurement techniques, transmission lines, line reflections, matching and terminations, scattering parameters, ground and power planes, and printed circuit board design considerations. Formerly ECE 345.

Course Objectives:

- teach high-speed design techniques for both of analog and digital circuits
- explain high-speed properties of logic gates
- explain standard high-speed measurement techniques

Course Outcomes:

Students shall be able to:

- design a matching network for maximum power transferred to an antenna system using a Smith chart
- design and analyze a transmission line operating at high frequencies, and optimize the design with techniques for eliminating traveling wave reflections
- design and analyze a quarter-wave parallel-plate line transformer for matching a microstrip line on a PCB board, including determine the length, width, thickness, and characteristic impedance of the quarter-wave parallel-plate line at an operating frequency of 1 GHz
- design a magnetic field detector to test for noise induced by mutual inductive coupling
- design and analyze a circuit on a PCB board to cancel parasitic capacitance at a frequency over a GHz
- design decoupling capacitors and a capacitor array for a PCB board that has a million transistors IC
- design 21:1 probe using 10-ft of RG-58, a BNC twist-on connector, and a probe loop of 0.2-in. diameter for high frequency measurement
- design and analyze a filter circuit for a clock oscillator of 2 GHz

Class/Laboratory schedule:
• One hundred and fifty minutes a week lecture

**Contribution of Course to Meet the Professional Component:**

- Engineering Science: 2 units
- Engineering Design: 1 unit

**Relationship of Course to Program Outcomes and Objective:**

This course makes significant contributions the following program outcomes:

- An ability to apply knowledge of math, science and engineering
- An ability to design a system, component, or process to meet desired needs
- An ability to identify, formulate and solve engineering problems
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

This course supports the achievement of the following elements of the program objective:

- Apply knowledge of mathematics, science, and engineering to identify, formulate, and solve computer engineering problems
- Use industry standard tools to analyze, design, develop and test computer-based systems containing both hardware and software components.
- Achieve success in graduate programs in computer engineering, electrical engineering or computer science.
- Continue to develop their knowledge and skills after graduation in order to succeed personally and contribute to employer success.
EECE 617: High-Frequency Analog Design

Prerequisites: EECE 417, EECE 615

Required for MSEE majors in EE option

Catalog Description: Design, analysis and construction of high-frequency amplifiers, oscillators and mixers are covered in this course. Formerly ECE 356.

Class/Laboratory schedule:

- One hundred and fifty minutes a week lecture

Contribution of Course to Meet the Professional Component:

- Engineering Science: 2 units
- Engineering Design: 1 unit

Relationship of Course to Program Outcomes and Objective:

This course makes significant contributions the following program outcomes:

- An ability to apply knowledge of math, science and engineering
- An ability to design and conduct experiments as well as to analyze and interpret data
- An ability to design a system, component, or process to meet desired needs
- An ability to identify, formulate and solve engineering problems
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

This course supports the achievement of the following elements of the program objective:

- Apply knowledge of mathematics, science, and engineering to identify, formulate, and solve computer engineering problems
- Use industry standard tools to analyze, design, develop and test computer-based systems containing both hardware and software components.
- Achieve success in graduate programs in computer engineering, electrical engineering or computer science.
- Continue to develop their knowledge and skills after graduation in order to succeed personally and contribute to employer success.

EECE 631: Processes Improvement

Prerequisites: CSCI 330 or EECE 431.
Catalog Description: Explore the Capability Maturity Model (CMM) developed by the Software Engineering Institute process maturity model; examine the differences between the CMM and ISO 9001; understand the key process areas for the CMM levels 2 and 3; participate in peer reviews and other quality assurance methods. Formerly ECE 310.

EECE 636: Project Implementation and Testing

Prerequisites: CSCI 630.

Catalog Description: This course is for students who have completed a graduate course in project requirements analysis and design. The class project involves implementation and testing of a large software system. Topics include advanced implementation and automated testing techniques. Formerly ECE 312.

EECE 639: Topics in Software Engineering

Prerequisites: EECE 431

Catalog Description: Study of advanced topics in software engineering as presented in recent journals. Topics reflect research interest of department faculty. Formerly ECE 333.

EECE 643: Computer-Aided Circuit Engineering

Prerequisites: EECE 615

Required for MSEE majors

Catalog Description: The use of computer-aided design tools to analyze, design, and test both analog and digital circuits and devices. Formerly ECE 388.

Course Objectives:

- explain VHDL background and Design methodology based on VHDL.
- explain of behavioral modeling of digital systems using VHDL.
- teach sequential processing techniques in VHDL.
- explain data types, subprograms, packages, predefined attributes and configurations of VHDL.

Course Outcomes:
Students must be able to design, simulate, analyze, build, and test:

- a 32-bit ALU (arithmetic and logic unit) using VHDL and implemented the design with an Altera UP 1 board
- an up-down 8-bit counter with parallel load and enable control using VHDL and implemented the design with an Altera UP 1 board
- a one-digit BCD adder using VHDL and implemented the design with an Altera UP 1 board or a Xilinx Digilab
- a CPU design with synthesis description, RTL simulation, place and route using VHDL and implemented the design with an Altera UP 1 board
- a VGA video display using VHDL and implemented the design with an Altera UP 1 board
- a computer interface to the PS/2 keyboard using VHDL and implemented the design with an Altera UP 1 board
- a full-wave bridge rectifier circuit that includes transformer, diodes, capacitors, inductors, and, resistors using Cadence PSPICE 9.2
- a bipolar junction transistor amplifier with editing BJT’s model parameters using Cadence PSPICE 9.2
- a MOSFET amplifier with transient analysis and AC sweep using Cadence PSPICE 9.2
- an Op-Amp circuit, which is actually a band-pass active filter, to find the magnitude and phase angle of the output voltage of band-pass active filter, and the bandwidth of the band-pass active filter using Cadence PSPICE 9.2

Class/Laboratory schedule:

- One hundred and fifty minutes a week lecture

Contribution of Course to Meet the Professional Component:

- Engineering Science: 2 units
- Engineering Design: 1 unit

Relationship of Course to Program Outcomes and Objective:

This course makes significant contributions the following program outcomes:

- An ability to design a system, component, or process to meet desired needs
- An ability to identify, formulate and solve engineering problems
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

This course supports the achievement of the following elements of the program objective:

- Apply knowledge of mathematics, science, and engineering to identify, formulate, and solve computer engineering problems
- Use industry standard tools to analyze, design, develop and test computer-based systems containing both hardware and software components.
- Achieve success in graduate programs in computer engineering, electrical engineering or computer science.
- Continue to develop their knowledge and skills after graduation in order to succeed personally and contribute to employer success.

EECE 655: Topics in Computer Networking

Prerequisites: EECE 344, EECE 455

Required for MSEE majors in CMPE option


Course Objectives:
- introduce physical components of networks: hubs, routers, bridges
- introduce the concepts of routing protocols
- teach limitations of these protocols and devices, factors affecting network performance
- present current issues in quality of service, security
- explain techniques for controlling network access and optimizing routing performance

Course Outcomes:
- analyze networking needs for an organization, and configure a network that meets these needs
- manage network access and traffic
- analyze and correct network configuration problems
- analyze network performance under various loads created using traffic simulation
- select and configure appropriate routing protocols to meet application needs, and understand the limitations of each of the common protocols

Class Schedule:
- One hundred fifty minutes a week lecture

Contribution of Course to Meet the Professional Component:
- Engineering Science: 2 units
• Engineering Design: 1 unit

Relationship of Course to Program Outcomes and Objective:

This course makes significant contributions the following program outcomes:

• An ability to apply knowledge of math, science and engineering
• An ability to design and conduct experiments as well as to analyze and interpret data
• An ability to design a system, component, or process to meet desired needs

This course supports the achievement of the following elements of the program objective:

• Achieve success in graduate programs in computer engineering, electrical engineering or computer science.
• Continue to develop their knowledge and skills after graduation in order to succeed personally and contribute to employer success.

EECE 659: Topics in Communication Systems

Prerequisites: EECE 453.

Catalog Description: Advanced study of selected topics in the area of communication systems such as error detection and correction, information encoding and decryption, and real-time performance. Other topics include material in recently published journals and research projects of department faculty. You may take this course more than once for a maximum of 8.0 units. Formerly ECE 324.

EECE 669: Topics in Digital Signal Processing

Prerequisites: EECE 465

Catalog Description: Study of selected topics in the area of digital signal processing such as computer aided filter design, two-dimensional signal processing, DSP chips, and pattern recognition. Other topics include material in recently published journals and research projects of department faculty. You may take this course more than once for a maximum of 8.0 units. Formerly ECE 330.

Course Objectives:

• teach computer-aided design of FIR and IIR filters
• understand linear convolution using overlap-add and overlap-save methods
• introduce multirate signal processing
• introduce power spectral estimation
• introduce spectrum analysis
• teach students to analyze and design two-dimensional digital filters

Course Outcomes:

Students shall be able to:

• design one-dimensional FIR and IIR filters using various methods
• explain the principles of multirate signal processing
• calculate the convolution using overlap-add or overlap-save method
• analyze adaptive filters, perform spectrum estimation
• calculate cepstrum coefficients
• design and analyze two-dimensional digital filters

Class/Laboratory schedule:

• One hundred and fifty minutes a week lecture

Contribution of Course to Meet the Professional Component:

• Engineering Science: 1.5 units
• Engineering Design: 1.5 unit

Relationship of Course to Program Outcomes and Objective:

This course makes significant contributions the following program outcomes:

• An ability to apply knowledge of math, science and engineering
• An ability to design and conduct experiments as well as to analyze and interpret data
• An ability to design a system, component, or process to meet desired needs
• An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

This course supports the achievement of the following elements of the program objective:

• Apply knowledge of mathematics, science, and engineering to identify, formulate, and solve computer engineering problems
• Use industry standard tools to analyze, design, develop and test computer-based systems containing both hardware and software components.
• Achieve success in graduate programs in computer engineering, electrical engineering or computer science.
EECE 675: Electromagnetic Compatibility

Prerequisites: EECE 615

Required for MSEE majors in EE option

Catalog Description: Analysis of cabling and grounding problems in high-frequency systems. Circuit layout for high-frequency applications. Electromagnetic discharge problems. Radio-frequency emissions from electronic devices. Shielding techniques to prevent ESD and EMI. Formerly ECE 357.

Course Objectives:

- introduce PCB design techniques for EMC compliance
- explain electromagnetic discharge problems
- explain radio-frequency emissions from electronic devices.

Course Outcomes:

Students must be able to:

- analyze cabling and grounding problems in high-frequency systems,
- analyze and simulate component placements in PCB board design to reduce EMI,
- apply reflection minimization techniques for micro strips and strip lines in high-frequency system design,
- design shielding techniques to prevent ESD and EMI in high-frequency systems,
- design bypassing and decoupling for power and ground planes, components, and internal power connection in high-frequency systems,
- apply techniques to prevent crosstalk's in high-frequency systems,
- apply layer stack up assignment techniques to implement PCB design for in high-frequency systems,
- design switching regulator circuits using EMI mitigation techniques

Class/Laboratory schedule:

- One hundred and fifty minutes a week lecture

Contribution of Course to Meet the Professional Component:

- Engineering Science: 2 units
- Engineering Design: 1 unit

Relationship of Course to Program Outcomes and Objective:

This course makes significant contributions the following program outcomes:
• An ability to apply knowledge of math, science and engineering
• An ability to design and conduct experiments as well as to analyze and interpret data
• An ability to design a system, component, or process to meet desired needs
• An ability to function on multi-disciplinary teams
• An ability to identify, formulate and solve engineering problems
• An understanding of professional and ethical responsibilities
• An ability to communicate effectively
• The broad education necessary to understand the impact of engineering solutions in a global and societal context
• A recognition of the need for, and an ability to engage in, life-long learning
• A knowledge of contemporary issues
• An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

This course supports the achievement of the following elements of the program objective:

• Apply knowledge of mathematics, science, and engineering to identify, formulate, and solve computer engineering problems
• Use industry standard tools to analyze, design, develop and test computer-based systems containing both hardware and software components.
• Achieve success in graduate programs in computer engineering, electrical engineering or computer science.
• Continue to develop their knowledge and skills after graduation in order to succeed personally and contribute to employer success.
• Work effectively as a member of a multi-disciplinary development team and undertake leadership roles when appropriate.
• Communicate their thoughts, in both written and oral forms, so that others can comprehend and build on their work.

Appreciate the importance of ethics in the profession and the need to act in society's best interest

**EECE 689: Topics in Robotics and Control Systems**

**Prerequisites:** Either EECE 482 or MECA 482.

**Catalog Description:** Advanced study of selected topics in the area of control systems such as nonlinear control systems and optimal control. Other topics include material in recently published journals and research projects of department faculty. You may take this course more than once for a maximum of 8.0 units. Formerly ECE 370.

**EECE 697: Independent Study**
**Catalog Description:** This course is a graduate-level independent study offered for 1.0-6.0 units. You must register directly with a supervising faculty member. Independent study and investigation of special problems in the student's area of concentration. Both registration and study plan must have approval of the instructor and the student's graduate advisory committee chair. You may take this course more than once for a maximum of 6.0 units. Formerly ECE 398.

**EECE 698: Seminar in Advanced Topics**

**Catalog Description:** This course is offered for 1.0-3.0 units. Typical subjects that will be taught include embedded systems design, high-speed networking, program management, and fault-tolerant system design. Consult *The Class Schedule* for listings. You may take this course more than once for a maximum of 12.0 units. Formerly ECE 397.

**EECE 699P: Master's Project**

**Catalog Description:** This course is offered for 1.0-3.0 units. Independent study and investigation of special problems in student's area of concentration. Both registration and study plan must have approval of the instructor and the student's graduate advisory committee chair. You may take this course more than once for a maximum of 6.0 units. Formerly ECE 399P.