Department of Electrical Engineering's Proposed Changes to Course Catalog/Program

Originally submitted by department on December 4, 2013
Revised February 21, 2014 after discussion in Council of Chairs meeting

The attached section of the course catalog shows proposed changes to electrical engineering's undergraduate program and catalog. A summary of the proposed (non-editorial) changes is provided below.

1. Remove the depth requirement in humanities and social sciences.

2. Mathematics core:

    a. Remove Math 332 (Vector Analysis).

    b. Add Math 335 (Ordinary Differential Equations) and an upper-level math elective. Math elective will replace free elective.

3. Electrical Engineering core:

    a. Allow EE 211 (Circuits and Signals I) or ES 332 (Electrical Engineering); pilot combined EE 211/ES 332 course(s) over the next year.

    b. Change EE 212's (Circuits and Signals II's) prerequisite from "EE 211" to "EE 211 or ES 332".

    c. Change EE 333's (Electricity and Magnetism's) prerequisite from "PHYS 122" to "PHYS 122 and MATH 231", and remove EE 333's corequisite of MATH 332.

    d. Change EE 341's (Signals and Linear Systems') prerequisite from "EE 212 and MATH 254" to "EE 212 and MATH 335".

    e. Incorporate existing laboratories into corresponding core courses (combine grades, 0-credit labs) instead of listing separately.

4. Electrical Engineering minor:

    a. Change "EE 211" to "EE 211 or ES 332".

~~5.~~

6. Change in course description for EE 451:

EE 451, Digital Signal Processing, 4 cr, 3 cl hrs, 3 lab hrs
Prerequisites: EE 308 and EE 341

Principles of digital signal processing. Infinite and finite impulse response filters, discrete and fast Fourier transforms, multirate processing, spectral estimation, quantization effects, system design. Implementation of real-time DSP algorithms on state-of-the-art hardware. Principles discussed in class will be demonstrated with real applications. Labs include design and implementation of infinite and finite impulse response filters, and applications such as communication systems, sound processing, and ~~other applications~~ image processing.

Electrical Engineering

Professors Teare, Wedeward (Chair of the Department)
Associate Professors Arechiga, El-Osery, Erives, Jorgensen
Assistant Professor Senay
Emeritus Professor Bond
Adjunct Faculty Andrews, Elias, Helmboldt, Kassim, Mansfield, Meason, Prager, Restaino, Wick, Xiao

Degrees Offered: B.S. in Electrical Engineering; M.S. in Electrical Engineering

Mission

The mission of the New Mexico Tech Electrical Engineering Department is two-fold: (1) to develop and maintain a program of excellence in teaching which ensures that our graduates have technical knowledge and professional skills they need to become effective engineers in the rapidly-changing technical environment of today's society, so that these graduates will contribute to the growth and development of New Mexico and our nation, and (2) to develop and maintain state-of-the-art research programs which are responsive to the needs of industry and government, which provide excellent educational opportunities for students, and which provide an environment for intellectual growth and excitement.

Program Educational Objectives

The objective of the B.S. in Electrical Engineering degree program is to prepare graduates who will be successful in their chosen career paths. Specifically, graduates of this program will be capable of achieving

1. success in post-undergraduate studies as evidenced by
   - satisfaction with the decision to further their education,
   - advanced degrees earned,
   - professional visibility (e.g. publications, presentations, awards, etc.), and
   - international activities (e.g., participation in international conferences and societies, collaborative research, study abroad, etc.); and/or

2. success in their chosen profession as evidenced by
   - career satisfaction,
   - professional visibility (e.g., publications, presentations, patents, inventions, awards, etc.),
   - professional development (e.g., continuing education, professional registration, etc.),
   - entrepreneurial activities, and
   - international activities (e.g., participation in international conferences and societies, collaborative projects, employment abroad, etc.)

Undergraduate Program

The Department of Electrical Engineering concentrates on a high-quality undergraduate program in electronics and design, combined with a firm intellectual foundation in the fundamentals of circuits, signals, and systems. As with other degree programs at Tech, students are also provided with a breadth of knowledge in the basic sciences, mathematics, humanities, and social sciences.

Laboratories constitute an important part of the electrical engineering program. The

laboratories are closely coupled with the lecture parts of courses and utilize modern, state-of-the-art equipment. ~~Personal c~~Computer-based instruments and software packages provide students with up-to-date engineering and design techniques.

Design is integrated into all aspects of the curriculum. Students take an "Introduction to Design" course in the second semester of their junior year. This and their other course work prepare students for two Senior Design Project courses, in which students apply material learned in the classroom to real-world problems. Projects are available from the greater Tech community, including Tech research labs, Langmuir Laboratory for Atmospheric Research, the Energetic Materials Research and Testing Center, ~~and~~ the VLA and VLBA facilities of the National Radio Astronomy Observatory, Etscorn Observatory, Sandia National Laboratories, Los Alamos National Laboratory, and National Instruments.

Graduates of Tech's electrical engineering program will be well equipped with the practical skills necessary for immediate employment, as well as with the intellectual base for graduate studies and lifelong learning.

Bachelor of Science in Electrical Engineering

Minimum credit hours required—130

In addition to the General Education Core Curriculum (page 5), the following courses are required:

Electrical Engineering core: EE 101~~ & 101L~~ (2), EE 211 (3) or ES 332 (3), EE 212~~ & 212L~~ (4), EE 231 ~~& 231L~~ (4), EE 308~~ & 308L~~ (4), EE 321~~ & 321L~~ (4), EE 333 (3), EE 341 (3), EE 382 (3), EE 434 (3), EE 451~~ & 451L~~ (4), EE 481 & 481L (3), EE 482 & 482L (3)

Introduction to problem-solving and computer skills: EE 251 (4) or CSE 113 (4)

Mathematics core: MATH 231 (4), 254 (3), 33~~2~~5 (3), 382 (3)

Mathematics elective: three credit hours from Mathematics 300- and 400-level courses

Electrical Engineering electives: a minimum of seven credit hours, including at least one lab credit hour, from Electrical Engineering 300- and 400-level courses, excluding the Electrical Engineering core classes listed above.

Engineering/Computer Science electives. Six hours from the following:

Electrical Engineering courses numbered 200 and ~~—~~above (excluding EE core and elective classes)

Computer Science courses except CSE 101, 113 and ~~—~~122

Other engineering department courses numbered 200 and above

Engineering Science courses numbered 200 and above, ~~-~~except ES 316 and ES 332

At least three credit hours must be from outside the Electrical Engineering Department.

Electives to complete 130 credit hours. Without prior departmental approval, the following cannot be used for these electives: ENGL 103; MATH 101, 103, 104, 105; PR courses; or New Mexico Tech Community College courses.

To enroll in an Electrical Engineering Department class, a student must have passed the prerequisites of the course. In addition, a student must be in good academic standing and have declared electrical engineering as a major to enroll in EE 382 and EE 481.

Students pursuing a B.S. degree in Electrical Engineering must take all Electrical Engineering courses for a letter grade.

All electrical engineering majors are required to take the Fundamentals in Engineering (FE) exam as a requirement for graduation.

~~While fulfilling the General Education Core Curriculum (page 5), Electrical Engineering students must also satisfy a depth requirement in the humanities and social sciences. Each Electrical Engineering student is required to take at least nine credit hours in a single area with three of the credit hours at the 300-level or above and be chosen from one of the following areas:~~

~~1. Political Science~~
~~2. Philosophy~~
~~3. History~~
~~4. Psychology~~
~~Courses from other Humanities and Social Science areas may be used to complete the general education core curriculum, but cannot be used to satisfy the Electrical Engineering Department's depth requirement.~~

Sample Curriculum for the Bachelor of Science in Electrical Engineering

Semester 1
4 MATH 131 (calculus I)
5 PHYS 121 & 121L (general physics I)
2 EE 101~~ & 101L~~ (introduction to electrical engineering)
3 ENGL 111 (college English)*
14 Total credit hours

Semester 2
4 MATH 132 (calculus II)
5 PHYS 122 & 122L (general physics II)
4 CHEM 121 & 121L (general chemistry I)*
4 EE 251 or CSE 113 (programming)
17 Total credit hours

Semester 3
4 MATH 231 (calculus III)
4 CHEM 122 & 122L (general chemistry II)*
3 EE 211 (circuits)
4 EE 231~~ & 231L~~ (digital electronics)
3 ENGL 112 (college English)*
18 Total credit hours

Semester 4
3 MATH 254 (linear algebra)
3 MATH 335~~2 (vector analysis)~~ (differential equations)
4 EE 212~~ & 212L~~ (circuits)
4 EE 308~~ & 308L~~ (microcontrollers)
3 Social Science*
17 Total credit hours

Semester 5
4 EE 321~~ & 321L~~ (analog electronics)
3 EE 333 (electricity and magnetism)
3 EE 341 (signals and linear systems)
3 ENGL 341 (technical writing)*
3 Mathematics Elective (upper-level)~~Humanities~~
16 Total credit hours

Semester 6

3 EE 382 (introduction to design)
3 EE 434 (electromagnetic wave transmission and radiation)
3 MATH 382 (probability)
4 Electrical Engineering Elective with lab
3 Social Science*
16 Total credit hours

Semester 7

3 EE 481 & 481L (senior design project)
4 EE 451 ~~& 451L~~ (digital signal processing)
~~3~~4 Electrical Engineering Elective
3 Humanities*
3 Humanities or Social Science*
1~~6~~7 Total credit hours

Semester 8

3 EE 482 & 482L (senior design project)
6 Engineering/Computer Science Elective
3 Humanities or Social Science*
~~4~~3 ~~Free Elective~~ Humanities*
1~~6~~5 Total credit hours

* These courses are requirements for the general education core curriculum, but are not pre- or co-requisites for courses in electrical engineering. Students are encouraged to work with their academic advisers to find suitable points of inclusion in the course program.

Minor in Electrical Engineering

Minimum credit hours required—19
The following courses are required:

- EE 101 ~~& 101L~~ (2), EE 211 (3) or ES 332 (3), EE 212 ~~& 212L~~ (4), EE 231 ~~& 231L~~ (4)
- Six (6) additional credit hours of Electrical Engineering courses selected from: EE 308 ~~& 308L~~ (4), EE 321 ~~& 321L~~ (4), EE 322 ~~& 322L~~ (4), EE 324 (3), EE 333(3), EE 341 (3).

Graduate Program

Master of Science in Electrical Engineering

The Electrical Engineering graduate program provides students with unique research opportunities, thanks to its close association with many research facilities. These facilities include Energetic Materials Research and Testing Center, Langmuir Laboratory, Magdalena Ridge Observatory, National Radio Astronomy Observatory, Incorporated Research Institutions for Seismology, and Institute for Complex Additive Systems Analysis; all easily accessible from campus. These facilities can provide opportunities for students to participate in research related to leading scientific and engineering projects and allow them to achieve highly desirable educational and research experiences.

The student's course of study must be approved by the student's advisory committee, must fulfill the general requirements for the master's degree (page 6), and must include any two of the following courses:

- EE 521, Measurement and Instrumentation
- EE 531, Advanced Digital Design
- EE 544, Modern Control Systems
- EE 554, Embedded Control Systems
- EE 570, Advanced Topics in Electrical Engineering

At least 12 semester hours must be approved Electrical Engineering courses. No more than six (6) semester hours of advanced undergraduate course work may be used to satisfy the degree requirements. Students are required to take at least six (6) credit hours from outside the Electrical Engineering department. Students may choose between an M.S. with thesis (24 credit hours of courses plus six (6) thesis hours) or an M.S. with independent study (27 credit hours of courses plus three (3) independent study hours). Students may be required to take an appropriate software course if they don't have an appropriate programming background.

A five-year B.S./M.S. Electrical Engineering degree can be achieved by fulfilling the separate requirements of both an undergraduate degree and a graduate degree in Electrical Engineering in a five-year period. A combined minimum of 158 credit hours with at least 19 credit hours of 500-level courses and Independent Study (EE 590) is required. Students in the Electrical Engineering five-year program must normally apply for graduate standing at the end of their seventh semester. Graduate admission will be contingent upon adherence to the approved program of studies. Graduate status will be granted on fulfillment of the requirements for the B.S. Degree.

Sample Curriculum for the Master of Science in Electrical Engineering with Thesis

Semester 1

4 EE 521 (measurement and instrumentation)
4 EE 554 (embedded control systems)
3 Non-EE Course
11 Total credit hours

Semester 2

4 EE 570 (advanced topics)
3 EE 581 (directed study)
3 Non-EE Course
10 Total credit hours

Semester 3

6 EE 591 (thesis)
3 Graduate Elective
9 Total credit hours

Graduate Certificate in Electrical Engineering

The Electrical Engineering graduate certificate program is aimed at practicing engineers wanting to increase their exposure to electrical engineering at the graduate level while not being tied to a degree program. The program is designed to provide a rigorous upgrade to the student's skills in electrical engineering while focusing on topics of interest to the student.

The certificate program requires a minimum of 16 credit hours of graduate course work. The course requirements are:

EE521 Measurement and Instrumentation (4 credits)

One 4 credit electrical engineering graduate course
One 3 credit or higher electrical engineering course at either graduate or upper undergraduate level.
One 3 credit or higher graduate course in either mathematics, physics, engineering or computer science.
EE590 Independent Study (2 credits) supervised by a member of the electrical engineering department.

Electrical Engineering Courses:

The Department of Electrical Engineering encourages students from other majors to take electrical engineering courses. Students from other disciplines who are interested in taking electrical engineering courses should inquire at the department office.

EE 101~~, 101L~~, Introduction to Electrical Engineering 2 cr, 1 cl hr, 3 lab hrs
Corequisites: MATH 103~~; EE 101 and 101L are corequisites of each other~~
A broad overview of electrical engineering, including an introduction to analog and digital circuitry. Practical exercises using the EE department's computer-based applications software and lab equipment.

EE 211, Circuits and Signals I, 3 cr, 3 cl hrs
Prerequisites: MATH 132; EE 101 or junior standing
Normally offered fall semester
Principles of electrical circuit analysis. Kirchhoff's laws, equivalent circuits, dependent sources, node and mesh analyses, signals, RLC components. Introductory circuits and operational amplifier circuits as examples.

EE 212~~, 212L~~, Circuits and Signals II, 4 cr, 3 cl hrs, 3 lab hrs
Prerequisite: EE 211 or ES 332
~~Corequisites: EE 212 and 212L are corequisites of each other.~~
Normally offered spring semester
Continuation of EE 211, Laplace transform techniques, transient response, steady-state sinusoidal response, power, and frequency response of RLC circuits.

EE 231~~, 231L~~, Digital Electronics, 4 cr, 3 cl hrs, 3 lab hrs
Prerequisites: EE 101~~ & 101L~~
Corequisites: EE 251 or CSE 113~~, EE 231 and 231L are corequisites of each other.~~
Normally offered fall semester
Foundation of combinational digital system analysis and design; including Boolean algebra, logic gates, and truth tables. Sequential digital design via finite state machines. Lab provides exposure to computer-aided design software and programmable logic hardware.

EE 251, Mathematical Engineering, 4 cr, 3 cl hrs, 3 lab hrs
Corequisites: MATH 103
Normally offered fall semester
Standard programming languages in engineering are applied to data acquisition, data analysis, and mathematical computations. Fundamental concepts in Matlab and C are used to develop programming skills and techniques by addressing problems related to electrical engineering. Typical topics include programming hardware; collection and manipulation of large data sets; signal and noise analysis; data fitting; numerical solutions to problems; basics

of image processing; data encryption; steganography; and signal acquisition and extraction using Matlab toolboxes with commonly available hardware.

EE 308~~, 308L~~, Microcontrollers, 4 cr, 3 cl hrs, 3 lab hrs

Prerequisites: EE 231~~ and 231L~~

~~Corequisites: EE 308 and 308L are corequisites of each other.~~

Normally offered spring semester

Introduction to microcontrollers. Elementary assembly- and C-language programming, bus structures, parallel and serial interfaces, support devices. ~~Using~~Use of logic analyzers and disassemblers in circuit testing. ~~Using~~Use of microcontrollers in measurement and control applications.

EE 321~~, 321L~~, Analog Electronics, 4 cr, 3 cl hrs, 3 lab hrs

Prerequisites: EE 212~~ and 212L~~

~~Corequisites: EE 321 and 321L are corequisites of each other.~~

Normally offered fall semester

Basic principles and use of operational amplifiers, diodes, field-effect transistors, and bipolar junction transistors in electronic circuits.

EE 322~~, 322L~~, Advanced Electronics, 4 cr, 3 cl hrs, 3 lab hrs

Prerequisites: EE 321~~ and 321L,~~ and EE 341

~~Corequisites: EE 322 and 322L are corequisites of each other.~~

Applications in analog electronics. Topics include timing and switching circuits, power supply techniques, active filters, switched capacitor circuits, oscillators, and phase-locked loops.

EE 324, Semiconductor Theory and Devices, 3 cr, 3 cl hrs

Prerequisite: PHYS 122

Fundamentals of semiconductor materials and devices. Topics include introduction to quantum mechanics and electrical conduction in conductors, insulators, and semiconductors. The theory is applied to pn junctions, bipolar and field-effect transistors and opto-electronic devices.

EE 333, Electricity and Magnetism, 3 cr, 3 cl hrs

Prerequisite: PHYS 122 and MATH 231

~~Corequisite: MATH 332~~

Electric and magnetic fields in free space and in matter. Energy storage as a function of field quantities and the relation of this to capacitance and inductance. Maxwell's equations applied to simple electrostatic and magnetostatic problems, plane waves, and transmission lines. Transient and sinusoidal steady state solutions of uniform transmission line problems modeled in terms of circuit parameters.

EE 341, Signals and Linear Systems, 3 cr, 3 cl hrs

Prerequisites: EE 212~~,~~ and MATH ~~254~~335

Principles of linear time-invariant systems. Dynamic systems, Laplace transforms, z-transforms, sampling theory, system functions, poles and zeros, frequency domain, Fourier Transforms, feedback systems, convolution.

EE 352, Microcomputer Interfacing, 4 cr, 3 cl hrs, 3 lab hrs

Prerequisites: EE 308~~, 308L~~

Design of hardware and software for microcomputer interfacing. Bus signals and timing.

Interrupt and direct memory access handling. Students will design, build, program, and test a simple interface card for a common microcomputer bus.

EE 382, Introduction to Design, 3 cr

Prerequisites: EE 308, ~~308L,~~ 321, ~~321L,~~ 333, 341, and have declared electrical engineering as a major
Normally offered spring semester

A course in design methodology as applied to a particular problem in electrical engineering. For a given project, students will integrate their formal course work with the use of computer-aided tools to design, construct, evaluate, and document a prototype system.

EE 408, Cooperative Education

On-the-job training to supplement the academic program. Students alternate periods (usually six months long) of full-time semiprofessional employment in Electrical Engineering with periods of full-time academic study. A written report of the student's activities will be required at the end of the training.

EE 434, Electromagnetic Wave Transmission and Radiation, 3 cr, 3 cl hrs

Prerequisite: EE 333
Normally offered spring semester

Reflection and refraction of plane waves at planar interfaces. The propagation characteristics of metallic and dielectric waveguides with particular emphasis on fiber optics. Radiation from linear current elements and planar apertures and arrays of these elements. Analysis of simple communication links.

EE 435L, RF and Microwave Laboratory, 1 cr, 3 lab hrs

Corequisite: EE 434

Experiments in radio frequency and microwave techniques and measurements.

EE 443, Intermediate Control Theory, 3 cr, 3 cl hrs

Prerequisite: EE 341

Modeling of dynamical systems via differential equations, transfer functions, and state-space methods. Performance, characterization, and behavior of linear feedback-systems. Design of various types of control schemes to meet performance specifications.

EE 443L, Intermediate Control Theory Lab, 1 cr, 3 cl hrs

Corequisite: EE 443 or MENG 405 or permission of instructor

Use of computer based data acquisition and control (DAC) hardware and software. Model validation and verification of physical systems. Implementation of real-time control schemes utilizing actuators and sensors.

EE 446, Introduction to Communications Theory, 3 cr, 3 cl hrs

Prerequisites: EE 341~~;~~ and MATH 382

Principles of communication theory. Modulation techniques, random signals and noise, analysis of communication systems in presence of noise, digital communication, matched filters, channel capacity, multiple access.

EE 451~~, 451L~~, Digital Signal Processing, 4 cr, 3 cl hrs, 3 lab hrs

Prerequisites: EE 308~~,~~ and EE 341

Principles of digital signal processing. Infinite and finite impulse response filters, discrete and fast Fourier transforms, multirate processing, spectral estimation, quantization effects, system design. Implementation of real-time DSP algorithms on state-of-the-art hardware. Principles discussed in class will be demonstrated with real applications. Labs include design

and implementation of infinite and finite impulse response filters, and applications such as communication systems, sound processing, and ~~other applications~~image processing.

EE 481, 481L, Senior Design Project I, 3 cr

Prerequisites: EE 382, and have declared electrical engineering as a major
Normally offered fall semester

Student design teams begin an academic year long capstone design project under the supervision of a faculty advisor. Each team may undertake a different project and will build a team, determine design requirements, perform detailed planning, identify project needs and establish goals leading toward the successful completion of the project. Periodic design reviews and reports, applications of engineering skills, project management and formal presentations are major components of the program. Successful completion of the project requires the application of electronics, applied physics, numerical computation, signal processing and other electrical engineering techniques to real-world engineering problems.

EE 482, 482L, Senior Design Project II, 3 cr

Prerequisites: EE 481, and have declared electrical engineering as a major
Normally offered spring semester

A continuation of the capstone design projects begun in EE 481. EE 482 must be taken in the semester immediately following EE 481, 481L to maintain project continuity. The student teams bring their design projects to successful conclusion. Status reports, a final presentation to faculty and reviewers and the submission of a senior thesis are included in the program.

EE 491, Special Topics, hrs and crs to be arranged

EE 500, Directed Research, cr to be arranged

Prerequisite: Graduate standing

Offered both Spring and Fall semester. Credits cannot be applied towards the 30 credit hours required for graduation. Research under the guidance of a EE faculty member.

EE 521, Measurement and Instrumentation, 4 cr, 3 cl hrs, 3 lab hrs

Prerequisites: EE 308, 322, 341 or equivalent or consent of instructor

Survey of various sensors and transducers for measuring physical quantities; measurement errors; analog and digital interfaces; sampling; quantization; actuators; and sensing devices in closed-loop control. Digital interfacing to the measurement devices for both experimentation and microprocessor control will be performed using a computer equipped with data acquisition hardware and software.

EE 531, Advanced Digital Design: 4 cr, 3 cl hrs, 3 lab hrs

Prerequisite: EE 231 or equivalent or consent of instructor

Advanced topics in digital design. Synchronous and asynchronous state machines. Timing issues in high-speed digital design. Design of a complex system using the VHDL programming language in a CAD environment.

EE 533, Optical/RF Engineering, 3 cr, 3 cl hrs

Prerequisites: EE 324, 434 ***or equivalent or consent of instructor***

Explore various topics in data links and telemetry including RF links, antennas, satellite communications, and optical fiber links. Projects will include design and fabrication of basic RF antenna and a case study of a satellite communications system.

EE 537, Photonics, 4 cr, 3 cl hrs, 3 lab hrs

Prerequisites: Graduate standing; EE 434; or consent of instructor

Topics include the generation, propagation, manipulation and detection of light from low to high energy. Uses and applications of optical systems: simple optics, binary and Fourier optics, electro-optics, wavefront analysis, modal decomposition, inversion techniques for wavefront reconstruction and correction and optical signal processing. Other advanced topics in optics.

EE 544, Modern Control Theory, 4 cr, 3 cl hrs, 3 lab hrs

Prerequisites: EE 443; MATH 454; or equivalent or consent of instructor

Treatment of modern approach to control system design primarily via state-space analysis techniques for both continuous and discrete time systems. Topics include the realization of MIMO models for real-systems, linear feedback control, the design of observers, optimal control, and concepts in stability. The latter part of the course will address recent advanced topics of current relevance. Associated hardware and software-based lab/project(s) will include the use of PC based data acquisition systems.

EE 545, Digital Communication I, 3 cr, 3 cl hrs

Prerequisite: EE 446 or equivalent or consent of instructor

Digital communication systems; response time requirements and control of user errors. Spread spectrum modulation and the fundamental limitations dictated by information theory. Various types of modulation and multiplexing including BPSK, QAM, QPSK, OQPSK. Statistical analysis of various modulation schemes.

EE 546, Digital Communication II, 3 cr, 3 cl hrs

Prerequisite: EE545 or consent of instructor

Spread-spectrum modulation, frequency hopping techniques, error control coding, multiple access techniques including TDMA (time division multiple access) and CDMA (code division multiple access). Various advanced case studies. Analysis of imperfections; noise and distortion line failures, data errors, delays and blocking, treatment of errors.

EE 548, Manipulator-based Robotics: 4 cr, 3 cl hrs, 3 lab hrs

Prerequisite: EE 443 or equivalent or consent of instructor

Fundamentals of the multi-disciplinary field of robotics. Emphasis is placed on understanding how to model and control robotic manipulators while providing an appreciation of the importance of sensing to robotic applications. Topics include: forward, inverse, and motion kinematics; dynamic modeling; position, velocity, and force control.

EE 551, Discrete-Time Signal Processing, Filtering, and Estimation, 3 cr, 3 cl hrs

Prerequisites: EE 451; MATH 254, 382; or consent of instructor

The fast-Fourier transform and its computer implementation; spectral estimation; analytic signals; multi-dimensional signal processing; digital filters. Signal detection and estimation, Kalman Filters, linear predictive coding, and adaptive filters. Project(s) include the design and implement a Kalman filter for GPS data processing and LPC for speech recognition.

EE 552, Image Processing and Data Compression Techniques, 3 cr, 3 cl hrs

Prerequisites: EE 451; MATH 254, 382; or consent of instructor

The basics of two-dimensional digital signal processing, image representation and human vision including color models, image transformation and video compression techniques (including JPEG and MPEG). Study of relevant current applications including HDTV.

EE 554, Embedded Control Systems, 4 cr, 3 cl hrs, 3 lab hrs

Prerequisites: EE 308, 443 or equivalent or consent of instructor

Micro-controller or microcomputer based embedded control systems. A comparative survey of currently available embedded computers/controllers including SBC's, PICs, basic-stamps, and single-chip computer solutions. Real time operating systems, including real-time LINUX, and hard real-time process requirements. Projects will include the implementation of an embedded real-time control solution.

EE 562, Microwave Engineering & Radar, 3 cr, 3 cl hrs

Prerequisite: EE 434 or equivalent or consent of instructor

Transmission media: waveguides, microstrip and glass fiber. Ferrite devices and cavity resonators. Equivalent circuits using scattering and transmission matrices. Active components in microwave circuits.

EE 569, Wireless Communications, 3 cr, 3 cl hrs

Prerequisite: EE 446 or equivalent courses or consent of instructor

Signaling: exchange, subscriber loops, and local loops, transmission media, and multeplexing. Switching: network switching, space-division and panel switching, and various digital-switching methods. Cellular telephony, data networks and communication protocols.

EE 570, Advanced Topics in Electrical Engineering, 4 cr, 3 cl hrs, 3 lab hrs

Prerequisite: EE 333 or equivalent or consent of instructor

Emerging technologies and specializations in Electrical Engineering addressed from the perspective of embedded systems and advanced design.

EE 581, Directed Study, cr to be arranged

Prerequisite: Permission of graduate advisor

EE 590, Independent Study, cr to be arranged

Prerequisite: Permission of graduate advisor

Independent research supervised by a faculty member. It is expected that this work will culminate in a paper to be published, and an oral presentation is required.

EE 591, Thesis (Master's Program), cr to be arranged

EE 592, Graduate Seminar, 1 cr, 1 cl hr

Prerequisite: Graduate standing

Offered both Spring and Fall semester. Credits cannot be applied towards the 30 credit hours required for graduation.

Faculty Research Interests

Andrews—Optoelectronics, Experimental Adaptive Optics, Imaging Systems
Arechiga—Speech Processing, Thunderstorms
Bond—Design for Test/Manufacturability, Teaching Effectiveness
Elias—Ionospheric Research, Optical Interferometry, Astronomical Photon Orbital Angular Momentum
El-Osery—Wireless Communications, Control Systems, Soft Computing
Erives—Hyperspectral Imaging, Sound Processing
Helmboldt—Novel Applications of Radio Astronomy Instrumentation
Jorgensen—Spacecraft and Astronomical Instrumentation, Space Physics, Data Assimilation,

Sensor Networks, Space Elevators
Kassim—Novel Applications of Radio Astronomy Instrumentation
Mansfield—Radar Systems
Meason—Nuclear, Electromagnetic and Space Radiation Effects, Directed Energy
Prager—Semiconductors
Restaino—Adaptive Optics, Novel Optical Systems
Senay—Communications, Signal Processing, Control
Teare—Adaptive Optics, Photonics, Smart Sensors, Ballistics
Wedeward—Adaptive Control, Robotic Systems, Electric Power Systems
Wick—Experimental Adaptive and Active Optics
Xiao—Photonic/Fiber Sensors