Electrical and Computer Engineering
In the College of Engineering

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The Radio Frequency Communication Systems Industry Chair
The Radio Frequency (RF) Communication Systems Industry Chair was established in recognition of the pervasiveness and vital role of radio frequency and wireless communications in modern society, and the emergence of San Diego as the world’s leading center of research and development in the field of telecommunications and wireless engineering. The chair is sustained through generous contributions of Cubic Corporation and other corporations engaged in wireless communication technology, in appreciation of contributions of students trained in the field at SDSU. The RF Communication Systems Industry Chair is intended to promote excellence in education of RF and microwave engineers, and encourage significant professional activities in the field. Dr. Madhu S. Gupta, the first occupant of the chair, maintains a major involvement in professional work in the discipline and has received international recognition from his professional peers as a distinguished educator and scholar in the field of RF and microwave engineering.

Courses Acceptable on Master’s Degree Program in Electrical and Computer Engineering (E E) (COMPE)
Refer to Courses and Curricula and Regulations of the Division of Graduate Affairs sections of this bulletin for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.

Electrical Engineering (E E)
UPPER DIVISION COURSES
NOTE: Prerequisites will be enforced in all 500-level courses. A copy of an official transcript will be accepted as proof. For prerequisites, an enrollment confirmation form will be accepted. All courses at the 300 level or below must be passed with a grade of C– or better in order to be used as a prerequisite for any subsequent course with the exception of Electrical Engineering 210, Computer Engineering 160, Mathematics 150, 151, Physics 195, 196, which requires a grade of C or better.

E E 502. Electronic Devices for Rehabilitation (3)
Two lectures and three hours of laboratory.
Prerequisite: Electrical Engineering 330.
Recent developments in electronic assistive devices and microcomputers for persons with various disabilities; assessment of disabled persons for suitable technological assistive devices.

E E 503. Biomedical Instrumentation (3)
Prerequisites: Aerospace Engineering 280; Electrical Engineering 410 and 430 (or for Mechanical Engineering majors, Electrical Engineering 204 and Mechanical Engineering 330).
Instrumentation systems to monitor, image, control, and record physiological functions.

E E 530. Analog Integrated Circuit Design (3)
Prerequisite: Electrical Engineering 430 with minimum grade of C–.
Advanced treatment of transistor pairs, device mismatches, differential amplifiers, current mirrors, active loads, level shifting, and output stages. Parasitic and distributed device parameters. Economics of IC fabrication and impact on design.

E E 534. Solid-State Devices (3)
Prerequisite: Electrical Engineering 434.
Energy bands and charge carriers in semiconductors; generation, recombination, and transport of excess carriers; semiconductor junctions; unipolar and bipolar transistors; high-frequency, high-power, and optoelectronic devices; integrated circuits.

E E 540. Microwave Devices and Systems (3)
Prerequisite: Electrical Engineering 440. Recommended: Aerospace Engineering 515.
Applications of Maxwell’s equations to wave propagation. Microwave network parameters; guided wave transmission and reflection. Design of filters, couplers, power dividers and amplifiers. Applications in radar and telecommunications systems.

E E 540L. Microwave Design and Measurements Laboratory (1)
Three hours of laboratory.
Prerequisites: Credit or concurrent registration in Electrical Engineering 430L and 540.
Microwave measurement equipment, simulation tools for designing microwave components, vector network analyzer calibration, design and measurement of planar microwave components, and a design project.
E E 541. Electro-Optics (3)
  Prerequisite: Electrical Engineering 434.
  Optical/electronic devices and systems; wave beams; light-matter
  quantum interactions; incoherent and laser light sources; modulators
  and detectors. Applications in data transmission, measurement, and
  materials processing.

E E 556. Digital Signal Processing (3)
  Prerequisite: Electrical Engineering 410.
  Discrete-time signals and systems. Sampling, Z-transform, Discrete-time Fourier transform and frequency responses, DFT, FFT, and introduction to IIR and FIR digital filter design.

E E 558. Digital Communications (3)
  Prerequisite: Electrical Engineering 458.
  Design of baseband digital communication systems; noise
  characterization, sampling, quantization, matched filter receivers,
  bit-error performance, inter-symbol interference, link budget analysis.

E E 581. Power System Dynamics (3)
  Prerequisite: Electrical Engineering 480.
  Three-phase faults, symmetrical components, unsymmetrical
  faults, protective relay operating principles, economic dispatch of
  thermal power generation units, power system controls, voltage and
  power stability.

E E 596. Advanced Electrical Engineering Topics (1-3)
  Prerequisite: Consent of instructor.
  Modern developments in electrical engineering. May be repeated
  with new content. See Class Schedule for specific content. Maximum
  credit of nine units for any combination of Electrical Engineering 496
  and 596 applicable to a bachelor's degree. Maximum combined
  credit of six units of Electrical Engineering 596 and 696 applicable
to a 30-unit master's degree. Credit for 596 and 696 applicable to
  a master's degree with approval of the graduate adviser.

E E 600. Seminar (1-3)
  Prerequisite: Consent of instructor.
  An intensive study in advance electrical engineering. May be repeated
  with new content. See Class Schedule for specific content. Maximum
  credit six units applicable to a master's degree.

E E 601. Linear System Theory and Design (3)
  Prerequisite: Electrical Engineering 420.
  State models and solutions of the state equations, stability,
  controllability and observability, realizability and minimal realizations,
  linear state and output feedback control, introduction to linear optimal
  control.

E E 602. Stochastic Signals and Systems (3)
  Prerequisite: Electrical Engineering 410.
  Random signals, correlation function, power spectral densities, the
  Gaussian process, narrow band processes. Applications to communication
  systems. (Formerly numbered Electrical Engineering 653.)

E E 631. RF Electronic Circuits (3)
  Prerequisites: Electrical Engineering 410, 430, 602.
  Distiguishing characteristics of RF circuits; analysis of noise and
  nonlinearity in circuits; frequency-selective and impedance-matching
  networks. RF amplifiers, oscillators and frequency conversion circuits.
  Phase-locked loops and their applications.

E E 634. RF Circuit Design (3)
  Prerequisite: Electrical Engineering 540.
  RF component and circuit design in frequency domain and
  scattering parameter terms. Linear amplifiers, stability considerations,
  unilateralization, matching techniques, low-noise amplifiers, wideband
  designs, power amplifiers, linearity considerations, oscillators, and
  mixers.

E E 641. RF Wireless Systems (3)
  Prerequisites: Electrical Engineering 440, 558, 602.
  Characteristics and performance measures of RF subsystem in
  wireless communication systems: wireless channel, antenna, modulators
  and demodulators, low-noise and power amplifiers, oscillators, ADC and
  DAC, receiver architectures, system-level design of RF front-end.

E E 645. Antennas and Propagation (3)
  Prerequisite: Electrical Engineering 540.
  Impedance characteristics and radiation patterns of thin linear
  antenna elements; field intensity calculations. Tropospheric and
  ionospheric propagation; propagation anomalies.

E E 650. Modern Communication Theory (3)
  Prerequisites: Electrical Engineering 558 and 602.
  Wireless digital communication; bandpass modulation and
demodulation, multiple access techniques, broadband signaling
  techniques, spread spectrum techniques; applications include CDMA
  and OFDM.

E E 652. Principles and Applications of Information Theory (3)
  Prerequisites: Electrical Engineering 558 and 602.
  Information measure of data sources; Shannon's theorem and capacity of communication links; rate-distortion theory and performance of source codes.
E E 653. Coding Theory (3)
Prerequisite: Electrical Engineering 556.
Error control for digital information; arithmetic of Galois fields; block, cyclic, convolutional and turbo encoding and decoding; applications in digital communication and computer systems.

E E 654. Adaptive Algorithms (3)
Prerequisite: Electrical Engineering 556.
Adaptive DSP algorithms. Time varying, data dependent filters, adaptive predictors, cancelers, equalizers. LMS and RLS algorithms, tapped delay line, lattice, and decision feedback structures. Adaptive beam forming and beam steering.

E E 655. Modem Design (3)
Prerequisites: Electrical Engineering 556 and 558.
System level and DSP design of modems for wireless and wireline communications. Study modems for QAM, OFDM, CDMA, and T-1 modulation.

E E 656. Multirate Signal Processing (3)
Prerequisite: Electrical Engineering 556.
DSP techniques for sample rate changes in digital filters. Decimation and interpolation, aliasing as a processing option in resampling filters. Applications in communication and entertainment media systems.

E E 657. Digital Image Processing (3)
Prerequisite: Electrical Engineering 556.
Theory of two-dimensional signals and systems, image transforms, image enhancement, restoration and compression, image analysis and computer vision.

E E 658. Advanced Digital Signal Processing (3)
Prerequisites: Electrical Engineering 556 and 602.

E E 660. High Speed Networks: Design Principles and Recent Advances (3)
Prerequisite: Computer Engineering 560.
Provides students with knowledge of recent developments in area of computer networks. Current research in high speed computer networks.

E E 662. Wireless Sensor Networks (3)
Prerequisite: Computer Engineering 560.
Sensor platforms, wireless channel characteristics, time synchronization, medium access control, topology control, routing protocols, localization, coverage and placement, detection and tracking, query processing.

E E 665. Multimedia Wireless Networks (3)
Prerequisite: Computer Engineering 565.
Multimedia source characteristics, compressed bitstreams, error resiliency, quality of service, cellular video telephony, multimedia QoS-awareWLAN, peer to peer networks, and multimedia broadcast multicast services.

E E 672. VLSI System Design (3)
Prerequisite: Computer Engineering 572.
Design of microprocessor data paths and controllers, memory management, pipelines, multipliers, Risc and multiprocessor systems and applications.

E E 674. Signal and Power Integrity (3)
Prerequisites: Electrical Engineering 440 and Computer Engineering 572.
Interconnect and power distribution network design in very-large-scale integration systems packaging. High-speed transmission lines and crosstalk, macromodeling of interconnects. Switching noise, decoupling, numerical methodologies in power integrity design.

(Same course as Mechanical Engineering 685)
Prerequisite: Mechanical Engineering 585.
Design and manufacturing technology for micro- and nano-scale devices. Topics include solid state transducers, microscale physics, biomedical microelectronics, microfluidics, biosensors, and hybrid integration of microfabrication technology. Emphasis on biomedical applications.

E E 740. Advanced Topics in Physical Electronics (1-3)
Prerequisites: Graduate level coursework in the area and consent of instructor.
Selected topics in electromagnetic fields and waves, optoelectronics, and semiconductor devices. May be repeated with new content and consent of graduate adviser. See Class Schedule for specific content. Maximum credit six units applicable to a master’s degree.

E E 795. Internship/Practicum (1) Cr/NC
Prerequisite: Consent of department chair.
Supervised internship or practicum experience with approval of graduate adviser. Not applicable to an advanced degree. Maximum credit three units.

E E 797. Research (1-6) Cr/NC/RP
Prerequisites: Consent of department chair. Open only to students in Plan A Thesis.
Research in engineering. Maximum credit six units applicable to a master’s degree for students in Plan A only.

E E 798. Special Study (1-3) Cr/NC/RP
Prerequisite: Consent of department chair.
Individual study. Maximum credit three units applicable to a master’s degree for students in Plan B study.

E E 799A. Thesis or Project (3) Cr/NC/RP
Prerequisites: An officially appointed thesis committee and advancement to candidacy.
Preparation of a project or thesis for the master’s degree.

E E 799B. Thesis or Project Extension (0) Cr/NC
Prerequisite: Prior registration in Thesis or Project 799A with an assigned grade symbol of RP.
Registration required in any semester or term following assignment of RP in Course 799A in which the student expects to use the facilities and resources of the university; also student must be registered in the course when the completed thesis or project is granted final approval.

E E 799C. Comprehensive Examination Extension (0) Cr/NC
Prerequisite: Completion or concurrent enrollment in degree program courses.
Registration required for all students taking the comprehensive examination for the master’s degree. Registration in 799C limited to two semesters.