

COURSES FOR SELF-FINANCED ELECTRICAL AND ELECTRONIC ENGINEERING POSTGRADUATE PROGRAMS

EESM 501 CMOS VLSI Design [3-0-0:3]

CMOS process and design rules; MOS device electronics; CMOS circuit and logic circuit characterization and performance estimation; VLSI design and verification tools. Project work will be centered on industry standard tools.

EESM 503 Analog IC Analysis and Design [3-0-0:3]

Current sources, output stages, operational amplifiers, frequency response, feedback analysis, stability and compensation, slew rate, advanced integrated-circuit design techniques, analog VLSI building blocks.

EESM 504 Advanced Analog IC Analysis and Design [3-0-0:3]

Noise analysis, advanced op-amp design techniques, analog VLSI building blocks, multipliers, oscillators, mixers, phase-locked loops, A/D and D/A converters, passive filter design, frequency scaling, active filter design. *Backgrounds:* ELEC 221 and ELEC 304 *Exclusion:* ELEC 504

EESM 505 Advanced Semiconductor Devices [3-0-0:3]

Principles and characteristics of semiconductor devices found in state-of-the-art ICs. Emphasis is on deep-submicron MOS device design, characterization and modeling. Important issues such as short channel effects, high-field behavior, hot carrier effects, reliability and device scaling for present and future technology will be covered. *Exclusion:* ELEC 505

EESM 506 Semiconductor Devices for Integrated Circuit Designs [3-0-0:3]

Review of MOSFET characteristics, device modeling for circuit simulation (SPICE models), the BSIM MOSFET models, other semiconductor models, circuit model parameter characterization, design guard-band and statistical modeling.

EESM 507 Microelectronics Fabrication Technology [3-0-0:3]

Process technologies in IC fabrication: epitaxial growth; chemical-vapor and physical-vapor deposition of films; thermal oxidation; diffusion; ion implantation; microlithography; wet/dry etching processes; process integration of MOS and bipolar technologies; introduction to electronic packaging. *Exclusions:* CENG 582, ELEC 507

EESM 508 IC Systems Design and Analysis [3-0-0:3]

System definition, design and analysis of integrated circuit systems: mixed-signal systems, low power systems, embedded systems, etc. System trade-offs; introduction to system-on-chip (SOC) concepts and methodology; case studies.

EESM 509 IC Product Development Methodologies [3-0-0:3]

Integrated circuit product development cycle; technology and foundry interfaces; yield and cost improvement; design-in-manufacturability; design-in-quality; product manufacturing logistics; IC debug methodology; case studies.

EESM 510 Photonics Technology and Applications [3-0-0:3]

This course introduces the fundamentals of photonics, as well as provides a survey on the frontiers of optics and photonics technology. Fundamental topics include: geometric and wave optics, fiber optics, semiconductor light sources, and electro-optics. Selected special topics include: biophotonics, micro and nano optics, photonic integrated circuits and components, optical switching and RF photonics.

EESM 514 Digital Communication Networks and Systems [3-0-0:3]

Basic layer model for computer communications; physical signal space and digital modulation concepts; M-ary modulation, CDMA and OFDM; TCP/IP and related protocols; local area networks; unicast and multicast routing; QoS; mobile IP; security.

EESM 515 IP Networks [3-0-0:3]

Designed for students with or without background in computer networks, this course covers the basic layer model for computer communications, TCP/IP and related protocols, local area networks, and advanced topics in unicast and multicast routing, QoS, mobile IP, and security.

EESM 516 Digital VLSI System Design and Design Automation [3-0-0:3]

Structured design styles, specification, synthesis and simulation using hardware descriptive language (HDL), structural chip design and system design, circuit design of system building blocks: arithmetic unit, memory systems, clocking and performance issues in system design, design-automation tools and their applications, introduction to testing. *Exclusion:* ELEC 516

EESM 517 Introduction to Integrated Circuit Testing [3-0-0:3]

Manufacturing test principles, design strategies for test, chip-level test techniques, system-level test techniques, layout design for improved testability, practical engineering techniques for IC testing.

EESM 518 VLSI Signal Processing Architecture [3-0-0:3]

VLSI architecture design for digital signal processing applications such as multimedia and communication systems will be covered; general techniques such as pipelining, retiming, folding and unfolding, and systolic array design will be discussed; algorithmic/architectural tradeoff in power and performance will be studied; example applications in video processing and wireless communication architectures will be provided. *Background:* ELEC 516 or EESM 516

EESM 520 Telecommunication Regulations, Markets, and Services [3-0-0:3]

Deregulations in US, Europe, Hong Kong, and China; historical perspectives; market stratification and players; technologies and business models; E-commerce and security; Cyberlaw; case studies.

EESM 525 Flat Panel Displays [3-0-0:-3]

Discussions on various flat-panel display technologies. Emphasis will be placed on liquid crystal displays. Liquid crystal alignment and optics. Driving methods. Active matrix. Bistable displays. Plasma display panels. Inorganic and organic light emitting diodes physics and devices. *Exclusion:* ELEC 525

EESM 526 Design and Analysis of Engineering Experiments [3-0-0:3]

Fundamental principles of planning, designing, and analysing statistical experiments. Probability distributions, tests of hypotheses, analysis of variance, and the applications using randomized block, factorial, and fractional factorial experimental designs. *Background:* MATH 244 *Exclusion:* IEEM 526

EESM 531 Total Quality Management [3-0-0:3]

Strategic importance and economic impacts of quality, managerial issues in planning and designing quality assurance systems, control of quality systems, employee involvement, statistical concepts in design for quality, inspection, process control, and ISO 9000. *Exclusion:* IEEM 531

EESM 532 Image and Video Signal Processing [3-0-0:3]

Multi-dimensional signals and systems; Characteristics of image and video signals; visual perception; multi-dimensional sampling and transforms; image and video enhancement and restoration; image and video compression; coding standards; delivery of visual contents over networks.

EESM 534 Signal Analysis and Pattern Recognition [3-0-0:3]

Computer-based interpretation of signals; temporal, frequency, and wavelet analysis; fractal analysis; object segmentation; data fusion; pattern recognition; density estimation; feature selection and extraction; clustering; dynamic time warping; hidden Markov models; examples from biomedical signal processing and speech recognition.

EESM 536 Digital Communications [3-0-0:3]

This course provides a comprehensive coverage of digital communication theory and design. Emphasis placed on system goals and trade-offs. Review of signals and systems, probability and stochastic processes; optimal detection of signals in noise; basic information theory concepts; coding; basic and advanced digital modulation schemes; signaling through band-limited and wireless channels; spread-spectrum communications. *Background:* Probability theory *Exclusion:* ELEC 536

EESM 539 Broadband Communication Networks [3-0-0:3]

Systems and protocols for wireless and high-speed communication networks; from cellular to wireless IP applications, broadband access technologies; performance analysis, core network, packet data protocols. *Background:* ELEC 537 *Exclusion:* ELEC 539

EESM 540 Introduction to Telecommunication Networks [3-0-0:3]

Telecommunication network structures, telephony, SS7, PDH and SDH transmission systems, network control and signaling, IN and network services, optical and DWDM networks, from ATM to new IP.

EESM 546 Wireless Communication Systems [3-0-0:3]

Overview of cellular structure and frequency reuse; mobile radio propagation and path loss models; statistical nature of radio channels; coding and time or frequency diversity; spread spectrum CDMA techniques and 3G Systems; OFDM and Wireless LAN standards; fast frequency hopping technology and Bluetooth. *Background:* ELEC 343 or equivalent *Exclusion:* ELEC 546

EESM 547 Multimedia Signal Processing [3-0-0:3]

Basic signal processing theory, image and video characteristics and processing, compression techniques, entropy coding, predictive coding, transform coding, vector quantization, subband coding, audio and speech processing, coding standards, real-time processing, watermarking, digital rights management.

EESM 560 Thin Film Materials Science [3-0-0:3]

Basic knowledge of materials science and mechanics of thin films with an emphasis on the mechanical properties on thin films and failure mechanisms in microelectronic devices. *Exclusions:* MATL 560, MECH 504

EESM 570 Feedback Control Theory [3-0-0:3]

Modeling, analysis, and design of feedback control systems; state space equations and transfer functions; system simulation; linear and nonlinear system analysis; Lyapunov stability; feedback controller design; performance specifications; linearization; optimal control; robotics; computer aided analysis and design.

EESM 581 Advanced Computer and Networking Architectures [3-0-0:3]

Design and implementation of computer architectures; analysis and comparison of different architectures; fundamental concepts including pipelining, instruction-level parallelism, memory hierarchies, input/output architectures, and multiprocessing; modern issues including networking architecture, storage area networking, and VLSI scaling.

EESM 592 Introduction to Electronic Packaging [3-0-0:3]

State-of-the-art in IC technology, fundamental packaging architecture, types of package; packaging materials and processing technologies; functions, geometry, materials and structure of substrates and PCBs; interconnection technologies; reliability testing and failure mechanisms of package components; characterization, measurement and failure analysis; future trends. *Exclusions:* MATL 540, MECH 592

EESM 690 Independent Study [3 credits]

Selected topics in electrical and electronic engineering studied under the supervision of a faculty member.

EESM 691 Topics in Telecommunications and Network Convergence [3-0-0:3]

This course integrates the MSc program materials together by covering one or more selected topics in the following areas: network convergence; multimedia and content delivery protocols; broadband signaling, and new IP signaling standards; mobile network and applications; other topics.

EESM 692 Topics in Analog IC Systems and Design [3-0-0:3]

Selected topics in analog and mixed-signal IC design drawn from disciplines such as RF/microwave IC design, integrated power electronics, imager design, micro-sensor design and micro-display design. Two to three selected topics will be discussed in depth that put emphasis on system level considerations as well as functional blocks design. *Backgrounds:* ELEC 304, EESM 503

EESM 698 MSc Project [2 credits]

Independent project carried out under the supervision of a faculty member. This course may be run repeatedly for credit(s). *Exclusion:* ELEC 698