

The Electrical Engineering Department

Master of Science (M.Sc.) Programs

The Electrical Engineering Department offers graduate programs leading to the degree of Master of Science in Electrical Engineering. The program has been designed to reflect the modern trends and developments in the Electrical Engineering curricula. The program is available with the following options in several specializations:

- Thesis Option
- Non-Thesis Option

Objectives:

The M.Sc. programs aim at:

- Offering specialized courses for electrical engineers.
- Development of production and service sectors in the Kingdom.
- Combining the university with industrial and technical sectors into common research programs.
- Promoting scientific and applied researches particularly that are related to development requirements of the kingdom.

Areas of Specialization

Both, Thesis as well as Non-Thesis option, M.Sc. degree programs are available in the following areas of specialization:

- Electronics
- Communications
- Electrical Machines and Power Electronics
- Electrical Power
- Control Systems and Computers

Degree Requirements for Thesis Option Program

The M.Sc. degree requirements for Thesis Option are:

- Completing 24 credit hours of course work from the approved graduate courses as follows:
 - 9 credit hours of common courses.
 - 15 credit hours of specialized electrical engineering courses following the Departmental regulations.
- The student must successfully complete and defend a thesis on a selected research topic in the area of specialization.

Degree Requirements for Non-Thesis Option Program

The M.Sc. (non-thesis option) program degree requirements are:

- Completing 36 credit hours of course work from the approved graduate courses as follows:
 - 9 credit hours of common courses.
 - 27 credit hours of specialized electrical engineering courses following the Departmental regulations.
- The student must successfully complete a research project, which comprises two parts (EE598 & EE599), each having 3 credit hours. Each part is graded pass/fail.

Common Courses

The common courses for Thesis as well Non-Thesis Options are given in the following (Each course is of three credit hours):

GE 501 Computer Simulation of Engineering Systems
EE 502 Modeling of Stochastic Engineering Systems

Math 505 Numerical Linear Algebra

Specialized Courses

The available courses, in different specializations, are given in the following. Each course is of three units (credit hours). Some of these courses are compulsory, while the others are elective. Some of the elective courses can be taken from EE specialized courses, different from the main specialization of the student. In selecting courses, there are certain rules that must be fulfilled for Thesis and Non-Thesis Options.

Electronics

EE 502 Modeling of Stochastic Engineering Systems

EE 503 Advanced Digital Circuit Design

EE 504 Electronic Devices

EE 506 Advanced Analysis of Electronic Circuits

EE 507 VLSI Design

EE 508 Optoelectronics

EE 509 Embedded Systems

EE 510 Data Communication Integrated Circuits

EE 512 Applications of Integrated Circuits

EE 515 Microwave Electronics

EE 516 Selected Topics in Electronics

EE 517 VLSI Fabrication Technology

EE 519 System on Chip

Communications

EE 521 Electromagnetic Fields

EE 524 Communication Networks

EE 526 Optical Communications

EE 528 Digital Communications

EE 571 Digital Image Processing

EE 572 Satellite Communications

EE 573 Information Theory

EE 574 Error correcting coding for communication systems

EE 575 Mobile Communications

EE 576 Selected Topics in Communications and Signal Processing

EE577 Selected Topics in Electromagnetic waves and Microwave Engineering

Electrical Machines and Power Electronics

EE 530 Design of Electrical Machines

EE 531 Advanced Theory of Electrical Machines

EE 532 The Generalized Theory of Electrical Machines

EE 533 Electrical Machine Dynamics

EE 534 Power Semiconductor Converters

EE 535 Selected Topics in Electrical Machines

EE 536 Electrical Machines for Special Purposes

EE 537 Selected Topics in Power Electronics

Electrical Power

EE 544 Reliability Evaluation and Power System Planning

EE 546 High Voltage Test Techniques

EE 547 Selected Topics in Power Systems

EE 548 Power System Protection

EE 549 Power System Dynamics

EE 581 High Voltage Transmission Systems

EE 582 Power System Transients

EE 583 Distribution System Engineering

EE 585 Power System Operation and Control

Control Systems and Computers

EE 550 Internet Technologies and E-Services
EE 551 Computer Controlled Systems
EE 552 Advanced Microprocessors and Applications
EE 553 Computer Organization and Architecture
EE 554 Performance Evaluations of Computing Systems
EE 557 Linear Systems
EE 559 Intelligent Control Systems
EE 560 Advanced Control Techniques
EE 561 Selected Topics in Computers
EE 562 Selected Topics in Control

M. SC Courses

Math 505 - Numerical Linear Algebra (3 credit hours)

Linear equations and matrix analysis; Approximation of functions, error analysis; Special matrices, error analysis for linear systems, iterative methods, computation of eigen values and eigen vectors.

EE 502 - Stochastic Modelling of Engineering Systems (3 credit hours)

Concepts of probability and random variables, reliability, lifetime, failure rate; Functions of random variables; Parameter estimations; Correlation; Experimental design; Stochastic processes; Time series models and regression models; Various applications in engineering systems.

GE 501 - Computer Simulation of Engineering Systems (3 credit hours)

Introduction to system modelling; Principles of computer simulation: system structure, function, timing rules, performance measures, and validation; Random number generators and Monte Carlo simulation; Simulation approaches using: languages and general purpose packages; Continuous system simulation; Discrete system simulation; Simulation examples of engineering systems.

EE 511 - Solid State Electronics (3 credit hours)

Fundamentals of quantum mechanics; Energy bands and carrier concentration; Carrier transport and recombination; P-N junctions; Schottky barrier junctions; Heterojunctions and ohmic contacts; Bipolar junction transistors; Field effect transistors; Semiconductors and diodes in optoelectronics.

EE 512 - Applications of Integrated Circuits (3 credit hours)

Review of semiconductor devices and their applications; Logic circuits and timers; Operational amplifiers applications; Function generators; Phase-locked loop (PLL) circuits.

EE 513 - Layout Design of Integrated Circuits (3 credit hours)

Basic concepts of integrated circuits; MOS integrated circuits fundamentals; Bipolar integrated circuits fundamentals; Integrated circuits layout; Design methods; CAD Tools; Packaging and testing.

EE 514 - Analysis of Analog and Digital Integrated Circuits (3 credit hours)

Nonlinear IC transistor model; Measurement and extraction of nonlinear model parameters; Terminal parameter characterization of logic circuits; Analysis of integrated ECL, TTL and MOS circuits; Analysis of integrated op-amp circuits: Bipolar and FET differential amplifiers, current sources, current mirrors, active loads, super-beta gain stages, cascaded differential amplifiers and the end amplifier.

EE 515 - Microwave Electronics (3 credit hours)

Survey of microwave semiconductor devices, their limitations and equivalent circuits; Microwave circuit techniques: design and construction of cavities; Analysis and design considerations of parametric amplifiers, harmonic generators, impulse generators, reflection-type tunnel diodes amplifiers; Microwave switches and limiters; Microwave transistors and circuits.

EE 516 - Selected Topics in Electronics (3 credit hours)

Topics of current interest will be offered.

EE 517 - VLSI Fabrication Technology (3 credit hours)

VLSI processing: crystal growth, oxidation, epitaxy, lithography, etching, doping and diffusion, ion implantation, dielectric and polysilicon film deposition, metallization; VLSI manufacturing: wafer cleaning and contamination control, process characterization and control, process modelling and simulation, emerging processes, Bipolar IC technology; MOS IC technology.

EE 518 - Optical Electronics (3 credit hours)

Optical principles; Optical detection; Laser theory; Laser light properties; Practical lasers; Noncoherent light sources.

EE 520 - Two-Dimensional Signal and Image Processing (3 credit hours)

Two-dimensional (2-D) signals, systems, and transforms; Design and implementation of linear 2-D digital filters; Image formation; Image sampling and quantization; Image transforms; Image enhancement and restoration; Image coding; Basic image analysis techniques: feature extraction, segmentation, edge detection and pattern recognition; Image processing systems and applications.

EE 521 - Electromagnetic Fields (3 credit hours)

Time harmonic fields; Wave propagation in unbounded media; Transmission line and waveguide concepts; Resonators; Radiation and antenna concepts; Quasi-stationary fields; Current sheets; Analytical and numerical techniques for solving field problems; Applications.

EE 524 - Communication Networks (3 credit hours)

Introduction to data networks; Data transmission over the telephone networks; Modems, multiplexers, concentrators and communication processors; Local area networks; Interfaces and protocols; Packet switching; Analysis of multiple access algorithms.

EE 525 - Digital Signal Processing (3 credit hours)

Mathematical description of discrete signals and systems; the z-transform; Processing continuous signals with discrete systems; Decimation and interpolation of discrete signals; Design of FIR and IIR digital filters; Realization and implementation of FIR and IIR digital filters; The discrete Fourier transform and the fast Fourier transform; Filtering of random signals and the finite precision arithmetic effects; Applications.

EE 526 - Optical Communications (3 credit hours)

Trends in optical communications; Laser theory and sources; Optical transmission; System components and design considerations; System applications; Future directions.

EE 527 - Selected Topics in Communications and Electromagnetics (3 credit hours)

Topics of current interest will be offered.

EE 528 - Digital Communication (3 credit hours)

Statistical decision theory; Geometrical representation of signals; The signal space; The optimum receiver; Modulation and Demodulation for the AWGN channel; Digital signaling over a channel with ISI and AWGN; Digital signaling over fading multipath channels; Introduction to spread spectrum signals for digital communications.

EE 529 - Information Theory and Coding (3 credit hours)

Measure of information (entropy and mutual information); Coding for discrete sources; Discrete memoryless channels and capacity; The noise channel coding theorem; Error detection and correction using block codes; Convolutional encoding and decoding (Viterbi and sequential codes); Application of coding to communication channels.

EE 531 - Advanced Theory of Electrical Machines (3 credit hours)

Transients of synchronous machines; Subsynchronous resonance phenomenon; Application of superconductivity to electrical machines; Operation of induction and reluctance generators.

EE 532 - The Generalized Theory of Electrical Machines (3 credit hours)

Linear transformation methods; General matrix equations of rotating machines; Applications to different machines; Determination of machine performance by matrix techniques.

EE 533 - Electrical Machine Dynamics (3 credit hours)

Electrical machines modelling techniques; State space representation; Small displacement equations; Simulation techniques; Applications to different types of electrical machines.

EE 534 - Power Semiconductor Converters (3 credit hours)

Semiconductor devices: Driving, snubber and protection circuits; Resonant converters; Switching D.C power supplies; Power conditioners; Applications in the fields of electrical energy utilization.

EE 535 - Selected Topics in Electrical Machines (3 credit hours)

Topics of current interest will be offered.

EE 541 - Advanced Power System Analysis (3 credit hours)

Advanced load flow techniques; Unit commitment; Optimal load flow; Contingency analysis; State estimation.

EE 542 - Stability and Control of Power Systems (3 credit hours)

Synchronous machine equations and equivalent circuit; Swing equation; Classical model; Small disturbance models; Damping and synchronizing torques; Linear model; Excitation and turbine systems; Load models; Principles of multi-machine modelling.

EE 543 - Extra High Voltage Transmission Systems (3 credit hours)

Performance characteristics of EHV and UHV transmission lines; Origin, propagation, control and simulation of transients on transmission lines; Corona and its effects.

EE 544 - Reliability Evaluation and Power System Planning (3 credit hours)

Probabilistic modelling of power system reliability evaluation; Reliability methods as applied to power system planning problems; Reliability methods for composite power system planning process; Reliability-based expansion planning methodologies.

EE 546 - High Voltage Test Techniques (3 credit hours)

Philosophy, significance and methods of high voltage AC, DC and impulse testing; Testing standards; Response of measuring systems and evaluation of measurement errors; Origins, practical significance and measurements of partial discharges; Dielectric loss measurements; High current testing of high voltage apparatus; High voltage testing of cables, insulators, transformers and surge arrestors.

EE 547 - Selected Topics in Power Systems (3 credit hours)

Topics of current interest will be offered

EE 548 - Power System Protection (3 credit hours)

type of relays; Three-phase relays; Transmission line protection; Generator and motor protection; Transformer protection; Bus protection; Overvoltage protection.

EE 551 - Computer - Controlled Systems (3 credit hours)

Introduction to digital systems: interfacing, sampling theorem, reconstruction; Computer oriented mathematical models; Process oriented models; Analysis of discrete systems; Design concepts: overview, conversion of analog design, state space designs; Implementation issues: prefiltering, computational delay, finite word length arithmetic.

EE 552 - Advanced Microprocessors and their Applications (3 credit hours)

Microprocessors architecture; Programming and interfacing; Supporting devices; Development tools; Real time programming aspects. Systems Applications with case studies.

EE 553 - Computer Organization and Architecture (3 credit hours)

Multilevel computer architecture; Memory hierarchy and management; I/O systems; Operating system processors and their management; C.P.U.; Control unit operations; Parallel architecture; RISC architecture.

EE 554 - Performance Evaluation of Computing Systems (3 credit hours)

Basic principles; Evaluation tools: Markov chains and queuing analysis; Analysis of single user system, time sharing and multiaccess system; Analysis and performance evaluation of LAN and WAN networks; Case studies.

EE 555 - Expert Systems in Engineering (3 credit hours)

Expert systems versus conventional systems; Components of an expert system; Knowledge representation; Development tools; Knowledge engineering languages; Phases of building expert systems; Applications of expert systems in engineering domain.

EE 556 - Selected Topics in Computers and Control systems (3 credit hours)

Topics of current interest will be offered.

EE 557 - Linear Systems (3 credit hours)

Linear system representation; State and simulation diagrams; Companion forms; Controllability and observability of systems; Sensitivity analysis, State and output feedback controllers; State estimations; Structural properties of linear multivariable system; Minimum order design problem.

EE 558 - Optimal Control (3 credit hours)

System description and performance measure; Dynamic programming; Pontryagin's minimum principle; Variational approach; Linear quadratic problems; Riccati equations, Numerical techniques for optimal control, case studies.