University of Tripoli
Faculty of Engineering

ELECTRICAL AND ELECTRONIC ENGINEERING DEPARTMENT
Graduate programs

General Information

The Electrical and Electronic Engineering Department at University of Tripoli is one of the vital and important departments of the faculty of Engineering, as it was started with the faculty establishment in **1961**. There are three programs in the department; Communication Engineering, Electrical Power System Engineering, and Control System Engineering. The post graduate program has started in 1981 in the three specialties of the department.

The total number of students are almost 1000 student, where the number of full-time staff members are 44, over 20% of them are full professors, in addition to some experts as part time. Each semester, almost 70 students are graduated from the department.

The department provides services to the community by contributing to the fulfillment of the nation's needs of electrical and electronic engineers who are being prepared and qualified to face the working life. Whereas, the majority of the faculty members in the department participated and participate in the technical advisory committees required by the competent authorities inside Libya.

Vision

The program vision is to be distinction and leadership in the field of education and scientific research with sustainability and society partnership.

Mission

The mission of the program is to prepare professional with high grade knowledge and efficacy in the field of Electrical and Electronic Engineering who are able to provide the society requirement and committed with professionality and ethical responsibilities.

Programs

The department currently awarding MSc degree in three disciplines which are:

Program I: ***Communication***

Program II: ***Control***

Program III: ***Power***

New branches are under study such as **Biomedical** Engineering and **Nanotechnology** Engineering Applications**.**

Program I

PROGRAM	***Communication***
DEGREE	*M.Sc.*
OBJECTIVES	1- To upgrade the engineers scientific level and link their knowledge with the state of the art technology. 2- To solve the local development problems through the post graduate research. 3- To develop an understanding for the current technologies through the world. 4- To go deeply and intensively into the fundamentals upon which the practice of engineering is based. 5- To develop experience in defining problems, forming solutions, and in conducting researches. 6- To develop expertise in different areas of electrical engineering. . 7- To emphasis the role of engineering science and technology in solving the problems of societies, and the development and advancement of mankind

Code	Title	Credits	Hours	ECT
Faculty Requirements (3 credits)				
GE604	Advanced Engineering Mathematics **	3	4	8
Department Requirements (9 credits)				
EE612	Advanced Electromagnetic **	3	4	8
EE622	Advanced Digital Signal Processing **	3	4	8
EE676	Advanced Electronic Circuit **	3	4	8
Elective courses (13 credits)				
EE611	Electro Magnetic Numerical techniques	3	4	8

EE613	Antennas Theory	3	4	8
EE614	Passive Microwave devices	3	4	8
EE615	Optical Communication I	3	4	8
EE616	Plasma dynamic I	3	4	8
EE617	Microwave networks	3	4	8
EE618	Optical fibers	3	4	8
EE620	Random Signal and Stochastic Process	3	4	8
EE621	Wireless Communication & Networks	3	4	8
EE623	Digital Image Processing	3	4	8
EE624	Digital Communication Eng.	3	4	8
EE625	Data Communication	3	4	8
EE626	Communication Systems Design I	3	4	8
EE627	Information Theory and Coding	3	4	8
EE628	Mobile Communication Engineering	3	4	8
EE670	Solid State and Semiconductor physics	3	4	8
EE671	Integrated circuit processing technology	3	4	8
EE672	Opto-electronic Devices, Technology and Applications	3	4	8
EE673	VLSI Design I	3	4	8
EE674	Electronic Circuits for Communication Systems	3	4	8
EE675	Introduction to Quantum mechanics	3	4	8
EE677	Photovoltaic Energy Conversion	3	4	8
EE678	Advanced Semiconductor Devices	3	4	8
EE6xx	Select one elective course of 600 level *** **	3	4	8
EE697	Special Topics	3	4	8
EE698	Graduate Seminar **	1	2	10
Thesis (6Credits)				
EE699	M. Sc. Thesis	6	0	*50*
TOTAL		**31**	***0***	***124***

ECTS: European Credit Transfer and Accumulation System *** Mandatory Courses*

**** from other department programs after consultation with the advisor*

Program II

PROGRAM	***Control***
DEGREE	*M.Sc.*
OBJECTIVES	1- To upgrade the engineers scientific level and link their knowledge with the state of the art technology. 2- To solve the local development problems through the post graduate research. 3- To develop an understanding for the current technologies through the world. 4- To go deeply and intensively into the fundamentals upon which the practice of engineering is based. 5- To develop experience in defining problems, forming solutions, and in conducting researches. 6- To develop expertise in different areas of electrical engineering. . 7- To emphasis the role of engineering science and technology in solving the problems of societies, and the development and advancement of mankind

Code	Title	Credits	Hours	ECT
Faculty Requirements (3 credits)				
GE604	Advanced Engineering Mathematics **	3	4	8
Department Requirements (9 credits)				
EE600	Analysis of Linear Systems **	3	4	8
EE632	Advanced Computer Network **	3	4	8
EE662	linear control system **	3	4	8
Elective courses (13 credits)				
EE663	Discrete control system	3	4	8
EE664	Analysis of nonlinear systems	3	4	8
EE665	Optimal Control Theory I	3	4	8
EE666	Fuzzy logic	3	4	8
EE667	Nonlinear Control Systems	3	4	8
EE668	Advanced control system	3	4	8
EE630	Advanced Computer programming	3	4	8
EE631	Fault Tolerant Computing	3	4	8
EE633	Parallel Processing	3	4	8
EE634	Advanced Digital system	3	4	8
EE635	Advanced Computer Architecture	3	4	8
EE636	Network Computer Security	3	4	8

EE637	Advanced microprocessor systems	3	4	8
EE6xx	Select one elective course of 600 level *** **	3	4	8
EE697	Special Topics	3	4	8
EE698	Graduate Seminar **	1	2	10
Thesis (6 Credits)				
EE699	**M. Sc. Thesis**	6	0	*50*
Total	***TOTAL***	**31**	***0***	***124***

ECTS: European Credit Transfer and Accumulation System *** Mandatory Courses*

*** from other department programs after consultation with the advisor

Program III

PROGRAM	***Power***
DEGREE	*M.Sc.*
OBJECTIVES	1- To upgrade the engineers scientific level and link their knowledge with the state of the art technology. 2- To solve the local development problems through the post graduate research. 3- To develop an understanding for the current technologies through the world. 4- To go deeply and intensively into the fundamentals upon which the practice of engineering is based. 5- To develop experience in defining problems, forming solutions, and in conducting researches. 6- To develop expertise in different areas of electrical engineering. . **7-** To emphasis the role of engineering science and technology in solving the problems of societies, and the development and advancement of mankind

Code	Title	Credits	Hours	ECT
Faculty Requirements (3 credits)				
GE604	Advanced Engineering Mathematics **	3	4	8
Department Requirements (9 credits)				
EE640	Power System Analysis I **	3	4	8
EE652	Advanced Machine Theories **	3	4	8
EE680	Power Electronics **	3	4	8
Elective courses (13 credits)				
EE641	Power System Analyses ll	3	4	8

EE642	Renewable energy & distributed generation	3	4	8
EE643	Power System Operation & Control	3	4	8
EE644	Power System reliability	3	4	8
EE645	Electric Distribution Systems	3	4	8
EE646	Power System Quality	3	4	8
EE647	High Voltage Engineering	3	4	8
EE648	Power System Stability	3	4	8
EE650	Power System Protections	3	4	8
EE656	Power System economics	3	4	8
EE651	Generalized theory of electrical machines	3	4	8
EE653	Electric Machine Applications	3	4	8
EE681	Electric Machine Drives	3	4	8
EE6xx	Select one elective course of 600 level *** **	3	4	8
EE697	Special Topics	3	4	8
EE698	Graduate Seminar **	1	2	10
Thesis (6 Credits)				
EE699	M. Sc. Thesis	6	0	*50*
TOTAL		**31**	***0***	***124***

ECTS: European Credit Transfer and Accumulation System *** Mandatory Courses*

*** from other department programs after consultation with the advisor

Description of Graduate Courses

- *Faculty General Courses*

GE604 Advanced Engineering Mathematics (3 *Credits* – 4 Hours)

Review of ordinary differential equations; linear differential equation of the first order; linear differential equations with constant coefficients; particular solutions by variations of parameters. Power series solutions; method of Frobenius; Legendre's equation; Fourier-Legendre Series; Bessel's equation; modified Bessel equation. Fourier methods; Fourier series; Sturm-Liouville theory; Fourier integral; Fourier transformation. Partial differential equations; heat conduction equation; separation of variables; waves and vibrations in strings; wave equation; D'Alembert's solution; longitudinal vibrations in an elastic rod; two dimensional stress systems; solution of Navier's equations by the application of Fourier transforms; Laplace equation.

- *Department Core Courses:*

✓ **General department course**

EE600 Linear Systems (3 Credits - 4 Hours)

Signals: standard, representation, generation, mathematical description. Finite difference and recurrence equations, convolution methods . system classification. Properties of linear time invariant systems. Distortion effects upon systems behaviors. Non-linear systems behavior and phenomena.. linearizing of non-linear systems .linear System models. linear System representation; transfer function, system response to step and impulse signals. State space form : State space forms , solution of linearized state equations. State –Flow diagram System, concept of system stability .. Case study.

✓ **Communication, EM & microwave and Electronics division**

EE612 Advanced Electromagnetic (3 Credits - 4 Hours)

Review of wave Propagation, wave Polarization, Reflection and Transmission Auxiliary vector Potentials, Solution of the inhomogeneous Vector potential equation. Electromagnetic Theorem and equivalence and Induction Theorems .Rectangular cross section wave guide cavities: Resonant cavities, TE2,TM2 and hybrid modes. Dielectric wave guide, circular cross section wave Guide and cavities: TE , TM2 modes, circular cavity and radial wave guides. Spherical transmission lines and cavities: construction of solutions, the vector potential F& A, TE& TM modes solution of the scalar Helmholtz wave equation. Scattering: plane wave scattering, circular cylinders, conducting wedge and conducting sphere scattering.

EE676 Advanced Electronic Circuits (3 Credits – 4 Hours)

Review of small signal Circuit amplifiers, power amplifiers (audio and R.F), Transistor Current Sources, Feedback amplifier Characteristics, oscillators, integrated differential and operation amplifier Circuits.

- ✓ **Power division**

EE 680 Power Electronics (3 Credits – 4 Hours)

Overview of power semiconductor devices, line-frequency diode rectifiers, line-frequency phase controlled rectifiers, rectifier analysis with ideal supply, effect of AC supply impedance, effect of discontinuous current DC/AC converter, control of DC/DC converter, step-down (Buck) and step-up (Boost) converter, DC/AC (single phase and 3- phase) inverter, voltage source and current source inverters , inverter witching schemes (stepped wave, PWM), AC/AC cycle converter construction and operation , power supply application , motor derive applications.

EE640 Power System Analysis I (3 Credits – 4 Hours)

General review. Transmission Line Sequence Impedances. Sequence Impedance of Machines. Sequence Impedances of Transformers.

- ✓ **Control and computer division**

EE634 Advanced Digital System (3 Credits – 4 Hours)

Arithmetic process, Synchronous sequential logic (SSL): analysis, state reduction and assignment design procedure. Algorithmic state machines (ASM): ASM charts, timing consideration, control implementation, design with multiplexers, PLA control. Asynchronous sequential logic (ASL): analysis and design procedures, flow tables, state reductions, races and race-free assignment. Reliable design and fault diagnosis. Analysis of finite state machines. Case studies.

EE662 Linear Control System (3 Credits – 4 Hours)

Introduction to control concepts, review of control modeling, time response specifications, stability analysis using Lyapunov method, review to design methods (Frequency response, state space) methods, Controllers and compensators. Controllability and observability. design a controllers and compensators using state space technique. State feedback, state estimators, Robust control system and H infinity techniques, LQG , pole placement, min variance.

- *. Contents of Depth and specialization Courses:*

✓ **Communication, EM& Microwave and Electronics division**

- **Communication and signal process field**

EE611 EM Numerical Techniques (3 Credits – 4 Hours)

Moment method, Finite difference time domain method , Numerical evaluation of Laplace transform , convolution .

EE613 Antenna Theory (3 Credits – 4 Hours)

Antenna synthesis and continuous sources. Integral equations, moment method and self and mutual impedances. Broadband dipoles and matching techniques. Traveling wave and broadband antennas, and frequency independent antennas. Aperture antennas, horn antennas, micro strip antennas.

EE614A Passive microwave devices (3 Credits – 4 Hours)

- Microwave engineering, planer technology and MIC. Mode theory TE, TM and TEM. Theory of micro strip line over isotropic and Anisotropic substrate , strip line, Coplanar waveguide, Coupled micro Strip line and strip line

- Matching networks using stubs and lumped elements. Theory of small Reflections, multi-section N4 matching networks, tapered lines - Resonator : lumped and distributed resonator series and parallel Connections. Dielectric resonator, excitation and coupling - Directional couplers: Tight coupling directional couplers (branch line and hybrid ring) multi-section coupled lines directional couplers the inter Digital couplers (Longe coupler).

- Filters**:** the in section loss method and the image method Butterworth and Chebyshev design (response) for prototype low pass filter .Implementation of microwave filter on printed circuits: LPF , BPF , HPF: using micro strip lines CL (Low – High impedance), edge coupled Line filers, impedance admittances inverters and their use in filter design

EE620 Random Signal and Stochastic Process (3 Credits – 4 Hours)

Review of probability distributions, transformation of random variables. Moment generating and characteristic functions, laws of large numbers, Central limit theorems. Time and ensemble averages. Stationary and ergodic stochastic processes. Narrowband and Gaussion derived processes. Correlation functions and spectral density for continuous and discrete time random signals. Spectral analysis .response of linear systems to random inputs.

EE621 Wireless Communication and networking (3 Credits – 4 Hours)

Review of indoor and outdoor propagation models and coverage Frequency bands, Design aspects Review of traffic concept and multi server models. Concept of spread spectrum, FHSS, DSSS,CDMA, generation of spreading sequences .Wireless media Access means .Cordless and wireless local loop (WLL) , wimax and IEEE802.16 broadband wireless access standards and link design and card Coverage . Mobile IP and wireless access protocols.
Wireless LAN technology : over view , infra red LANs, Narrow band microwave LANs. Wifi and the IEEE802.11 wireless LAN standard , Hiper LAN IEEE802 protocol architecture, IEEE802.11: Architecture and services, Medium Access control, physical layer, and coverage design . Other IEEE802.11 Standard Blue tooth and IEEE802.15: Overview, Radio and base band specification, link manager protocol, logical link control and adaptation protocol .Coverage calculation, IEEE802.15 overview and specification.TCP1IP over wireless system. Ad-hoc Routing aspects . Q.O.S Consideration in wireless networks .

EE622 Digital Signal Processing (3 Credits – 4 Hours)

Introduction to digital filtering IIR and FIR. Digital Linear filtering and deconvolution techniques, floating spectra, circular convolution and correlation. Nonlinear discrete-time systems, homorphic filtering and deconvolution. Effect of Quantization and rounding errors. Introduction to two dimensional signal processing. Discrete random signal processing. Application to specific signals.

EE623 Digital Image Processing (3 Credits – 4 Hours)

This course will start with the basic image processing techniques such as image sampling and quantization. Color system understanding and binary and gray level image loading and reading. This course will include image enhancement techniques such as histogram equalization and digital filtering in two dimensions.
Two dimensional Fast Fourier Transform(FFT) and discrete Fourier Transform will also be included. Mathematical Morphology, Wavelet Transform, Image Compression and Pattern Recognition will also be included.

EE624 Digital Communication Systems (3 Credits – 4 Hours)

IEEE802.5MAC, FDDI MAC. Wireless LAN standard, IEEE802.11 physical layer specification and MAC. Performance comparison, Wide Area networks: Routing strategies, Adaptive Routing, X25, Frame relay, ATM networks. Internetworking :Architecture, Relays , IP standards IPV4, IPV6 Routing IP Addressing plan , IPV6 addressing notation Routing strategies static and dynamic addressing. Network performance issues, effect of data rate, propagation and queue delay , transmission delay , utilization and throughput

EE625 Data Communication (3 Credits – 4 Hours)

Overview of data communication basis, communication protocols :closed system and open system, ISO reference model. Data link control: flow control, error detection, data

compression, coding schemes. Local area networks: Architectures, Protocols, Topologies, MAC, Hubs and switches.IEEE802.3MAC, Specifications, Fast Ethernet and Gigabit Ethernet

EE626 Communication Systems Design I (3 Credits – 4 Hours)

System design requirements. Review of telephone transmission. Subscriber loop design . concepts of traffic , traffic theory . multichannel system load. Signaling methods, practical signaling systems in use and international standards. Telephone switching. Design of switching networks, switching systems and digital switching.

EE 627 Information theory and coding. (3 Credits – 4 Hours)

Information theory (Information measures: entropy, relative entropy and mutual information). Asymptotic equipartition property. Data compression. Channel capacity. Differential entropy and the Gaussian channel.
Coding theory (linear block codes: the generator and parity check matrices, Hamming codes). Introduction to finite fields. Cyclic codes, Reed-Solomon codes. Convolution codes and the Viterbi algorithm. Trellis coded modulation. Turbo codes. Introduction to cryptography

EE628 Mobile Communication Engineering (3 Credits – 4 Hours)

Overview of land mobile communication systems and standards, propagation characteristics of land mobile channels: mobile radio environment, channel path loss predication models. Channel fading characteristics and models. Cells and cellular traffic :co-channel and adjacent channel interference, interference reduction techniques , cell splitting and types, coverage area estimation, traffic capacity and trucking.
Fading counter measures: effect of fading and concept of diversity, types of diversity and combining techniques, performance improvement, equalization. Mobile access techniques: FDMA, TDMA, CDMA, WCDMA and their applications in different mobile standards.
System capacity calculation and comparison. Design parameters at the base- station and mobile units. Modulation techniques for mobile systems and their performance: MSK, GMSK, MPSK, M-QAM, DS-spread spectrum techniques. Performance in fading channels.

EE670 Solid State and Semiconductor physics (3 Credits – 4 Hours)

Fundamental properties of electron, statistics of particles, properties of electron in solids, Fundamental electronic process in solids, Principle of operation for junction diodes, photodiodes, LED, (LED material, fiber optic communication), Lasers.

EE671 Integrated Circuit Processing Technology (3 Credits – 4 Hours)

Sources and purification of semiconductor materials, crystal structure, oxidation, diffusion , ion implantation, epitaxial technology , chemical vapor deposition(CVD) , impurity profiling methods, alloying , metallization, photo lithography. CMOS fabrication process.

EE672 Optoelectronic Devices , Technology and Applications (3 Credits – 4 Hours)

Photodiodes ; Light emitting diodes ; Semiconductor Lasers ; Integrated optics: wave guides , wave guides for visible and infrared light , wave guide couplers ; Optical amplifiers ; Examples of optical devices applications .

EE673 VLSI Design I (3 Credits – 4 Hours)

Introduction to VLSI systems ; CMOS Fabrication Technology and Design Rules ; Full-Custom Mask Layout Systems ; Parasitic Extraction and Performance Estimation from Physical Structure ; Clock Signals and System Timing ; Arithmetic for Digital Systems ; Low-Power VLSI Circuits and Systems ; Testability of Integrated Systems ; Case Study: Digital TV

EE674 Electronic Circuits for Communication Systems (3 Credits – 4 Hours)

Tuned amplifiers , narrowband RF amplifiers, Broadband RF amplifiers, Gain-bandwidth enhancement techniques, Low-noise amplifier (LNA) , Mixers. Background for understanding oscillators , Phase noise in oscillators, Voltage Controlled Oscillators (VCO's) . Phase-locked loops (PLLs) , Frequency synthesizers . High efficiency Power amplifiers .

EE675 Introduction to Quantum mechanics (3 Credits – 4 Hours)

Introduction , the inadequacy of classical of wave equation, general principles of Schrödinger's equation, harmonic oscillator, Hydrogen atom, the spin, Pauli principle.

EE676 Advanced Electronic Circuits (3 Credits – 4 Hours)

Review of small signal Circuit amplifiers, power amplifiers (audio and R.F), Transistor Current Sources, Feedback amplifier Characteristics, oscillators, integrated differential and operation amplifier Circuits.

EE677 Photovoltaic Energy Conversion (3 Credits – 4 Hours)

Physical source of solar radiation; direct and diffuse radiations; review of electronic materials; optical absorption; generation and recombination processes in semiconductors; operating principles of photovoltaic devices; homo- and hetero- junction devices; equivalent circuits; quantum efficiency; current-voltage characteristics; Efficiency limits in photovoltaic devices; short circuit current and open circuit voltage losses; temperature effect; material-imposed limits; theoretical and practical limits; Photovoltaic device design and fabrication; silicon-based devices; gallium arsenide devices; thin film devices; fabrication technologies; Advanced photovoltaic concepts; nano-structure and organic PV devices; System-level photovoltaics ; module structure and design; balance of system electronics; stand-alone and grid-interactive systems; photovoltaic hybrid systems.

EE678 Advanced Semiconductor Devices (3 Credits – 4 Hours)

Devices equation & basic assumptions, generation –recombination process, carrier transport, Switching devices , negative conductance microwave devices and III- V semiconductor devices ; MOSFET , MESFET ; Short channel effects , Scattering theory of MOSFET ; SOI (Silicon on Insulators) , single gate and double gate.

- ✓ **Power division**
  - **power system field**

EE640 Power System Analysis I (3 Credits – 4 Hours)

General review. Transmission Line Sequence Impedances. Sequence Impedance of Machines. Sequence Impedances of Transformers.

EE641 Power System Analysis II (3 Credits – 4 Hours)

This course will introduce the students to the most common types of system Analysis details which are normally done during either the system Planning stage or during the system operation stage. The student should be encouraged to develop his own computer programs to the following subjects; Load Flow studies ; Short Circuit studies and Stability studies using any computer language type:

1. Computer Solution Methods using the Admittance Matrix

Primitive Matrix, Node Incidence Matrix , Node Admittance and Impedance Matrices

2. Computer Solution Methods using the Impedance Matrix

The impedance matrix Algorithm without and with mutually coupled lines

3. Short Circuit Analysis

Review to the system normal Faults types

Simultaneous Faults

- Simultaneous faults by two port Network Theory
- Interconnection of Two port networks
- Simultaneous fault connection of sequence networks
- Series-Series connection
- Parallel-Parallel Connection
- Series –Parallel Connection

4.Load Flow Analysis

Solution of nonlinear equations , Gauss-Seidel Methods. Newton Raphson Methods ; Decoupled Load flow solution – Fast Decoupled load flow solution .

Practical Applications and simulation using computer

5. Stability

Introduction, Steady state stability, Transient stability . Methods of Simulation for transient stability . Representation of transmission networks and loads. Synchronous Machine models for Stability studies

Numerical Solution of the swing equation . Multi machine transient stability

Computer applications

EE642 Renewable Energy and Distributed Generation (3 Credits – 4 Hours)

Wind Turbines, Wind Farms, Solar Photovoltaic Systems, Hydroelectric Plants, Other Technologies, Interface to Distribution systems.

EE643 Power System Operation & Control (3 Credits – 4 Hours)

Power systems today, Overview to power system operating status. Power system Control. Control Centers. Power System State Estimation **.** Power System Security. Optimal Power flow.

EE644 Reliability Assessment of Power Systems. (3 Credits – 4 Hours)

Concepts of power system reliability, Modelling in repairable systems, Generation capacity, Composite Generation and Transmission, Distribution systems, Substations and Switching stations, Plant and station availability, Reliability Cost/worth.

EE645 Electric Distribution Systems (3 Credits – 4 Hours)

Part I - Distribution System Planning
Distribution system components and description desired features – types of electric systems. Factors effecting distribution system planning load growth, density, system expansion, technical economic features, load forecast, forecast methods- scada systems , data acquisition load management
Part II - Distribution system design
Load characteristics – load factors , demand etc. Electric design , primary system, secondary systems voltage regulators , taps , Boosters , capacitors , reactors General about , mechanical design of overhead and under ground system Distribution substation design Voltage drop equation, substation design procedure feeders design – secondary design – load substation design for future load growth cost function , linear and dynamic programming for optimal distribution system design .

EE646 Power System Quality (3 Credits – 4 Hours)

Definition of different power quality criteria. Voltage sag and swell: sources of voltage sags, ISBN curve, IEC 502 standard, mitigation techniques, Voltage flicker, capacitive transients, notch. Harmonics in power system, harmonic source, Harmonic calculations. Power quality monitoring

EE647 High Voltage Engineering (3 Credits – 4 Hours)

Streamer or Kanat theory yor Spark .Break down in non uniform fields ,partial breakdown, corona discharge , positive or anode corona Impulse corona negative or cathode corona ,

polarity elect – Iutluena or space charger . Breakdown in lignid dielectric , purification, breakdown tests Breakdown in lignite electronic B.D. mechanisms of B.D in commercial liquids , suspended particle, cavitations , stressed oil ualume . B.D in pure lignid dielectrics (Electro convection model) Breakdown in solid Dielectric intrinsic breakdown, streamer B.D, Electronic lanied B.D, edge B.D, and treeing , thermal B.D , erosion B.D tracking .

EE648 Power System Stability (3 Credits – 4 Hours)

power system stability definition. stability and statement of the problem methods of simulation. Elementary of mathematical model. Swing equation , Mechanical and electrical torques. The classical model of one machine against an infinite bus. classical model of multi-machine system. short comings and block .System Response to small disturbances .The synchronous machine , Parks transformation , flux linkage equation –voltage equations normalizing torque equations –torque and power equivocate circuit for synch. Machine – state space models flux linkage model , voltage behind Sub transient turbine – generator model. The simulation of synchronous machines Steady state

- **Electric Machines field**

EE650 Power System Protections (3 Credits – 4 Hours)

Review to power system protection principles. Non-unit protection for feeders. Unit protection:, Feeder protection, Generator and Transformer protection. Distance protection, distance protection schemes. Digital distance relays: principle of operation, construction, Transmission line model, Fourier transformation model, comparison between different algorithms, weighing techniques.

EE652 Advanced Machine Theories (3 Credits – 4 Hours)

Revision of basic operation of DC machines , design and construction, armature reaction, armature inductance and dynamic operation. Design and analysis of permanent magnet brushed motors. Series universal machines design, construction and analysis with alternating supplies. Asynchronous AC Machines revision of basic operation and torque speed characteristic. Analysis of equivalent circuit to predict peak torque, speed at peak torque, starting torque and maximum efficiency. Aspects of machine design which have an impact on torque speed characteristic. Voltage control and frequency control. Brushless DC machines operation, construction, design and analysis. Back-emf and torque characteristics. Radial and axial flux machines. Brushless permanent magnet generators. Switched Reluctance Motors operation, design, construction, analysis. Stator and rotor pole numbers relationship to number of phase windings. Power electronic control. Hybrid Stepping Motors design, construction and analysis. Magnetic flux paths in 3 dimensions. Stepping modes, step integrity, oscillations, pull out and pull in torque. Mathematical Modeling: Basic synchronous machine parameters, voltages, flux linkage and inductance relations, Park's transformation – its physical concept, equations of performance.

EE656 Economics of Power System (3 Credits – 4 Hours)

1-Characteristics of power generation units, Economic importance
2-Economic dispatch of thermal units; economic dispatch problem, dispatching with thermal losses, Lambda, gradient and Newton methods, economic dispatch using dynamic programming.
3-Transmission line effect; power flow problem and its solution, transmission losses, B matrix formula, exact methods of calculating penalty factors.
4-Unit commitment; Constrains, spinning reserve, thermal unit constraines, unit commitment solutions methods.
5-Generation with limited energy supply
6-Hydrothermal coordination
7-Production cost models

- **Power electronics field**

EE680 Power Electronics (3 Credits – 4 Hours)

Overview of power semiconductor devices, line-frequency diode rectifiers, line-frequency phase controlled rectifiers, rectifier analysis with ideal supply, effect of AC supply impedance, effect of discontinuous current DC/AC converter, control of DC/DC converter, step-down (Buck) and step-up (Boost) converter, DC/AC (single phase and 3- phase) inverter, voltage source and current source inverters , inverter witching schemes (stepped wave, PWM), AC/AC cycle converter construction and operation , power supply application , motor derive applications.

EE681 Electric Machine Drives (3 Credits – 4 Hours)

Power electronics control of electrical machines , effect of non-sinusoidal power supply, torque and speed pulsation , PWM inverters, simulation of induction motors, vector-control of induction motors

✓ Control and Computer division:

- **Computer field**

EE600 Linear Systems (3 Credits – 4 Hours)

Signals: standard, representation, generation, mathematical description. Finite difference and recurrence equations, convolution methods . system classification. Properties of linear time invariant systems. Distortion effects upon systems behaviors. Non-linear systems behavior and phenomena.. linearizing of non-linear systems .linear System models. linear System representation; transfer function, system response to step and impulse signals. State space form : State space forms , solution of linearized state equations. State –Flow diagram System, concept of system stability .. Case study.

EE631 Fault tolerant computing (3 Credits – 4 Hours)

Terminology and metrics. Faults and their Causes. General Fault Tolerance Concepts. Redundancy (spatial, temporal, information, etc.) Forward recovery & backward recovery. Applying Theory to Real Systems Hardware: microprocessors, memory, disks, networks, Software. Modeling/Evaluation Testing and Design for Test .

EE632 Advanced Computer Networks (3 Credits – 4 Hours)

Internetworking; WAN Topology, Plain Old Telephone System (POTS), xDSL Technology, T-Carrier and ATM.Theories for design, analysis and evaluation of high-speed networks including scalability, performance, and issues related to local area, metropolitan, and wide area networks. Includes architecture, protocols, and applications of high-speed networks; performance modeling of high-speed networks; flow control and routing; design issues for high-speed switches, interfaces, and controllers; all optical networks and their architectures; examples of high-speed computer networks and Internetworking; video, imaging, and multimedia applications; software issues, robustness, and applications; and selected topics in current research areas in high-speed computer networks.

EE633 parallel Processing (3 Credits – 4 Hours)

Motivation for parallel processing. Classification of parallel architectures_ SIMD / MIMD: control data flow , distributed/ shared memory architecture . Mapping algorithms onto regular arrays: data dependencies, linear, rectangular mesh and hexagonal array and algorithms for these architectures. SIMD Algorithms: design consideration, masking , and vector instructions and data structures. Memory allocation techniques. Interconnection networks. Sorting and data broadcasting. Algorithms for shuffle /exchange networks. MIMD algorithms(shared memory) : synchronous, mutual exclusion, hotspots. Interconnection networks. Algorithms for SM / SIMD machines. Performance issues. MIMD algorithms (distributed memory): synchronous and asynchronous operation. Message routing schemes. Interconnection networks.

EE634 Advanced Digital System (3 Credits – 4 Hours)

Arithmetic process, Synchronous sequential logic (SSL): analysis, state reduction and assignment design procedure. Algorithmic state machines (ASM): ASM charts, timing consideration, control implementation, design with multiplexers, PLA control. Asynchronous sequential logic (ASL): analysis and design procedures, flow tables, state reductions, races and race-free assignment. Reliable design and fault diagnosis. Analysis of finite state machines. Case studies.

EE635 Advanced Computer Architecture (3 Credits – 4 Hours)

Simple machine design (ISAs, microprogramming, unpipelined achiness,) Simple pipelining (hazards, stage pipelines, branch prediction, in-order superscalar)Memory systems (DRAM, caches, optimizations). Virtual memory systems, exceptions, interrupts Complex pipelining (score-boarding, out-of-order issue). Explicitly parallel processors (vector machines, VLIW machines, multithreaded machines).

EE636 Network Computer Security (3 Credits – 4 Hours)

Introduction to Computer Network Security. Conventional Encryption Message Confidentiality. Public Key Cryptography and Message Authentication . Authentication Applications. Email Security. IP Security. Web Security. Intruders and Viruses. Firewalls**.**

EE662 Linear Control System (3 Credits – 4 Hours)

Introduction to control concepts, review of control modeling, time response specifications, stability analysis using Lyapunov method, review to design methods (Frequency response, state space) methods, Controllers and compensators. Controllability and observability. design a controllers and compensators using state space technique. State feedback, state estimators, Robust control system and H infinity techniques, LQG , pole placement, min variance.

EE663 Discrete control system (3 Credits – 4 Hours)

Introduction to discrete control systems. Time domain representations of linear discrete systems. State variable representation, analysis of discrete control system. Stability analysis. Design techniques for discrete time control systems. Optimal linear digital regulator design. Digital state observer. Engineering characteristics of computer control systems: Computer methods in systems studies: Case. Studies.

EE664 Analysis of Nonlinear systems (3 Credits – 4 Hours)

General characteristics of systems. Nonlinear phenomena . Fundamental Properties (Mathematical Preliminaries, Existence and Uniquencess….), Analysis of nonlinear systems:. Stability analysis : Lyapunov theory, absolute stability, Asymptotic and exponential stability, local and Global stability ,Input-Output stability. Perturbation: Theory and Averaging, Singular Perturbation. linearizing approximations, describing functions, phase- plane.

EE665 Optimal Control Theory I (3 Credits – 4 Hours)

Calculus of variation. State variable description of system optimal control by dynamic programming Pontryagin's Maximum principle and volitional methods, minimum time, energy, and fuel. Bellman – Jaccobi equation and its applications. Problem for linear continues and discrete system. Introduction to optimal control distributed parameter system. Computer methods of analysis. Case studies.

EE666 Fuzzy logic (3 Credits – 4 Hours)

Introduction, General Fuzzy systems (Basics), Fuzzy control , Fuzzy controller , Fuzzy control

design (performance objective, performance evaluation, design methodology), Nonlinear Fuzzy analysis. Perspectives on Fuzzy control.

EE667 Nonlinear Control Systems analysis (3 Credits – 4 Hours)

Analysis of nonlinear Feedback control systems based on (stability problem) using describing functions, phase- plane, Lyapunov methods , Popov and Circle Criterion and Passivity approach. Non-linear control system Problems (Stabilization, Tracking and Regulation): Non-linear control systems design methods (Feedback linearization, Lyapunov approach ,Sliding mode control and center manifold theory) , Case studies.

EE668 Adaptive control system (3 Credits – 4 Hours)

Introduction to adaptive control ; (Stability, Robustness, Uncertainties, Stabilization and tracking problem …..etc).Adaptive control techniques and properties. Adaptive control classifications (Indirect and direct control schemes, Robust adaptive control, adaptive pole-placement control,……etc) .Adaptive control construction approaches (Gain schedule , Model reference and self-tuning,…….etc) Applications of adaptive control (Adaptive control of linear systems for solve the stabilization and tracking problems)

EE697 Special Topics (3 Credits – 4 Hours)

The topics are not listed in department programs and may vary from year to year according to interests of students and instructors.
M.S. students choose and study a topic under the guidance of the department coordinator. Typical contents include advanced fields of study according to recent scientific and technological developments in the related areas. Also, it could be studied from other related departments after getting the permission.

EE698 Graduate Seminar (1 Credits - 2 Hours)

This course help students to develop their research proposals, establishing and expanding their research skills and implementing their work through scholarly writing, which can be achieved through the seminar.
The seminar course must to be taken in the second semester of the registration and managed by an instructor who is responsible to prepare the final grade list of all the registered students.
Students must prepare and present their chosen topics through a scientific term paper, which can be shared and discussed with other students and department staff to gain their feedback.

EE699 M, Sc. Thesis (6 Credits)

Learning Objectives (outcomes)

Upon completion of the Master of Science Program in the Electrical and Electronic Engineering, graduates are expected to attain the following outcomes:

1- Understand the integrated nature of the disciplines of the Electrical and Electronic Engineering.

2- Conduct research contributing to knowledge, including as appropriate both independent and collaborative research, and in conformity with all standards, for responsible conduct of research.
3- Apply advanced studies to identify, understand, formulate, and solve high-grade thermal Power engineering problems.
4- Have an advanced technique to design and conduct experiments, and to represent, evaluate, analyze and interpret the available data.
5- Build professional skills and ethical behaviors in their professional life.
6- Work with advanced techniques, skills, and modern scientific and engineering software tools for professional practice.
7- Communicate, applied in oral, text, and digital formats and consistent with the highest standards.
8- Achieve effective communications in written, oral, and visual means.

الاعتماد			
البيان	منسق الدراسات العليا بالقسم	رئيس القسم	مدير مكتب الدراسات العليا بالكلية
الاسم			
التاريخ	2022 / 09 /	2022 / 09 /	2022 / 09 /
التوقيع			
الختم			

اعداد / لجنة دليل الدراسات العليا 2022