

Course Outline for Electrical Engineering

EE 100: Electric Circuits

Electric Circuits I (3+1);

Historical development: charge, current, potential difference. Current-voltage relationship of resistance, inductance, and capacitance. Constant voltage and constant current sources. Kirchoff's Laws: Loop and node equations, Thevenin and Norton's theorems, Concept and use of duality. First order differential equations. Determination of current and voltages in R-L and R-C circuits. Sinusoidal Current: Complex numbers and phasor notations, Concept and handling of phasor impedances. Lagging and leading currents and voltages. RMS and average values in general and for sinusoidal circuits.

Text Book:

- Introduction to Electric Circuits, 5th Edition, by Richard C. Dorf and James A. Svoboda, John Wiley & Sons Inc., 2001
- The Analysis and Design of Linear Circuits, by Ronald E Thomas, Albert J Rosa, Gregory J, Toussaint, John Wiley, 7th 2012

Objectives:

- Make Nodal analysis of DC Circuits
- Determine Nodal Voltages
- Find Branch currents
- Find Branch Impedance's.

HU 100: Communication Skills

Communication Skills (2+0)

Overview of tense systems: Principles of grammar, common idiomatic language, Common usage problems and grammatical errors. Understanding of Gist, Structure and vocabulary. Speaking and listening skills; Critical reading; Criticism of text; Agreeing, disagreeing persuasion and counter-arguments techniques. Turn Talking and Class decorum. Modern conventions of electronic media, presentation problems. Recent twists in communication skills. Classrooms communication dills for variety of situations.

Text Book:

- Business Communication: Making Connections in a Digital World, by Lesikar 12th Edition McGraw Hill 2010:

Objectives:

- On completion of this students shall be able to make successful; dialogue in English
- Should be able to listen, understand, and write from mother tongue speakers.

MA 123: Calculus

Calculus (3+0)

Objectives:

- Introduce differentiation and integration techniques.
- Functions and limits. Differentiation,
- Application of Derivatives, Integration, techniques of Integration.
- Application of Definite Integrals, Infinite Sequences and Series. Vectors and the geometry of space, Vector-Valued functions and motion in space, Partial derivatives, Multiple integrals in vector fields.

Text Book:

- Calculus, by Gilbert Strang, 2nd Edition, Wellesley –Cambridge, 2010

PH 111: Applied Physics

Applied Physics (2+1)

The Course shall cover: Waves and Wave equation, reflection and transmission, Interference, Standing waves, Sound waves. Doppler Effect, Magnetics, Force on electronic charge moving in a magnetic field. Hall effect. Ray model of light. Reflection and refraction. Snell's law. Total internal reflections and fiber optics. Ray tracing and thin lenses magnetization equation. Combination of lenses, Lenses in cameras. Wave versus particles. Huygens' principle and diffraction, Huygens's principle and law slit. Circular apertures, Spectrometer, Polarization and Liquid Crystal Displays , Potential Energy diagrams for molecules, Weak bonds, Bonding ins solids, Free electron theory of metals Semiconductors and doping, Structure and properties of nucleus, Radioactivity , Alpha decay Beta decay, Gamma decay. Conservation of nucleon number, Detection of radiation.

Text Book:

- Physics for Scientists and Engineers, by Douglas C, Glancoli, 4th Edition Prentice Hall, 2009

Objectives:

- Students shall be able to apply Sound and Light Waves theories in later subjects of study
- Must have capacity to understand physics of semi conductor devices to be studied later.

EE 110: Circuit Analysis and Design

Circuit Analysis and Design (3+1)

Solution of R-L-C circuits.; Higher order differential equations. Laplace transforms and related theorems. Transform of signals involving generalized functions, Convolution, Impedance functions and network theorems. Two-Port parameters, Frequency responses, Magnitude and phase plots. Parts of network function, Real and imaginary parts as a function of frequency. Fourier series, trigonometric and exponential forms, signals spectra and Fourier transform. Relationship between Laplace and Fourier transform

Text Book:

- The Analysis and Design of Linear Circuits by Ronald E. Thomas, Albert J, Rosa, Gregory J, Toussaint, John Wiley, 7th Edition, 2012

Objectives:

- Students shall be able to make Nodal analysis of AC Circuits inclusive of Parameters and variables

EE 111: Semiconductor Devices

Semiconductor Devices (3+1)(Pre-Requisite Physics)

Examples of Electronic systems, Basic physics of semiconductors , P_N junctions as diode, P_N junction forward bias, P_N junction reverse bias, Zener diodes, Zener breakdowns, Physics of bipolar transistors, Bipolar amplifiers: Physics of MOS transistors, CMOS amplifiers

Text Book:

- Fundamentals of Microelectronics by Behzad Razavi, 2nd Edition, John Wiley 2013
- Microelectronic Circuits, by Adel Sedra and Kenneth Smith, 6th Edition Oxford University Press, 2010

Objectives:

- Explain the working of various devices. The will understand device characteristics and be ready to take and understand in a meaningful way courses in electronic circuits using more advanced devices.
- Analyze Circuit with Diodes, Zener diodes, and transistors.

HU 101: Technical Writing

Technical Writing (2+1)

Introduction to technical writing; Differential between technical and creative writing; Project/thesis/report writing; Technical terminology; APA,MLA,and IEEE writing styles; Bibliography writing; Eliminating jargon, redundancy; Planning and Organization, Style and register, Use of proper English in technical writing; CV writing, office correspondence writing minutes of meetings; examination answering; Note taking; research proposals

writing; Modifying techniques, hypothesis building; writing article and research papers; Plagiarism and self-plagiarism.

Text Book:

- A Manual for Writer of research papers, Thesis and Dissertations, Chicago style for Students and Reseachers, by Kate L, Turaban, Wayne C Booth, Gregory G Volomb and Joseph M, Williams, 7th edition The University of Chicago Press

Objectives:

- Write Technical Reports of Mini –Projects
- Learn citing references.

MA 200: Differential Equations

Differential Equations (3+0)(Pre-Requisite MA-100)

The aim of this introductory course is to familiarize students to the subject of differential equations and their applications in simple physical situations. The student is supposed to understand how DE's arise in mathematics, physics and engineering and the importance of initial and boundary conditions in solving an equation. Standard methods for solving first order DE's and general method for solving second order DE's with constant coefficients are presented with applications. Laplace and Fourier transform techniques are introduced and applied in simple cases. The method of solution in series is discussed and exemplified

Text Book:

- D.G. Zill: Differential Equations and their Applications (Latest edition, PWS Publishing, Boston.) G.D. Zill 16th edition.
- Elementary Differential Equations, by Boyce and Diprima, 10th edition, John Wiley, 2012

Objectives:

- The student should be able to understand the basic concepts and terms of differential equations and their applications in simple physical situations.
- The student is supposed to understand how DE's arise in mathematics, physics and engineering.
- The student should appreciate the importance of initial and boundary conditions in solving an equation
- The student should be able to classify a given DE and be able to analyze which method to apply.
- He should be familiar with Laplace and Fourier transform techniques.

ME 200: Applied Thermodynamics

Applied Thermodynamics (2+0)

Introduction and basic concepts, energy conservation, and General Energy Analysis, Properties of Pure Substances, Energy Analysis of Closed Systems, Mass and Energy Analysis of control Volumes. The second Law of Thermodynamics, Entropy, Energy. A Measure of work, potentials Gas Power Cycle, Vapour and Combined Power Cycle, Refrigeration and Air-conditioning

Text Book:

- An Introduction to Thermal physics by Daniel V, Schroeder, AW, 1990
- Thermodynamics : An Engineering Approach, by Yunus Cengel and Michael Bolss, 7th Edition, McGraw-Hill, 2010

Objectives:

- Appreciate the importance of Thermodynamics in Electrical Engineering.
- Its contribution in Energy Analysis

EE 210: Analogue and Digital Electronics

Analogue and Digital Electronics (3+1)(Pre-Requisite EE-111)

Topics to be covered include: Introduction to amplifiers, BJT amplifiers; DC biasing, Common Emitter, Common Base and Emitter Follower, MOSFET amplifier, DC biasing, Common source, Common Gate and Source Follower, Multistage amplifiers, low frequency response, power amplifiers, OPAMP base amplifiers, BJT as an Inverter, Introduction to Feedback, Multi-vibrators and Schmitt trigger.

Text Book:

- Fundamental of Microelectronics, by Behzad Razavi, 2nd Edition, John Wiley, 2013
- Microelectronic Circuit, by Adel Sedra and Kenneth Smith, 6th Edition, Oxford University Press, 2010

Objectives:

- Learn the application of Analogue Devices
- Learn the application of Digital Devices.

EE-270: Digital Logic Design

Digital Logic Design (3+1)

This is a first course in digital logic design. The topics covered include: numbers systems, codes, Boolean algebra, combinational logic, arithmetic, MSI logic circuits, latches/flip flops, counters/registers, sequential circuit design, memory devices and digital electronics:

- Number Systems and Codes
- Logic Gates and Boolean Algebra
- Combinational Logic
- Combinational Logic Design Practices
- Latches and Flip-Flops
- Counters / Registers
- Sequential Logic Design Principles
- Memory, CPLD, FPGA
- Interfacing with Analog World
- Digital Electronics and Logic Families

Text Book:

- Digital Systems, Principles and Applications by Tocci & Widmer, 8th Edition, Pearson Education

Objectives:

- Students shall be able to design and build Arithmetic Circuits.

MA 201: Linear Algebra

Linear Algebra (3+0)

Course stresses important mathematical concepts and tools used in advanced mathematics, Computer Science, Physics and Economics. Systematic methods of solving systems of linear equations are the underlying theme and applications of the theory will be emphasized. Topics of exploration include Gaussian elimination, determinants, linear transformations, linear independence, bases, eigen vectors and eigenvalues. Conference time will be allocated to clarifying course ideas and exploring additional applications of linear algebra:

Introduction to Systems of Linear Equations, Matrices and Matrix Operations, Elementary Matrices and a Method for finding A-1 Diagonal, Triangular and Symmetric Matrix, The Determinant Function and its properties, Cramer's Rule, Introduction to Vectors, Lines and Planes in 3-Space, Linear Transformations from R_n to R_m , Composition of Linear Transformations, Real Vector Spaces, Subspaces, Bases and Dimensions, Row Space and Column Space, Null Space, Rank and Nullity, Inner Products, Angle and Orthogonality in Inner Product Spaces.

Text Book:

- Anton, Howard and Chris Rorres, *Elementary Linear Algebra, Applications Version*, 8th Edition. John Wiley & Sons, Inc. 2000
- Linear Algebra and its Applications, by Gilbert Strang, 4th edition, Brooks Cole, 2005

Objectives:

- Should be able to apply in Electrical Engineering

EE 220: Signals and Systems

Signals and systems (3+0)

Introduction to Signals and Systems [Continuous-time, Discrete-time, Periodic, Even, Odd signals, Complex exponential and sinusoids in continuous-time and discrete-time, Unit step and unit impulse, Example and Basic properties]

LTI Systems [Discrete-time LTI systems, Impulse response, Discrete-time convolution, Examples and properties of discrete-time convolution, Continuous-time LTI systems, Continuous-time convolution, Relationship between system properties and impulse response, Properties of LTI systems, Differential equation representations]

Fourier Series [Introduction, Eigen function property of complex exponential, Continuous-time Fourier series, Exponential and Trigonometric forms, Examples, Convergence, Gibbs Phenomenon, Properties of Fourier series, Discrete-time Fourier series, Properties, Examples and Parseval's relationship]

Continuous Time Fourier Transform [Definition, Frequency response, Properties and Examples]

Discrete Time Fourier Transform [Definition, Relationship to Fourier series, Examples and Properties]

Laplace Transform [Definition, Region-of-Convergence, Properties, Examples and Characterization of linear time-invariant systems]

Z Transform [Definition, Region-of-Convergence, Properties, Examples and Characterization of linear time-invariant systems]

Text Book:

- Signal and Systems by A. V. Oppenheim, A. S. Willsky and S. H. Nawab, Prentice Hall (or **Laboratory Manual** for Laboratory Courses)

Objectives:

- To provide the student with a solid mathematical foundation in complex variables and common engineering transforms
- To prepare the student for graduate-level core courses in communication, control and signal processing by giving the student a thorough working knowledge of these techniques.

EE 230: Data Structures

Data Structures (3+1)

Mathematical Tools, recursion. Algorithm analysis, Big-Oh and other measure, Abstract Data Types, Lists, Stacks, Queues, Trees: Binary Search Tree, Hashing, Separate chaining, Open Addressing, Rehashing, Priority Queues, Sorting: insertion sort, Shellsort, Heapsort, Mergesort, Quicksort, Graph Algorithms shortest path algorithms.

Text Book:

- Data Structures and Algorithm Analysis in C++, by Mark Allen Weiss, 3rd Edition Pearson, 2006

EE 250: Electric Machinery Fundamentals

Electric Machinery Fundamentals (3+1); Pre-requisite: EE 110 Circuit Analysis & Design

The course explores concepts in electrodynamics, using electric machinery as examples. It teaches an understanding of principles and analysis of electromechanical systems. By the end of the course, students are capable of doing electromechanical analysis of the major classes of rotating and linear electric machines, and have an understanding of the principles of the energy conversion parts of Mechatronics. Students learn how to estimate the dynamic parameters of electric machines and understand what the implications of those parameters are on the performance of systems incorporating those machines.

- Introduction to Machinery Principle; Transformers: Ideal, Equivalent Circuit, Per Unit System, Voltage Regulation, Efficiency, Auto-transformer, Three Phase Transformer
- DC Machines Fundamentals: Linear Machines and its transient analysis, Operating Principle, commutation, internally generated voltage and torque, Power flow and losses.
- DC Generators: Equivalent Circuits, Types, Parallel Operation.
- DC Motors: Equivalent Circuits, Types, Motor Starting.
- AC Machines: Fundamentals: Concept of Rotating magnetic field, MMF and Flux distribution, induced voltage, basic definition, induced torque, power flow and losses.
- Synchronous Generators: Speed and frequency, internally generated voltage, equivalent circuit, phasor diagram, power and torque relationships, Parallel operation.
- Synchronous Motors: Basic principle, steady state operation, starting.
- Induction Motors.

Text Book:

- Electric machinery fundamentals, by Stephen J, Chapman, 5th Edition, McGrawhill, 2011

Objectives:

- Analyze Magnetic Circuits
- Exploit the existing Leakage and Mutual Inductances.
- Determine efficiency of Machines considering all kinds of Losses.
- Analyze Machines –Parameters using Open Circuits and short Circuits variables.

HU 202: Pakistan studies

Pakistan studies (3+0)

Ideological foundations of Pakistan, Different approaches towards ideology of Pakistan, Ideology of Pakistan in the light of documents: A study of Presidential Address of Allama Muhammad Iqbal at Allahabad Session 1930 & Letters of Iqbal to Jinnah etc.

History of struggle movement for Pakistan: War of independence, Aligarh Movement (1858-98). Urdu – Hindi Controversy, Partition of Bengal [1905-1911], Simla Deputation (1906), The formation of the Muslim League in 1906, The Lucknow Pact (1916), Khilafat Movement (1919-1924), Rule of Congress Ministries (1937-1939).

Constitutional development in Indo-Pakistan sub-continent: Constitutional reforms in India , Government Act of India 1852, Government of India Act 1892, Indian Councils Act 1909 (Minto-Morley Reforms), Government of India Act 1919 (Montague-Chelmsford Reforms), Simon Commission (1927), Nehru Report (1928) , Fourteen Points of M. A. Jinnah (1929), Round Table Conferences 1930-1932, Government of India Act 1935, Cabinet Mission Plan (1946) , June 3rd Plan 1947, Indian Independence Act July 18, 1947, Objectives Resolution 1949, The Constitutional crisis 1954-55, East Pakistan issue, 1956, 62, 73 Constitutions. Amendments.

Pakistan's Foreign Policy, Kashmir Issue, Challenges for Pakistan after 9/11-2001 and Future of Pakistan.

Text Book:

- "Ready to Write" Karen Blanchard / Christine Root.
- Class notes and Handouts.

Objectives:

- Students should own the struggle of their forefathers in making Pakistan
- Seriousness in retaining the culture for which the continent was divided based on two nation theory

MA 202: Scientific Computing

Scientific Computing (3+0)

This course presents a broad overview of numerical methods for solving all the major problems in scientific computing, including Linear and Nonlinear equations, Linear Least Squares, Eigen values Problems, Nonlinear Equations, Optimization, Interpolation, Numerical Integration and differentiation, Initial value problems for Ordinary differential Equations, Boundary Values Problems for Ordinary Differential equations, Partial Differential equations, Fast Fourier transforms, Random numbers generators.

Text Book:

- Applied Numerical Methods with MATLAB for Engineer and Scientists, by Stephen C, Chapra, 3rd edition, McGraw Hill 2011

Objectives:

- Students should be able to design a mathematical model all electrical systems inclusive of:
 - Circuits
 - Machines
 - Transmission lines
 - Communication Systems

EE 353: Power Generation and Transmission

Power Generation and Transmission (3+0)

Transmission systems planning, transmission Line Structure and equipment, Fundamental Concepts, Overhead power transmission, Underground Power Transmission and Gas Insulated Transmission Lines, Direct-Current Power Transmission, Transient Over voltages and Insulation. Coordination, Limiting Factors for Extra-High and ultrahigh Voltage Transmission: Corona, Radio Noise, and Audible Noise, Symmetrical Components and Fault Analysis, Protective Equipment and Transmission Systems Protection, transmission System Reliability, Construction of overhead Lines, Sag and Tension Analysis.

Text Book:

- Electric Power Generation, Transmission, and Distribution, by Leonard L, Grigsby, 3rd Edition CRC Press 2012
- Electrical Power Transmission System Engineering: Analysis and Design, by Turan Gonen, 2nd edition CRC Press, 2009
- Electricity Power generation: The Changing Dimensions, by Digamber M, Tagare MJW, 2010

Objectives:

- To realize existing setup of Power Generation systems
- To understand and work out Transmission lines for characteristics.

EE 371: Microprocessor Systems

Microprocessor Systems (3+1) Pre-requisite: EE 230 Data Structure

Microprocessor Systems bus structure, DMA, and interrupts, microprocessor architecture, memory an I/O ports, addressing modes, instruction set, microprocessor programming techniques, Microcontrollers memory systems design, CPU read/write timing, RAM, and ROM interface requirements, address decoding and interfacing dynamics RAM Interface serial, parallel programming and interrupt driven I/O, direct memory access and peripheral controllers, programmable peripherals interface, universe synchronous/asynchronous receiver/transmitter an programmable interrupt controller, data communication standards

Text Book:

- The x80 PC Assembly Language Design and Interfacing. By Muhammad Ali Mazidi, Janice Mazdi, and Danny Causy, SE PH, 2009
- Embedded Systems: Real-Time Interfacing to Arm@ Cortex™-M Microcontrollers, by J. W. Valvano, Create Space Independent Publishing Plateform, 2011

Objectives:

- Design real time applications of systems based on Microprocessors
- Analyze existing Microprocessor based systems.

EE 380: Electromagnetic Theory

Electromagnetics (3+0); Pre-requisite: PH 100 Applied Physics

This course introduces fundamental concepts of static electric and magnetic field. After a review of coordinate systems, scalar and vector fields, and some mathematical concepts, we will study electric and magnetic fields in free space and other media. Energy in the fields and its use will also be discussed. Course will end with the introduction of Maxwell's equations for static and time-varying fields.

- Coordinate Systems and Integrals, Gradient, Divergence and Curl, Static Electric Fields, Static Magnetic Fields
- Potential, Materials, Energy, Force and Torque

Text Book:

- Electromagnetic Concepts and Applications by S. Marshall, R. DuBroff, G. Skitek, 4th Edition, Prentice Hall, 1996
- Engineering Electromagnetics, by William H, Hayt and J A Buck, 8th Edition McGraw Hill, 2011

Objectives:

- Understand and apply electro-dynamics in Electrical machines
- Understand and apply electromagnetic in Communication systems

MA 320: Applied Probability and Statistics

Applied Probability & Statistics(3+0);

This is a junior level course in probability theory that is a pre-requisite for almost all graduate level courses in communications, signal processing and controls. The course will cover: axiomatic foundations of probability theory, random variables, distributions, densities, functions of a single and multiple random variables, moment generating functions, random v

- Basic Concepts [Axiomatic Probability Theory, Discrete Probability Space and Independent Events
- Repeated Trials [Single and Multiple Events, Distributions – Binomial and Gaussian
- Random Variables [Distribution and Density Functions, Conditional density functions
- Functions of A Random Variable, $Y = g(X)$ [Distribution and Density Functions, Conditional density functions
- Functions of Two Random Variables, $Z = g(X, Y)$ [Distribution and Density Functions, Conditional density functions
- Moment Generating Functions [First and Second order Moments, Conditional Moments and Characteristic Functions
- Sequence of Random Variables [Sum, Product and Random Vector and random sequences

Text Book:

- Probability, Random Variables and Stochastic Processes by Athanasius Papoulis and S. U. Pillai, 4th Edition, McGraw Hill.
- Introduction to Probability, by Dimitri P. Bertsekas, John N. Tsitsiklis, 2nd Edition Athena Scientific, 2008
- Introduction to Probability and Statistics for Engineers and Scientists, by Sheldon Ross, 6th edition AP, 2013

Objectives:

- Understand and apply in courses like Communication, signals & Systems and Control

IE 300: System Engineering Management

System Engineering Management (3 + 0)

This practical introduction to system engineering and analysis provides the concepts, methodologies, models, and tools needed to understand and implement a total life-cycle approach to systems and their analysis. Contents would address identification of a need and extending that need through requirements determination, functional analysis and allocation, design synthesis, and validation, operation and support, phase-out and disposal improvements of systems currently in being showing that by employing the iterative process of analysis, evaluations, feedback, and modification, most systems in existence can be improved in their affordability, effectiveness, and stakeholder satisfaction.

Text Book:

- System Engineering management, by Benjamin S, Blanchard, 4th edition, Wiley, 2008
- System Engineering and Analysis, by Benjamin S, Blanchard and Walter J, Fabrycky, 5th Edition Prentice Hall, 2010

Objectives:

- Embed engineering design taking care of Economical and Agronomical issues.
- Analyze Life Cycle approach of each product and procedural effectiveness of designs.

EE 321: Communication Systems

EE 321: Communication Systems (3+1)

The course covers basic principles of communication theory with emphasis on analog modulation systems:

- Introduction to Signals [Classification of Signals, Useful Signal Operations, Signals and Vectors, Signal Comparison via Correlation, Signal Representation by Orthogonal Signal Set, Trigonometric and Exponential Fourier Series]
- Analysis and Transmission of Signals [Fourier Integral, Transforms of Some Useful Functions, Properties of Fourier Transform, Signal Transmission Through a Linear System, Signal Distortion over a Communication Channel, Signal Energy (Power) and Energy (Power) Spectral Density]
- Amplitude (Linear) Modulation [Baseband and Carrier Communication, Amplitude Modulation, Double Sideband, Quadrature Amplitude Modulation, Single Sideband, Vestigial Sideband, Carrier Acquisition, Superheterodyne AM Receiver and Behavior of Amplitude Modulated Systems in Noise]
- Angle (Nonlinear) Modulation [Instantaneous frequency, Bandwidth of Angle Modulated Waves, Generation of FM Waves, Demodulation of FM, Interference in Angle Modulated Systems, FM Receiver and Behavior of Angle Modulated System in Noise]
- Sampling and Pulse Code Modulation [Sampling Theorem, Pulse-Code Modulation, Differential Pulse Code Modulation and Delta Modulation]

- Principles of Digital Data Transmission [Digital Communication System, Line Coding, Pulse Shaping, Scrambling, Regenerative Repeater, Detection-Error Probability, M-ary Communication, Digital Carrier Systems and Digital Multiplexing]
- Miscellaneous Topics [Digital Services, Digital Switching Technologies, Cellular Telephone System, Spread Spectrum Systems and Transmission Media]

Text Book:

- Modern Digital and Analog Communication Systems by B. P. Lathi, 3rd Edition, Oxford University Press.

Objectives:

- Analyze different modes of communication Systems
- Work out performance measures of each communication System.
- Conduct and build different type of communication Systems

EE 340: Control System

Control System (3+1) Pre-requisite: EE 220 Signals and Systems

The course familiarizes the student with the mathematical tools and skills needed to analyze and design feedback control systems:

- Preliminaries [Examples of Control Systems, Closed-Loop and Open-Loop Control Systems, Laplace Transformation, Laplace Transform Theorems, Inverse Laplace Transformation and Differential Equations]
- Mathematical Modeling [Transfer and Impulse Response Functions, Automatic Control Systems and Block Diagrams, Application to Electrical Systems and Signal Flow Graphs]
- Transient and Steady State Response Analysis [First-Order Systems, Second-Order Systems, Higher Order Systems and Routh-Hurwitz's Stability Criterion]
- Analysis and Design with Root-Locus Technique [Root-Locus Plots, Root-Loci Construction Rules, Design Considerations, Lead Compensation, Lag Compensation and Lead-Lag Compensation]
- Analysis and Design with the Frequency Response Technique [Bode Diagrams, Polar Plots, Magnitude-Phase Plots, Nyquist Stability Criterion, Stability Analysis, Lead Compensation, Lag Compensation and Lead-Lag Compensation]

Text Book:

- Computer Networks: A Systems Approach by Larry Peterson and Bruce Davie, Morgan Kaufmann.
- Modern Control Engineering, by Katsunihiko Ogata, 5th Edition, Prentice Hall, 2011

- Control Systems Engineering, by Norman S. Nise, 6th edition, Wiley, 2011

Objectives:

- Analyze Systems for their Static or Dynamic Stability
- Design Feed Back block for a stable system.
- Have a clear concept of transient, and steady states
- Analyze systems using Root Locus and State Space methods
- Understand examples of electrical systems of 1st, 2nd and 3rd order

EE 354: Power Distribution and Utilization

Power Distribution and Utilization (3+1)

Load Characteristics, Application of Distribution Transmission, Design Considerations of Primary Systems, Voltage Drop and Power Loss Calculations, Distribution Systems voltage regulation, Distribution Systems Protection, distribution Systems reliability, Electric power quality, and electric utilities.

Text Book:

- Electric Power Generation, transmission, and Distribution, by Leonard L. Girgsby, 3rd Edition, CRC Press, 2012
- Electrical Power Distribution System engineering, by Turan Gonen, 2nd edition CRC Press, 2008
- Understanding Today's electricity Business, by Bob Shively and John Ferrare Enerdynamics LLC, 2010

Objectives:

- Understand Power distribution System as prevailing in the country by visiting different places
- Work out Losses, Voltage Drops, Voltage regulation, and reliability of Power System.
- Determine Power quality in cases of load variations.

EE 330: Operating Systems

Operating Systems (3+1)

Operating systems: structure, Process management, Threads, PU Scheduling Process synchronization, Deadlocks, Virtual memory, File System Interface and Implementation, Mass-storage Structure, I/O Systems, Protection and Security, Distribution Systems, Special Purpose Systems, real Time systems, Linux Systems.

Text Book:

- Operating Systems Concepts, by Abraham Silberschatz, Peter B, Galvin, Greg Gagne, 9th Edition, Wiley, 2012

Objectives:

- Understand sequential System of instruction handling,
- Flow of Data from different memory addresses,
- Virtual Memory concept,
- I/O process and respective effects on the overall process time.
- Comparison of all Operating Systems like Real Time, Linux and Distribution Systems.

EE 352: Renewal Electrical Energy Systems

Renewal Electrical Energy Systems (3+1)

The course covers topics as distributed generation and its interconnections issues photovoltaic, solar-thermal, hydro power, fuel cells, wave energy and wind turbines. Social, economical and environmental issues related with the renewable-energy technologies will also be discussed.

Text Book:

- Renewable and Efficient Electric Power, by Gilbert M, Masters Wiley, 2004
- Fundamentals of renewable Energy processes, by Aldo Vieira Da Ross, 3rd Edition Academic Press, 2013

Objectives:

- Interconnection of Renewal Energy System to Existing Power distribution Systems,

- Issues related Photovoltaic, Solar Thermal, Fuel Cells, Wave and Wind Energy Systems.

EE 410: Power Electronics

Power Electronics (3+1)

Power Semiconductor diodes and Circuits, Diode rectifiers, Power transistors, Dc-DC Converters, Pulse-width Modulated inverters, Thyristors, resonant pulse Inverters, Multilevel inverters, Controlled Rectifiers, AC Voltage controllers, Static switches, Flexible AC transmission Systems, linear Regulated power Supplies, Dc Drives, Ac drives, Protection of devices and circuits.

Text Book:

- Introduction to Modern power electronics, by Andrzej M, Trzynadlowski, 2nd Edition Wiley, 2010

Objectives:

- Semiconductor devices used in Power electronics.
- Day to day requirement of rectifiers and their application.
- Voltage Regulator Supplies.
- Protection of devices.

EE 412: Electronic System Design

Electronic System Design (3+1)

The topics to be covered include; modeling resistors, capacitors and inductors, sensors models, sensor interfacing, high speed PCB design, low power design, active filters, high precision circuits and low-noise techniques.

Text Book:

- The art of Electronic by Paul Horowitz and Winfield Hill, 2nd edition, Cambridge university Press, 1989

Objectives:

- Model all Electrical and Electronic System for soft simulation.
- Work out performance envelop of each such system.
- Boundary Condition of each such system.

EE 422: Digital Signal Processing

Digital Signal Processing (3+1)

The course provides a basic introduction to the theory of digital signal processing. The course concentrates on signal analysis using Fourier Transforms, linear system analysis, filter design and effect of fixed word length on the design of filters, Matlab is used for Fourier analysis and designing of digital filters.

Text Book:

- Understanding Digital signal processing, by Richard Lyons, 3rd Edition, Prentice Hall, 2011

Objectives:

- Analyze Signals using Fourier Transforms utilizing Mat lab
- Design digital Filters in a communication system.
- Analyze Linear Systems for step-wise behavior or state space methods.

EE 433: Computer Networks

Computer networks (3+1)

Computer Networks and the Internet, Application Layer, Transport Layer, The Network Layer, The Link Layer and Local Area Networks, Wireless and mobile Networks, Multimedia Networks

Text Book:

- Computer Networking: A Top-Down Approach, by J Kurose and Ross, 6th Edition, Addison-Wesley, 2012

Objectives:

- Understand communication protocols
- Design Top-Down network requirements.

EE 434: Algorithms

Algorithms (3+1)

Topics covered include: Big O , omega, and theta notation to give asymptotic upper, lower, and tight bounds on time and space complexity of algorithms; Time complexity of recursively defined algorithms ; Algorithm design using the greedy, dynamic programming, divide-and conquer and branch-and-bound, strategies, Hash tables, binary search trees, and graphs. Sequential search, binary search, $O(N \log N)$ sorting algorithms and fundamental graph algorithms including depth-first and breadth-first search, single-source and all-pairs shortest paths, and minimum spanning tree algorithm.

Text Book:

- Introduction to Algorithms, by Cormen et al, 3rd Edition, MIT Press, 2009

EE 436: Database Engineering

Database Engineering (3+1)

This course is an introduction to the architecture and design of modern database management systems (DBMSs) DBMSs are used to manage, store, and query diverse data, including audio, video and image data, Topics include logical database storage and organization, SQL transaction management and concurrency control, query processing algorithms and data structures, physical database implementation, including data storage, indexing, and optimization.

Text Book:

- Database System Concepts, by Abraham Silberschatz, 6th Edition, Mc-Graw Hill, 2010

EE 491: Electrical Instruments and Measurements

Electrical Instruments and Measurements (3+1) Pre-requisite EE 100 Electric Circuit

Precision measurements terminologies including resolution, sensitivity, accuracy, and uncertainty; engineering units and standards; principles of different measurement techniques; instruments for measurement of electrical properties, pressure, temperature, 33 position, velocity, flow rates (mass and volume) and concentration; systems for signal processing and signal transmission; modern instrumentation techniques; static and dynamic responses of instrumentation and signal conditioning; basic data manipulation skills using personal computers and graphs; data acquisition systems; principles of operation, construction and working of different analog and digital meters, oscilloscope, recording instruments, signal generators, transducers, and other electrical and non-electrical instruments; types of bridges for measurement of resistance, inductance, and capacitance; power and energy meters; high-voltage measurements.

Text Book:

- Digital and Analogue Instruments, Testing and Measurement, by Nihal Kularatna, Instityute of engineering and Technology, 2008
- Fundamentals of Instruments and Measurement, by I, Placko, Dominique, ISTE Ltd, 2007

EE 451: Power System Analysis and Design

Power System Analysis and Design (3+1)

Power System, Past, Present and Future trends, Electric Utility Industry Structure, Computer in Power System engineering, Distributed Generation, Instantaneous Power in Single-Phase ac circuits Complex Power, Power in Balanced Three-Phase Circuits, transformer Equivalent Circuits, Three-phase transformers Connections and phase Shift, Balanced three-Phase Two-Phase Winding transformers, Three-Windings Transformers, Transmission-Line parameters, Power Flows, Solutions to Linear Algebraic Equations, Gauss Eliminations, Jacobi and Gauss-Seidel, Newton-Raphson, Power-Flow Problem, Power-Flow Solution by Gauss-Seidel and Newton Raphson methods.

Text Book:

- Power Systems Analysis and Design, by Duncan Glover, J Duncan Glover, Mulukulta S. Sarma and Thomas Overbye, 5th Edition, CL-Engineering, 2011

EE 461: Design of Electrical Machines

Design of Electrical Machines (3+1)

Theoretical principles and techniques of electrical machine design. Design of rotating electrical machines with step-by step approach to machine design. The course presents: Machine type definitions: different synchronous, asynchronous, DC, and doubly salient reluctance machines. Analysis of types of construction; external pole, internal pole, and radial flux machines. The properties of rotating electrical machines, including the insulation and heat removal options. Methods for tackling, and solutions to, real design problems. Rotor surface magnets permanent magnet machine and squirrel cage induction machine design calculations

Text Book:

- Design of Rotating Electrical Machines, by Juha Pyrhonen, Tapani Jokinen , and Valeria Hrabovcova, Wiley, 2009

EE 482: Microwave Engineering Passive Devices

Microwave Engineering Passive Devices (3+1)

Topic to be covered include: Review of Maxwell's equations, field in media and boundary conditions, the plane wave, reflection from media (dielectric, conductor) boundary, loss in conductors, surface resistance, energy, power, transmission line theory, the lossless line, terminated line, Smith's chart, quarter wave transformer, lossy transmission line, general guide, TEM TE and TM modes, TE and TM solutions in rectangular wave guide. TEM modes on coaxial line and Strip-line structure, Quasi-TEM on Micro-strip line, characteristic impedances and loss calculations, microwave network analysis, impedance and equivalent voltage and current, impedance matrix and loss calculations, microwave network analysis, impedance and equivalent voltage and current, impedance matrix, signal flow graphs, microwave matching networks, limited single stub and double stub matching, microwave resonators, dielectric resonator, resonator coupling, microwave power dividers and couplers, properties of three port and four ports networks, Wilkinson's power divider, hybrid coupler quadrature and rat race and coupled line coupler.

Text Book:

- Microwave Engineering, by David Pozar, 4th Edition, Wiley, 2011

BA 400: Entrepreneurship and Small Business Management

Entrepreneurship and Small Business Management (2+0)

Fundamental principle of mental life and human behavior, Significance of psychology in human relationships and self-understanding, Topics covered include evolutionary psychology, neuropsychology, biological psychology, positive psychology, applied psychology, careers, and multiculturalism and diversity.

Text Book:

- Innovation and entrepreneurship, by Peter F. Drucker, Harper, 2006
- Patterns of Entrepreneurship Management, by Jack. M Kaplan and M. Kaplan (Author) Anthony Warren, 3rd Edition, Wiley, 2009
- Essentials of Entrepreneurship and Small Business management, by Norman M. Scarborough, 6th Edition, Prentice Hall, 2010

EE 411: Industrial Control Systems

Industrial Control Systems (3+1)

Electric Heating: principles and applications, induction and dielectric heating. HF Welding, Spot welding control. Industrial control: speed control of DC, AC and servo motors. AC and DC drives. Process control. Measurement of non-electric quantities: temperature, displacement, pressure, time, frequency. Digital industrial measuring systems; Ultrasonic generations and application; X-Rays application in industry; PLC's industrial control using PLC's ; Data acquisition, distributed control system in process industries.

Text Book:

- Modern industrial electronics, by Timothy J. Maloney, 5th edition, Prentice Hall, 2009.
- Electric Motors and control Systems, Frank, Petruzella, Career Education, 2009

EE 423: Digital communications

Digital communications (3+1); DSP as Pre-requisite

The course deals with the fundamentals and practical aspects in the analysis and design of digital communication systems,. Topics covered are: the spectrum efficient digital modulation techniques their comparison and detection techniques, channel coding principles, wireless communication channel, cellular communication principles, communication link analysis, and techniques used to combat the channel impairments, overview of multiple access techniques and example wireless communication systems.

Text Book:

- Digital Communication, by J.G. Proakis and M. Salehi, 5th Edition McGraw Hill, 2005
- Digital Communication Systems, by S. Haykins, Wiley, 2013

EE 414: Satellite Engineering

Satellite Engineering (3+0)

The aim of the course is to provide a comprehensive introduction of satellite technology with the emphasis, space segment. It will develop a thorough understanding of space mission elements, space environmental and different subsystems of a satellite, and also includes the basic terminologies and principles which govern the design of satellite. Topics to be covered include: space environment, orbits and elements of space mission, launch vehicle and propulsion, attitude and orbit control subsystems, electrical power subsystem, Tracking telemetry and command subsystem, spacecraft mechanical design, thermal design, payload, satellite reliability, earth stations and introduction to Pakistan satellite programs.

Text Book:

- The Communication Satellite by M. Williamson
- Spacecraft System Engineering by P. Fortescue, J. Stark and G. Swinerd, John Wiley and Sons, 2003
- Space Mission Analysis and Design by W. J. Larson and J. R. Wertz, 2nd Edition, Kluwer Academic Publication, 1992

EE 437: Computer Graphics

Computer Graphics (3+1)

This course gives a broad overview of the field of computer graphics and covers the hardware, software and techniques used in computer graphics students learn about rasterization and ray tracing, homogeneous and perspective transform, object representation, illumination models, basic GPU architecture. 2D transformations, painting windowing, clipping, 3D graphics including hidden lines and surface and shading;

Text Book:

- Interactive Computer Graphics: A Top-Down Approach with Shader-Based Open GL by Edward Angel and Dave Shreiner, 6th Edition, Addison-Wesley, 2011
- The Grammar of Graphics by Leland Wilkinson, 2nd Edition, Springer, 2005
- Information Visualization: Perception for design (Interactive technologies), by C. Ware, 3rd edition, Morgan Kaufmann, 2012

EE 438: Introduction to Artificial intelligence

Introduction to Artificial intelligence (3+0)

Introduction, Intelligence Agents, Solving Problems by Searching, Constraint satisfaction Problems, Logical Agents, Inference in First-Order Logic, Planning and acting in the real world, Knowledge Representation, Quantifying Uncertainty, Probabilistic Reasoning, making simple decision, Making Complex decision, Learning from Examples, Probabilistic Models, reinforcement Learning.

Text Book:

- Artificial Intelligence: A modern Approach, by Stuart Russel and Peter Norvig, 3rd Edition, Prentice Hall, 2009

EE 450: High Voltage Engineering

High Voltage Engineering (3+1)

Generation of High Voltage, Measurement of high voltage; Electronics field and field stress control; Electrical breakdown in gases; Breakdown in solid and liquid dielectrics, Non-destructive insulation test techniques; Over voltages; testing procedures and insulation coordination: Design and testing of external insulation.

Text Book:

- High Voltage and Electrical Insulation engineering, by Ravindra Aror and Wolfgang Mosch, Wiley, 2010

EE 453: Power Operation and Control

Power Operation and control (3+1); Pre-requisite: PsAnD

Energy control center functions, state estimation and steady state security assessment techniques, economic dispatch, optimal power flow, automatic generation control, and dynamic equivalents.

Text Book:

- Power Generation, Operation, and Control, by Allen Wood and Wollenberg, 3rd edition, Wiley, 2013

EE 454: Power System Protection

Power System Protection (3+1); Pre-requisite: PsAnD

This course covers: elements of protection system; relay Operating principles; Current and Voltage Transformers; Non-pilot Over current Protection of Transformation Lines; Rotating Machinery Protection; Transformers Protection: Bus Reactor and capacitor Protection; Power System Phenomena and relaying Considerations.

Text Book:

- Power system relaying, by Stanley H. Horowitz and Arun G. Phadke, 3rd Edition, Wiley, 2008
- Protection Relay Principles, by Anthony F. Sleva, CRC Press , 2009