

**DEPARTMENT OF
ELECTRONIC ENGINEERING**



**SYLLABI OF COURSES
FOR
B.E. (ELECTRONIC ENGINEERING)
DEGREE PROGRAMME
APPLICABLE FROM BATCH
2023 & ONWARDS**

**NED UNIVERSITY OF ENGINEERING & TECHNOLOGY,
KARACHI-75270, PAKISTAN**

B.E. (ELECTRONIC) DEGREE PROGRAMME

AT

**NED UNIVERSITY OF ENGINEERING
AND TECHNOLOGY, KARACHI**

COURSES OF STUDIES

**Detailed Syllabi
2023 & ONWARDS**

**DEPARTMENT OF ELECTRONIC ENGINEERING
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY,
KARACHI-75270, PAKISTAN**

*Issued by the
Registrar*

**NED UNIVERSITY OF ENGINEERING & TECHNOLOGY,
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**B.E. (ELECTRONIC ENGINEERING)
COURSES OF STUDIES
Applicable for Batches: 2023 & ONWARDS**

First Year									
Fall Semester					Spring Semester				
Course Code	Course Title	Credit Hours			Course Code	Course Title	Credit Hours		
		Th	Pr	Total			Th	Pr	Total
EA-111	Functional English	2	0	2	EE-121	Circuit Analysis	3	1	4
EE-120	Basic Electrical Engineering	3	1	4	EL-106	Basic Electronics	3	1	4
MT-171	Differential & Integral Calculus	3	0	3	MT-227	Differential Equations	3	0	3
EL-104	Electronic Engineering Drawing & Workshop	0	2	2	ME-110	Basic Mechanical Engineering	2	0	2
PH-112	Applied Physics	2	1	3	CY-110	Applied Chemistry for Engineers	2	1	3
EL-105	Computer and Programming	3	1	4	ES-105/ ES-127	Pakistan Studies / Pakistan Studies (For Foreigners)	2	0	2
Total		13	5	18	Total		15	3	18

Second Year									
Fall Semester					Spring Semester				
Course Code	Course Title	Credit Hours			Course Code	Course Title	Credit Hours		
		Th	Pr	Total			Th	Pr	Total
EL-201	Electronic Devices and Circuits	3	1	4	EL-202	Integrated Circuits	3	1	4
EA-214	Academic Writing	3	0	3	CS-216	Data Structure & Algorithms	3	0	3
TC-202	Signals and Systems	2	1	3	EE-223	Instrumentation & Measurement	2	1	3
EE-382	Electromagnetic Fields	2	0	2	EE-246	Electrical Machines	2	1	3
MT-272	Linear Algebra and Geometry	3	0	3	ES-205/ ES-209	Islamic Studies OR Ethical Behavior	2	0	2
TC-201	Digital Logic Design	2	1	3	TC-212	Digital Signal Processing	2	1	3
					EA-200	Community Service	-	-	NC
Total		15	3	18	Total		14	4	18

Syllabi of B.E. (Electronic) Degree Programme

Third Year									
Fall Semester					Spring Semester				
Course Code	Course Title	Credit Hours			Course Code	Course Title	Credit Hours		
		Th	Pr	Total			Th	Pr	Total
MT-331	Probability and Statistics	3	0	3	CS-430	Microprocessor Programming & Interfacing	3	1	4
TC-307	Communication Systems	3	1	4	EA-304	Business Communication & Ethics	3	0	3
EF-304	Occupational Safety & Health	2	0	2	EF-305	Engineering Economics & Management	3	0	3
EL-307	Power Electronics	3	1	4	EL-309	Artificial Intelligence and Machine Learning	2	0	2
EE-374	Feedback Control Systems	3	1	4	EL-308	Industrial Electronics	2	1	3
					EA-###	Foreign Language-I	-	-	NC
Total		14	3	17	Total		13	2	15

Final Year									
Fall Semester					Spring Semester				
Course Code	Course Title	Credit Hours			Course Code	Course Title	Credit Hours		
		Th	Pr	Total			Th	Pr	Total
MT-442	Numerical Methods	3	0	3	TC-421	Telecommunication Networks	3	1	4
EL-409	VLSI Systems Design	2	1	3	MG-481	Entrepreneurship	3	0	3
MG-482	Organizational Behavior	3	0	3	EL-421	Embedded Electronics	3	1	4
EL-422	Robotics	3	1	4	EL-###	Elective*	2	0	2
EA-###	Foreign Language-II	-	-	NC	EL-401	Final Year Design Project	0	3	3
EL-401	Final Year Design Project	0	3	3					
Total		11	5	16	Total		11	5	16

*Elective: EL-410 Nano Electronics
 EL-411 Optoelectronics
 EL-412 Microwave and RF Circuits

EA 111 FUNCTIONAL ENGLISH

Objectives of the Course: The course aims at improving the four language skills –listening, speaking, reading and writing.

The functional aspect of language will be stressed further through development of students' vocabulary and use of grammar.

Speaking and Listening: Listening actively through the use of skills and sub skills, and in a variety of situations.

Speaking: Fluency and confidence building through group discussions, role plays and public speaking.

Vocabulary development: Tips / strategies in vocabulary enhancement. Practice in vocabulary development.

Reading: Reading skills, Sub skills.

Reading strategies.

Reading practice through variety of reading texts and comprehension exercises.

Précis writing.

Writing: Note taking: Techniques for taking notes from lectures, from books (integrated with listening & reading).

Process of Writing with practice in pre writing strategies, in revising, and in, editing for grammar.

Writing well- structured and effective paragraphs, essays and letters (routine communication) using proper writing mechanics. Writing descriptions, narrations, cause and effect, compare and contrast etc.

EE 120 BASIC ELECTRICAL ENGINEERING

Fundamentals of Electric Circuits: Charge, Current, Voltage and Power, Voltage & Current Sources. Ohm's Law:

Voltage and Current Laws: Nodes Paths, Loops and Branches, Kirchhoff's Current Law, Kirchhoff's Voltage Laws, the single Loop Circuits, the single node-pair circuits, series and parallel connected independent sources, resistors in series and parallel, voltage and current division.

Basic Nodal and Mesh Analysis: Multi-Nodal Analysis, the super node, Mesh Analysis, the super mesh.

Circuit Analysis Techniques: Linearity and Superposition, Source Transformations, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion.

Capacitors and Inductors: Capacitors, Inductor, Inductance and Capacitance Combination.

Basic RL and RC Circuits: The Source-Free RL Circuit, Properties of the Exponential Response, the Source-Free RC Circuits, the Unit-Steps Function. Driven RL Circuits, Natural and Forced Response, Driven RL Circuits.

The RLC Circuit: The Source-Free Parallel Circuit, the over damped parallel RLC Circuits, Critical Damping, the under damped Parallel RLC Circuit, the Source-Free Series RLC Circuit, the complete response of the RLC Circuit, the Lossless LC Circuit.

MT 171

DIFFERENTIAL & INTEGRAL CALCULUS

Complex Number: Argand diagram, De Moivre formula, root of polynomial equations, curve and regions in the complex plane, standard functions and their inverses (exponential, circular and Hyperbolic functions).

Limits and Continuity: Bounds and bounded sets, Limit point of sets, Sequences, Convergence of sequences monotonic sequences, Function and their graph, limit of function and continuous functions.

Differential Calculus: Differentiation and Successive differentiation and its application; Leibnitz theorem, Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, Taylor and Maclaurin series, L' Hospital's rule, extreme values of a function of one variable using first and second derivative test, asymptotes of a function, curvature and radius of curvature of a curve, partial differentiation, exact differential and its application in computing errors. Multivariate functions, Maxima and Minima for multivariate functions, Maxima Minima under certain conditions (Lagrange Multiplier).

Integral Calculus: Indefinite integrals and their computational techniques, reduction formulae, definite integrals and their convergence,

Beta and Gamma functions and their identities, double and triple integration with applications. (Area, volume, centroid, inertia, arc length).

Vectors Calculus: Scalar and Vector quantities, physical and geometrical meanings, Algebra of vectors, Scalar and vector triple products.

Vector derivatives, Line and surface Integrals, Gradient of a Scalar.

EL 104 ELECTRONIC ENGINEERING DRAWING & WORKSHOP

PCB Design & Workshop: PCB design and layout drawings using PCB software: From Schematic & Layout to Machine File generation. PCB technologies, single layers and multi-layer boards, PCB testing, Switches, PCB standards, Routing. Fabricating PCB, Assembling & soldering components on PCB, PCB Processes; CNC Drilling, Electroplating, Photo-plotting, Laminating, Developing and Exposing

Electronic Workshop: Introduction to Operations of Voltmeters, Ohmmeters, Power supplies, Function generators & Oscilloscopes. Measuring parametric values of discrete passive components fabricating simple electronic circuits on breadboard, Simulate an electronic circuits using pspice/multisim/Simulink

PH 112 APPLIED PHYSICS

ELECTROSTATICS AND MAGNETISM: Coulombs Law. Electrostatic potential energy of discrete charges, Continuous charge distribution, Gauss's Law . Electric field around conductors, Magnetic fields, Magnetic force on current, Hall effect, Biot-Savart Law. Ampere's Law, Fields of rings and coils. Magnetic dipole, Diamagnetism, Paramagnetism and Ferromagnetism.

SEMICONDUCTOR PHYSICS: Energy levels in a semiconductor, Hole concept, Intrinsic and Extrinsic regions, Law of Mass Action, P-N junction, Transistor.

WAVES AND OSCILLATIONS: Simple Harmonic oscillation, Damped harmonic oscillation, Forced oscillation and Resonance, Types of waves and superposition principle, wave speed on a stretched string.

OPTICS AND LASERS: Two-slit interference. Huygens Principle, Single-slit diffraction. Resolving power of optical instruments Principals

of laser action, Types of Laser, Application of laser.

MODERN PHYSICS: Planck's explanations of black body radiation Photoelectric effect, Compton effect. Bohr theory of Hydrogen atom, Atomic spectra, Reduce mass, De-Broglie hypothesis , Electron microscope, Atomic nucleus and property of nucleus, Radioactive Decay and Radioactive, Radiation detection instruments, Nuclear reaction and Nuclear Reactors, Nuclear Fusion.

EL 105 COMPUTER AND PROGRAMMING

Number Systems; Structure and Organization of Computers and Computer Systems; Classification of Software Systems; Introduction to Software Development Process; Levels of Programming Languages.

Introduction to Programming Languages: Overview of programming, writing, compiling and debugging.

Building Blocks: data types, variables, Input/output functions.

Operators: Arithmetic, Relational, logical and Assignment Operators.

Decisions: if-else statements, conditional Statements, Switch, break, continue.

Loops: for Loop, while loop, do while loop.

Modular programming: declaring, definition, calling functions.

Arrays and strings: single and multidimensional arrays, sorting, strings and string functions.

Pointers: Pointer overview, Returning data from functions, Pointers and arrays, Pointers and strings, Pointers to pointers.

Structures: defining, structures with arrays, Dynamic memory allocation.

C++ and Object Oriented Programming: Object oriented programming, Some useful C++ features, Classes and objects, Constructors and memory allocations, Inheritance, Function overloading, Operator overloading. Practical design through object oriented programming.

Use of generative AI in programming.

EE 121 CIRCUIT ANALYSIS

AC Circuits: Sinusoids and phasors, phasor relationships for circuits elements, impedance and admittance, Kirchhoff's laws in the frequency domain, impedance combinations

Sinusoidal steady state analysis: Nodal analysis, Mesh analysis, Superposition theorem, source transformation. Thevenin and Norton equivalent circuits. Op Amp AC Circuits

AC Power Analysis: Instantaneous and average power, Maximum average power transfers, Effective or RMS value. Apparent power and power factor, Complex power, Conservation of AC power, Power factor correction.

Three-Phase Circuits: Balance three-phase voltages, Balanced Wye-Wye Connections, Balanced Wye-Delta Connections, Balanced Delta-Delta Connections, Balanced Delta-Wye Connections, Power in Balanced systems, Unbalanced Three-Phase Systems.

Magnetically Coupled Circuits: Mutual inductance, Energy in a Couple circuits, linear transformers, Ideal transformers, Ideal autotransformers, Three-Phase transformers

Two-Part Networks: Impedance parameters, admittance parameters, hybrid parameters, transmission parameters, Relationship between parameters, interconnection of networks.

EL 106 BASIC ELECTRONICS

PN Junction Diode: Introduction. PN junction diode, Unbiased diode, Barrier potential, Diffusion & drift current, Forward & reverse bias, Minority carrier current. Diode characteristics, Load line, Diode current equation .

Diode applications: Rectifier, switch, Wave-shaping, Voltage multiplier, Breakdown diode, Voltage regulator, Power Supply.

FET: Field effect transistor; Device, Structure & Physical operation of the MOSFET, Current-voltage characteristics. DC analysis of MOSFET circuits, MOSFET as an amplifier. MOSFET amplifier configurations

Common Source, common drain and common gate with passive loads. Determining voltage gain, input and output resistance for each configuration.

Operational Amplifiers: Terminal characteristics only, ideal op-amp characteristics, inverting and non-inverting configurations, op-amp applications like weighted summer, difference amplifier, instrumentation amplifier, differentiator, integrator, logarithmic amplifier etc.

MT 227 DIFFERENTIAL EQUATIONS

1st Order Differential Equations: Basic concept; Formation of differential equations and solution of differential equations by direct integration and by separating the variables; Homogeneous equations and equations reducible to homogeneous form; Linear differential equations of the order and equations reducible to the linear form; Bernoulli's equations . Application in relevant Engineering: orthogonal trajectories: Numerical approximation to solutions; Solution in series. Euler method, Euler modified method, RungeKutta method of order 4.

2nd and Higher Orders Equations: Special types of II and order differential equations with constant coefficients and their solutions; The operator D; Inverse operator 1/D ; Solution of differential by operator D methods; Special cases, Cauchy's differential equations; Simultaneous differential equations; simple application of differential equations in relevant Engineering.

Partial Differential Equation: Basic concepts and formation of partial differential equations; Linear homogeneous partial differential equations and relations to ordinary differential equations; Solution of first order linear and special types of second and higher order differential equations; D' Alembert's solution of the wave equation and two dimensional wave equations; Lagrange's solution: Various standard forms.

Laplace Integral & Transformation: Definition, Laplace transforms of some elementary functions, first translation or shifting theorem, second translation or shifting theorem, change of scale property, Laplace transform of the nth order derivative, initial and final value theorem Laplace transform of integrals. Laplace transform of functions $t^n F(t)$ and $F(t)/t$, Laplace transform of periodic function, evaluation of integrals, definition of inverse Laplace transform and inverse transforms, convolution theorem, solutions of ordinary differential using Laplace transform.

ME 110 BASIC MECHANICAL ENGINEERING

Thermodynamic Properties: Working Substance, System, Pure Substance, PVT Surface, Phases, Properties And State, Units, Zeroth Law, Processed and Cycles, Conservation of Mass.

Energy and its Conservation: Relation of Mass and Energy, Different Forms of Energy, Internal Energy and Enthalpy Work, Generalized Work Equation Flow and Non-Flow Processes, Closed Systems, First Law of Thermodynamics, Open Systems and Steady Flow, Energy Equation for Steady Flow, System Boundaries, Perpetual Motion of the First Kind. Energy and Property Thermodynamic Equilibrium, Reversibility, Specific Heats and their Relationship.

Relations: Entropy, Second Law of Thermodynamics, Property relations from Energy Equation, Frictional Energy.

Ideal Gas: Gas Laws, Specific Heats of an Ideal Gas, Dalton's Law of Partial Pressure, Thermodynamic Processes. Fundamentals of Conduction and Convection, Radiation, Thermal Conductivity, Overall Heat.

Heat Transfer: Transfer Coefficients, Practical Equations.

Thermodynamic Cycles: Cycle Work, Thermal Efficiency Carnot Cycle, Reversed and Reversible Cycles, Most Efficient Engine.

Two-Phase Systems: Two-Phase System of a Pure Substance, Changes of Phase at Constant Pressure, Steam Tables, Superheated Steam, Liquid and Vapour Curves, Phase Diagrams, Rankine Cycle, Components of Steam Power Plant.

Internal Combustion Engines: Otto Cycle, Diesel Cycle, Dual Combustion Cycle, Four-stroke and Two-stroke Engines, and Types of Fuel. Reciprocating Compressors: Condition for Minimum Work, Isothermal Efficiency, Volumetric Efficiency, Multi-Stage Compression, Energy Balance for a Two-Stage Machine with Intercooler. Introduction To Heating and Cooling Load and its calculations, Comfort Charts, Outline of A.C. Air-Conditioning and Systems, Consideration for Air – Conditioning in Buildings, Natural Ventilation.

Refrigeration: Insulating Materials.

CY 110 APPLIED CHEMISTRY FOR ENGINEER

Gases: Gas Laws, Kinetic gas equation, Vander Waal's Equation, Critical phenomenon, liquidification of gases, specified heat (molar heat capacity). Properties of Solution Surface Tension, Viscosity, Osmosis, Osmotic Pressure, pH-Buffer solution, & Liquids: Spectrophotometer, Basic concepts of Colloidal Chemistry, Classification purification (dialysis).

Thermochemistry: Chemical thermodynamics, Hess's Law, Heat of reaction, Relation between H and U measurement of heat reaction, Bomb Calorimeter.

Electrochemistry: Laws of Electrolysis, E.M.F. series, corrosion (Theories, inhibition & protection)

Water & Sewage: : Sources of water, impurities, hardness, water softening, purification of water for potable and industrial purposes, electro dialysis, introduction to environmental pollution, main sources and effects, Sewage treatment.

Fuels: Types of fuels, classification of fossil fuels.

Metals & Alloys: Properties and general composition of metals and alloys such as Iron, Copper, Aluminum, Chromium, Zinc used in engineering field.

Engineering Materials: Inorganic engineering materials, Cement, Class Organic engineering materials, Polymers, Rubbers, Plastics and Paints, Semiconductors and Dielectric materials.

ES 105 PAKISTAN STUDIES

Historical and Ideological Perspective of Pakistan Movement: Two Nation Theory, Definition, Significance, Creation of Pakistan, Factors leading to the creation of Pakistan, Quaid-e-Azam and the demand of Pakistan.

Land of Pakistan: Geo-physical conditions, Geo-political and strategic importance of Pakistan, Natural resources-mineral, Water and Power.

Constitutional Process: Early efforts to make a constitution – problems

and issues, Constitution of 1956 and its abrogation, Constitution of 1962 and its abrogation, Constitutional and Political crisis of 1971, Constitution of 1973, Recent Constitutional developments.

Contemporary Issues in Pakistan: A brief survey of Pakistan Economy, Agricultural and industrial development in Pakistan, Internal and external trade, Economic planning and prospects, Social issues, Literacy & education in Pakistan, State of Science & technology with special reference to IT Education, Pakistan society and culture, Environmental issues, Hazards of atmospheric pollution, Other forms of environmental degradation & their causes & solution, Pakistan's role in preservation of nature, Through international conventions/efforts.

Foreign Policy: Pakistan Relations with neighbors, Super powers, Muslim world.

Human Rights: Conceptual foundation of Human rights, Human rights; Definition, significance and importance, Comparative analysis of Islamic and Western Perspectives of Human Rights, UN System for Protection of Human rights, Overview, UN Charter, International Bill of Human rights, Implementation mechanism, Other important international treaties & conventions, The Convention on the elimination of all forms of discrimination against woman, International Convention on the rights of child, Convention against torture, Refugee Convention, Pakistan's response to Human rights; At national and international level, Constitutional Provisions, Pakistan's obligations to international treaties and documents, Minority rights in Pakistan, Pakistan's stand on violation of Human rights in international perspective.

ES 127

PAKISTAN STUDIES (FOR FOREIGNERS)

Land of Pakistan: Land & People-Strategic importance- Important beautiful sights, Natural resources.

A Brief Historical Background: A brief Historical survey of Muslim community in the sub-continent, British rule & its impacts, Indian reaction, Two nation theory, Origin & development, Factors leading towards the demand of a separate Muslim state, Creation of Pakistan.

Government & Politics in Pakistan: Constitution of Pakistan, A brief outline, Governmental structure, Federal & Provincial, Local Government Institutions, Political History, A brief account.

Pakistan & the Muslim World: Relations with the Muslim countries.

Language and Culture: Origins of Urdu Language, Influence of Arabic & Persian on Urdu Language & Literature, A short history of Urdu literature.

EL 201 ELECTRONIC DEVICES AND CIRCUITS

Differential Amplifier: MOS differential pair operation with differential and common mode input voltage, large signal analysis, small signal analysis, differential and common mode gain calculations, non-ideal characteristics of differential pairs. Common Mode Rejection Ratio.

Current Sources: Simple MOS current sources and mirrors, MOS based current steering circuits. Cascode current source design.

Active Loading and Multistage amplifiers: Active loaded MOS differential pair, differential and common mode gains of actively loaded MOS differential pair, Useful cascades of single stage MOS amplifiers like CS-CS, CS-CG (Cascode amplifier) etc.

Introduction to BJT: Construction, configuration and biasing.

Output Stages: Introduction to classes of power amplifier (A, B, C, AB etc.).

Frequency Response: Introduction, High frequency small-signal model of MOSFET, Miller's Theorem, Analysis of Common-Source, Common-Gate, Common-Drain.

Feedback and stability: Negative feedback circuits, Birkhausen Criterion, phase margin and gain margin, Oscillators Ring Oscillator, LC oscillator.

EA 214 ACADEMIS WRITING

Writing Process: Identifying topic area, narrowing topic, planning, brainstorming, mind mapping, outlining, writing first draft, reviewing, revising, proofreading, writing final draft.

Reading & Writing: Analyzing different texts: identifying point of views, claims, assumptions, differentiate facts from opinions.

Practicing Academic Language: differentiate using language of opinion and fact.

Synthesize information, developing critical write up with relevant factual information, personal views, academic evidence, examples, cause and effect etc.

Presenting and describing visuals (tables & graphs).

Avoiding plagiarism and ensuring originality: summarizing, paraphrasing and quoting sources, citing, documenting sources through a referencing system (MLA / APA / Harvard style, as suggested by the discipline)

Writing Products: Writing a well-structured paragraph (topic sentence, supporting details, conclusion).

Writing narrative, descriptive, expository, and argumentative essays.

Developing an effective essay using thesis statement, adequate development & argument, supporting details & Conclusion.

Writing short reports (technical reports).

TC 202

SIGNALS AND SYSTEMS

LTI Systems: Elementary Continuous-Time and Discrete-Time Signals and Systems, Linear Time-Invariant Systems, Differential and Difference LTI Systems.

Transforms: Continuous time Fourier series, Continuous time Fourier Transform, Discrete Time Fourier Series, Discrete Time Fourier Transform, Discrete Fourier Transform, Laplace Transform, Z-Transform.

Time-Frequency Analysis of LTI System:

Introduction to Time Frequency Analysis of Continuous time LTI System, Introduction to Time Frequency Analysis of Discrete-time LTI System.

Lab work: Lab work will be based on above mentioned contents.

EE 382

ELECTROMAGNETIC FIELDS

Vector Analysis: scalars and vectors, vector algebra, the Cartesian coordinate system, vector components and Unit vectors, the vector field, the dot product the cross product, other coordinate systems, circular

cylindrical coordinates, the spherical coordinate system, transformations between coordinate systems.

Coulomb's Law and Electric Field Intensity: The experimental law of coulomb, Electric field intensity, field of a point charge, field due to a continuous volume charge distribution, field of line charge, field of sheet charge, streamlines & sketches of fields.

Electric Flux Density Gauss's Law and Divergence: Electric flux density, Gauss's law, application of Gauss's law, some symmetrical charge distributions, differential volume element, divergence, Maxwell's first equation, electrostatics, the vector operator and the divergence theorem.

Energy and Potential: Energy expended in moving a point charge in an electric field, the line integral, definition of potential difference and potential, the potential field of a point charge, the potential field of a system of charges, conservative property, potential gradient, the dipole, Energy density in the electrostatic field.

Conductor Dielectrics and Capacitances: Current and current density continuity of current metallic conductors, conductor properties and bounded conditions, semiconductors, the nature of dielectric materials, capacitance, several capacitance examples, of a two wire lines . Curvilinear square, physical modules, current analogies, fluid flow maps the iteration method.

Poisson's and Laplace's Equations: Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, examples of the solution of poisson, product solution of Laplace's equation.

The Steady Magnetic Field: Biot Savart's Law, Amperes circuit law, curl, Stoke's theorem, Magnetic flux and magnetic flux density, the scalar and vector magnetic potentials, derivation of steady magnetic field laws.

Magnetic Forces Materials and Inductance: Force on a moving charge force on a differential current element, force between differential current element, force and torque on a closed circuit, the nature of magnetic materials, Magnetization and permeability, magnetic boundary conditions, the magnetic circuit, potential energy and forces on magnetic materials, inductance and mutual inductance.

Time Varying fields and Maxwell's Equations: Faraday's Law, displacement current, Maxwell's equation in point form, Equation in integral form, the related potentials

The Uniform Plane Wave: Wave motion in free space, wave motion in perfect dielectric, plane waves in loose dielectrics. The Pointing vector and power considerations, propagation in good conductors, skin effect, reflection of uniform plane waves standing wave ratio.

MT 272

LINEAR ALGEBRA & GEOMETRY

Linear Algebra: Linearity and linear dependence of vectors, basis, dimension of a vector space, field matrix and type of matrices (singular, non-singular, symmetric, non-symmetric, upper, lower, diagonal tri-diagonal matrix), Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, transitions matrix.

Euclidean Spaces and Transformation: Geometric representation of vector, norm of vector, Euclidean inner product, projections and orthogonal projections, Euclidean n spaces n properties Cauchy-Schwarz inequality, Euclidean transformations, apply geometric transformations to plane figure, composition of transformations.

Application of linear Algebra: Leontief Economic models, Electrical Networks, Scaling, translation, rotation, and projection etc.

Eigen values & Eigen Spaces: Interpret eigenvectors and eigenvalues of a matrix in terms of transformation it represents, convert a transformation into a matrix eigen value problem, find the eigenvalues and eigenvectors of order not more than 3×3 matrices algebraically, determine the modal matrix for a given matrix, reduce a matrix to diagonal (form and Jordan form, state the Cayley-Hamilton theorem and use it to find powers and the inverse of a matrix, understand a simple numerical method for finding the eigenvectors of a matrix, use appropriate software to compute the eigenvalues and eigenvectors of a matrix, Define quadratic form and determine its nature using eigenvalues.

Solid Geometry: Coordinate Systems in three dimensions. Direction cosines and ratios, vector equation of a straight line, plane and sphere,

curve tracing of a function of two and three variables, Surfaces of revolutions . Transformations (Cartesian to polar & cylindrical).

TC 201 DIGITAL LOGIC DESIGN

Computer Operations: Evaluation of the computer, basic organization of digital computer, instruction formats, some different types of computers, special purpose and general purpose computers.

Number Systems: Conversion between bases, arithmetic with bases other than ten, negative numbers, binary coded decimal numbers, octal, and hexadecimal number systems.

Truth Function: Binary connectives, evaluation of truth functions, many statement compounds, physical realizations, sufficient sets of connectives, digital computer examples.

Boolean Algebra: Truth functional calculus as Boolean algebra, duality, fundamental theorems of Boolean algebra, examples of Boolean simplifications, remarks on Switching functions.

Switching Devices: Switches and relays logic circuits, speed and delays in logic circuits, integrated logic circuits.

Minimization of Boolean Functions: Standard forms of Boolean functions, Minterm and maxterm, Designation of Boolean functions, Karnaugh map representation of Boolean functions, simplification of functions on Karnaugh maps, map minimization of product of sums expressions, incompletely specified functions.

Tabular Minimization: Cubical representation of Boolean functions, Determination of prime implicants, Selection of an optimum set of prime implicants, Design of NAND and NOR Networks and properties of combinational network, Introduction to design of NAND and NOR Networks, Switching expressions for NAND and NOR Networks, Transient response of combination Networks.

Introduction to sequential Networks: Latches, Sequential Networks in fundamental mode, Introduction to the Synthesis of Sequential Networks, Minimization of the number of states, Clocked Networks.

Introduction to Verilog HDL and VHDL Lab work:

EL 202 INTEGRATED CIRCUITS

Integrated Circuits: Introduction to IC processing for MOS integrated circuits,

Op-amp: One and Two-stage CMOS Op Amps, input common mode range, voltage gain, and slew rate.

IC Packaging: Different types of packaging and their need. Wire-bond vs. flip-chip

MOSFET as a switch: MOS Inverter Circuits: Voltage transfer Characteristics, Noise Margins

Static MOS Gate Circuits: CMOS gate circuits, Flip-Flops & Latches, Pseudo NMOS and Pass Transistor Logic circuits

Transmission gate and Dynamic Logic: Pass Transistor, CMOS Transmission gate Logic, Dynamic D- Latches, Domino Logic

Semiconductor Memory Design: Memory Organization, Address Buffers & Decoders, Static RAM Cell Design, SRAM Column I/O Circuits. Dynamic RAM circuits.

CS 216 DATA STRUCTURE AND ALGORITHMS

Introduction and classification of Data Structures; Basic operations; Classification of Algorithms, Classification by implementation; Classification by design paradigm . Basics of Complexity of Analysis; Rate of growth of Complexity of Algorithms; Asymptotic notations; Time-Space Tradeoffs .

String Processing-Operations on strings; word processing; Pattern Matching Algorithms

Array-One-dimensional Arrays: Insertion, Deletion; Multi-dimensional Arrays: Matrix Multiplication, Sparse Matrices. Stacks, Queues and Recursion; Basic Concepts and functions; Polish Notation; Priority Queues; Factorial Calculation; Fibonacci Series; Ackermann Function, Towers of Hanoi. Linked Lists; Definition and Representation; Traversal and searching; Insertion; Deletion; Circular Lists; Doubly linked lists. Tree; Terminology; Representation in memory; Binary search tree, Heaps; Heap-sort algorithm . Graphs; Terminology; Representation in

memory, Traversal Algorithms; Shortest path Algorithms Sorting and searching; Searching and sorting Algorithm; Hashing.

EE 223 INSTRUMENTATION AND MEASUREMENT

General Theory: Classification of instruments. Block diagram of various instrumentation schemes. Performance characteristics of instruments

Measurement of Electrical Quantities: Basics of electromechanical instruments, moving coil and electro-dynamometer instruments as ammeter, voltmeter and ohmmeter, Extension of ranges.

Instrument Transformers: Their burden and accuracy, clamp meter, Active and reactive power measurement. Max, Demand indicator, Classification of energy meter, Induction type KWH meter, p.f meter

Measurement of resistance by bridge method and meggar, Measurement of Inductance and capacitance. Measurement of dielectric strength of insulators, high voltage surges.

Electronic Instruments: Data Acquisition, A/D conversion. Electronic and digital voltmeters, digital frequency meter, time interval measurement. Power and energy meter.

Transducers: Temperature transducers, Pressure transducers, Variable, resistance and inductance transducers. Linear variable differential transformer (LVDT), capacitive photoconductive and piezo-electric transducers, thermoelectric transducers

Measurement of Nonelectrical Quantities: Measurement of temperature, pressure flow strains, thermal conductivity, motion speed and vibrations.

EE 246 ELECTRICAL MACHINES

Three Phase Circuits: Three phase voltages, Currents and power, Star and Delta connected circuits, Analysis of balanced three phase circuits, Line diagram, Power and power factor measurement in 3-phase circuits.

Transformer: Basic principles, Single and 3-phase transformers, Construction, General transformer equation, Voltage and current relations

in transformer, Ratio of transformation, Loading a transformer, Equivalent circuits of a transformer, OC and SC tests, Regulations and methods of calculation of regulation, Efficiency and calculation of efficiency, Auto transformer, 3-phase transformer.

Direct Current Machines: Electric circuit aspects of DC machine, Magnetic circuit aspects, Types of DC generator, Performance, Types of motors, Performance, Motor speed control, Transient and dynamic responses, Transfer functions and frequency response.

Alternating Current Machines: Rotating magnetic field, Induction motor action, Induction motor characteristics and performance, Synchronous generator characteristics and performance, Synchronous motors, Induction motor, Speed control elementary AC two phase control motors, Constructional features of fractional horse power AC motors.

Direct Current Machines Winding: Gramme Ring winding, Simple lap and wave windings, Diagrams and developments and elementary calculations.

Control Systems: Motor drive systems, Introduction to feedback control systems, System aspects and classification, Elements of analysis of feedback control systems, Digital control systems.

ES 205

ISLAMIC STUDIES

Thematic study of Holy Quran: Basic Islamic Believes, Tauheed, Al-Ambiya-22, Al-Baqarah-163-164, Prophet hood, Al-Imran-79, Al-Hashr-7, Al-Madah-3, Here-After, Al-Hajj-5, Al-Baqarah-48, Two Hadith, Basic Islamic Practices, Al-Mu' minun-I-II, Amre-Bil-MA' Roof WA-Nahi Anil Munkar, The concept of Good & Evil, Importance & necessity of DA' Wat-e-Deen Al-Imran-110, Method of DA' Wat-e-Deen, An-Nehl-125, Al-Imran-104, Two Hadith, Unity of the Ummah, Al-Imran-103, Al-Hujurat-10, Al-Imran-64, Al-An'am-108, Kasb-e-Halal, Taha-81, Al-A'raf-32-33, Al-Baqarah-188, Two Hadith, Huquq-ul-Ibad, Right to Property, Al-Maidah-32, Right to Property, An-Nisa-29, Right of Respect & Dignity, Al-Hujurat-11-12, Freedom of Expression, Al-Baqarah-256, Right of Equality, Al-Hujurat-13, Economic Security, Al-Ma'araj-24-25, Employment Opportunity on Merit, An-Nisa-58, Excession Right to Justice, An-Nisa-135, Women Rights, An-Nehl-97, Al-Ahzab-35, An-Nisa-07, Relations With Non-Muslims, Al-Mumtahanah-8-9, Al-Anfal-61, Last sermon of Hajj at Arafat on 10th Zil-

Hajj, Translation & the important points of the sermon.

Serat Life of the Holy Prophet: Birth, Life at Makkah, Declaration of Prophet hood, preaching & its difficulties ,Migration to Madina, Brotherhood (Mawakhat) & Madina Charter, The Holy War of the prophet (Ghazwat-e-Nabawi), Hujjat-ul-Wida.

Islamic Civilization: Impacts of Islamic civilization on the sub-continent, The civilization of sub-content before Islam, The Political, Social & Moral Impacts of Islamic Civilization on sub-continent, Academic, Intellectual, Social & cultural Impacts of Islam on the World..

ES 209 ETHICAL BEHAVIOR

Introduction to Ethics: Definition of Ethic, Definition between normative and positive science, Problem of freewill, Method of Ethics and Uses of Ethics

Ethical Theories: History of Ethics: Greek Ethics, Medieval, Modern Ethics, Basic concepts of right and wrong: good and evil, Utilitarianism, hedonism, self-realization: self-realization: egoism, intuitionism, rationalism, Kant's moral philosophy

Ethics & Religion: The relation of Ethics to religion, Basic ethical principles of major religions: Hinduism, Judaism, Buddhism, Zoroastrianism, Christianity and Islam

Ethics, Society, and moral theory: Ethical foundation of Rights and Duties, Applied Ethics, Society as the background of moral life, Universalism and Altruism, theories of punishment.

TC 212 DIGITAL SIGNAL PROCESSING

Overview of Discrete-time Signals and Systems – Sampling, Aliasing, Quantization, Convolution, Correlation, Properties of Discrete time Signals and Systems;

Discrete Fourier Transform – Frequency Domain Sampling, DFT Properties, Inverse DFT, Windowing and DFT Leakage, Direct Computation of DFT;

Fast Fourier Transform – Divide and Conquer, Radix algorithms; Inverse FFT, Applications of FFT

Discrete time systems implementation – Overview of z-transform, Structures of Discrete time systems, Fixed and Floating number types, and Quantization effects.

Design of Digital Filters – General Considerations, FIR and IIR Filters, Techniques of FIR and IIR filter Design.

Multi rate Signal Processing – Down sampling and Up sampling, Decimation and Interpolation.

MT 331 PROBABILITY AND STATISTICS

Statistics: Introduction, Types of data and variables, Presentation of data, Objects, Classification, Tabulation, Frequency distribution, Graphical representation, Simple and Multiple Bar diagrams, Sartorial and Pie diagrams, Histograms, Frequency polygons, Frequency curves and their types.

Measures of Central Tendency: Statistical averages, Median, Mode, Quartiles, Range moments, Skewness, Quartile deviation, Mean deviation, Standard deviation, Variance and its coefficients, Practical significance in related problems.

Curve Fitting: Introduction, Fitting of a first and second degree curve, Fitting of an exponential and logarithm curves, related problems, Principle of least squares, Second order statistics & Time series not in bits details.

Simple Regression and Correlation: Introduction, Scatter diagram, Correlation and its coefficient, Regression lines, Rank correlation and its coefficient, Probable error, related problems.

Sampling and Sampling Distribution: Introduction, Population, Parameter and statistics, Objects of sampling, Sampling distribution of mean, Standard errors, Sampling and Non-sampling errors, Random sampling, Sampling with and without replacement, Sequential sampling, Central limit theorem with practical significance in related problems.

Statistical Inference and Testing of Hypothesis: Introduction, Estimation,

Types of estimates, Confidence interval, Tests of hypothesis, Chi-Square Distribution/test, one tail and two tails tests, Application in related problems.

Probability: Basic concepts, Permutation and combination. Definitions and Laws of probability, Conditional probability, Baye's rule, Related problems and practical significance.

Random Variable: Introduction, Discrete and continuous random variables, Sequences and transformations, Probability distribution, Probability density function, Mathematical expectation, Moment generating functions, Markove random walks chain and related problems.

Probability Distribution: Binomial, Poisson, Hyper geometric & Negative binomial distribution, Continuous probability distribution, Uniform, Exponential and Normal distributions and their practical significance.

TC 307

COMMUNICATION SYSTEMS

Introduction: Introduction to Communication, elements of communication system, Fundamental Limitations, Hartley Shannon law Needs and benefits of Modulation, electromagnetic spectrum, multiplexing and multiple access, Phasors and Line Spectra.

Analog Communication: Baseband and carrier communication, Linear CW (AM, SSB, DSB, VSB) Modulation and demodulation techniques, modulator and demodulator Circuits, AM and SSb Transmitter and Receivers, SSB Filters, Transmission Bandwidth for AM, Angle/Exponential CW (FM, PM) Modulation and demodulation techniques, modulator and demodulator Circuits, FM/ PM Transmitter, FM Generation Methods, Transmission Bandwidth for FM/PM, Carson's rule, PLL Systems, Pre-emphasis and De-emphasis circuits, Narrowband and wideband FM, Demodulation of FM/PM and Receivers.

Noise: Mathematical representation, Signal to Noise Ratio, Noise in AM, FM and PM systems.

Digital Communication Systems: Digital transmitters and receivers, Pulse Modulation, Pulse Amplitude Modulation, Pulse Position and Pulse width Modulation, BER.

Random Signal Analysis: Review of probability and random variables,

statistical measures, Probability models, Introduction to random processes.

EF 304 OCCUPATIONAL SAFETY & HEALTH

Introduction to Occupational Safety and Health, Historic development in the subject, Safety Legislations, Safety and Ethics;

Hazards-Mechanical and Machine, Falling, lifting and Vision related hazards, Temperature and Pressures, Electrical, Fire, Radiation, Chemical and Material, Noise and Vibration, Computers and Automation related Hazards, Industrial Hygiene and Confined Spaces; Case Studies
Hazards Analysis, Concepts of Risks, Incidents and Accidents, Accidents Prevention and Control, Personal Protective Equipment, Management Responsibilities, Accident Causation, reporting and Investigation; Case Studies.

Developing and maintaining Codes, Standards and Regulations, ISO Standards 14001 and 45001/BS OHSAS 18001

EL 307 POWER ELECTRONICS

Introduction and scope of power electronics: Solid state devices used in power electronics, such as power diode, power transistor, power MOSFET, SCRs, DIACs and TRIACs etc. SCRs turn on techniques, elementary and advanced firing schemes of power devices, VTA analysis.

Uncontrolled and controlled rectifiers: Single phase half wave uncontrolled /controlled rectifiers with R, RL and Pure inductive loads, three phase and semi convertors, full convertors, dual convertor, analysis and performance parameters as harmonic factor, utilization factor, distortion factor and etc., rectifiers with purely resistive and highly inductive and RL loads.

Introductions to AC Voltage controllers: Single phase unidirectional and bi directional AC Voltage regulators

Thyristors Commutation: Self-commutation, impulse commutation

Ideal DC-DC Converter: Principle of step up and step-down choppers,

with their respective operations, design and analysis, buck regulator, boost regulator, buck and boost regulator, cuk regulators, *SEPIC converter*.

Isolated DC-DC Converters: Switch mode power supplies, design and analysis of isolated converters such as Flyback and Forward Converter.

Inverters: Principle of half and full bridge inverters, constant pulse width modulation (PWM), variable PW modulation, SPWM and MSPWM techniques.

Simulation and control of Power electronics Converter. MATLAB implementation of Power converters, design, open-loop and close-loop control. Controllers for Power converters.

Practical will be based on above contents.

EE 374 FEEDBACK CONTROL SYSTEMS

Introduction: Introduction to control systems, examples and classifications, Feedback and its characteristics. Nature and representation of control system problem, block diagram fundamentals, terminology of block diagram for a feedback control system, block diagram representation of various control systems.

Linear Systems and Differential Equations: Methods of writing differential equations of various physical systems such as static electric circuits, mechanical translational and rotational systems, thermal systems, hydraulic linear and rotational transmission systems, electromechanical dynamic systems DC and AC speed control systems.

Time-Response of Linear Systems: Types of standardized inputs to linear systems, steady state response and transient response of systems to standard inputs, response of second order systems time response specifications.

Laplace Transforms: Definition, derivation of Laplace transforms of simple functions, Laplace transform theorems, transformations of differential equations of physical systems, inverse transformation techniques, stability, Routh's stability criterion.

Block Diagram Algebra: Transfer functions of physical systems, canonical and unity feedback forms of control system block system block diagram, block diagram reduction techniques, signal flow graph algebra, block diagram reduction using signal flow graphs.

Control System Characteristics: Classification of feedback systems by type, analysis of system types, error coefficients, error constants, sensitivity.

Root Locus: Introduction, rules for construction of root locus, qualitative analysis of root locus, the spirule, analysis of performance characteristic of systems in time domain, dominant pole zero approximations, gain margin and phase margin, root locus compensation. Phase & gain compensation, root locus compensation, PID controller.

Frequency Response: Introduction, transfer function of systems in frequency domain, magnitude and phase angle frequency response of plots of closed loop control systems.

Introduction to Digital Control: Computer as control device, Single-loop digital control system, Digital control: pros and cons, Data Converters.

Linear Difference Equations (LDE) and z-transform: Scalar difference equation, z-transform of simple sequences and inversion, solving LDE using partial fraction and z-transform, z-domain transfer function and impulse response, relation between S and z-domain.

Digital control system design techniques: Digital control strategies and implementation, closed-loop characteristic equation, z-domain design considerations, General PID digital control algorithm, Tuning procedure for PID controller.

CS 430

MICROPROCESSOR PROGRAMMING AND INTERFACING

Computer Architecture, Instruction Cycle, Memory Organization, Address decoding, Memory Hierarchy, Interrupts, Bus Arbitration Schemes, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access. General purpose and special purpose processors, Internal Registers, Internal Bus Architecture, Pin Function, Addressing Modes, Instruction Set Architecture: (Data Transfer Instructions, Arithmetic & logic instructions, Branch instruction), Assembler Directives, Macros, Procedures, Instruction Encoding, Bus Cycles, Reset Circuit, Clock

generation circuits, Wait states, Memory interfacing, Memory Speed Requirement, I/O Interfacing, Programmable Peripheral Interface, Programmable interval Timer, Programmable interrupt Controller, Microprocessor System Design, Recent Microcontroller Architectures.

EA 304 BUSINESS COMMUNICATION & ETHICS

Business English: Writing formal and business letters and memos: Drafting notices and minutes; Theoretical knowledge and comprehension of contracts and agreements; preparing proposals and conducting and writing research project reports. Participating in seminars and interviews, and writing and presenting conference papers; Solving IELTS type papers.

Engineering Ethics: Introduction, Objective of the course, Definite of (a) a code (b) ethic, Defining needs for a code of ethics, Need for a code of ethics, For who and why, Review of Code of Ethics of international engineering and other bodies, Review of Code of Ethics of other professional bodies of Pakistan, Comparing/Contrasting, Review of PECs Codes of Ethics. Code of Conduct, Comparison b/w PEC's Codes & of similar International bodies.

EF 305 ENGINEERING ECONOMICS & MANAGEMENT

Introduction: Basic Concepts and principles of Economics, Micro- and Macro-economic theory, the problem of scarcity. Basic concepts of Engineering Economy, Financial effectiveness and non-monetary factors

Economic Environment: Consumers and producer goods, Goods and services, Demand & Supply concept. Market Equilibrium, Elasticity of demand, Elasticity of Supply, Measures of Economics worth, Price-supply-demand-relationship, Revenue, Cost and profit function.

Elementary Financial Analysis: Basic accounting equation. Development and interpretation of financial statements-Income Statement, Balance Sheet and Cash Flow, Working capital management, Financial Ratio Analysis.

Time Value of Money and Financial Returns: Concepts of simple, compound and effective interest rates, Less often than compounding period and more once a year; Present Value, Future Value and Annuities concepts, Uniform gradient and geometric sequence of cash flow.

Depreciation and Taxes: Depreciation concept, Economic life, Methods of depreciation, Gain (loss) on the disposal of an asset, Depreciation as a tax shield.

Basic cost concepts and Break Even Analysis: Types of costs and cost curves; Determination of Cost/Revenues. Numerical and graphical presentations. Practical applications, BEA as a management tools for achieving financial/operational efficiency.

Linear Programming: Mathematical statement of linear programming problems, Graphical solutions, Simplex method, Duality Problems.

Business Organizations and financial Institutions: Type of ownership, single ownership, partnerships, corporation, type of stocks and joint stock companies, Banking and specialized credit institutions.

Project Management: Integration of Organization Strategy with Projects, Defining the project, developing a network plan, managing risk, reducing project time, project selection and comparing alternatives techniques scheduling resources.

Introduction to Projection Management and Production Concepts: Basic production function, stages of production, returns to scales, Production lead time, Production rate, capacity, operations, planning and control, order processing, Scheduling, Material requisitions planning, line of balance.

EL 309

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Introduction to artificial intelligence: Branches, overview of AI and its applications. Programming for AI.

Problem solving by search: Searching techniques, blind, informed, uninformed, local, games and adversarial search techniques and algorithms.

Introduction to machine learning: Basics of machine learning, supervised and unsupervised learning, linear regression, cost function, gradient descent and its different types, logistic regression, over fitting, under fitting and regularization, k-means clustering, Naïve Bayes, k-nearest neighbors (KNN). Basics of deep learning.

Basics of neural networks: Structure of neural network, artificial neural networks. Fully connected neural network, forward and backward propagation, errors and evaluation metrics. Basics of convolutional neural network, stride, padding, filters, channels and other convolution neural network (CNN) related concepts.

EL 308 INDUSTRIAL ELECTRONICS

Industrial process components: Plant safety management (PSM) and preventive measurements. Introduction to industrial process system and its components, process sensors, industrial transmitter and receivers, embedded controller based data acquisition system, HART equipment based process instrumentation system, industrial actuators.

Data acquisition and communication: Industrial transmitter and receivers, MICRO CONTROLLER based data system, industrial communication standards and protocols

Process control: why control, on-off control, P control, PD control, PID control, case study to control motors (actuators)

Industrial process control using PLC: Introduction, architecture, I/O s detail, memory detail, programming details, Ladder logic based control programming, interfacing with PLC, ON/OFF process control, PID process control, Development of process and instrumentation (P&ID) diagrams

SCADA, DCS and robotic manipulators: introduction to SCADA and DCS, specification, working principle, introduction to robotic manipulators and kinematics.

Practical work of the course will be based on above contents.

MT 442 NUMERICAL METHODS

Error Analysis: Types of errors (Relative, Absolute, Inherent, Round-off, and Truncation) Significant digits and numerical instability, flow chart, Use of any computation tool to analyze the Numerical solutions.

Linear Operations: Functions of operators, Difference operators and the derivative operators, identities.

Difference Equations: Linear homogenous equations and non-

homogenous equations.

Solution of Non-Linear Equations: Numerical methods for finding the roots of transcendental and polynomial equations (Secant, Newton_Raphson, Chebyshev and Graeffe's root squaring methods), Rate of convergence and stability of an iterative method.

Solution of Linear Equations: Numerical methods for finding solutions of linear equations (Gauss Elimination, Gauss-Jordan Elimination, Triangularization, Cholesky, Jacobi and Gauss-Seidel).

Interpolation and Curve Fitting: Lagrange, Newton, Hermit, Spline Least squares approximation (Linear and non-linear curves).

Numerical Integration and Differentiation: Computation of integrals using trapezoidal rule, $1/3^{\text{rd}}$ Simpson's rule, $3/8^{\text{th}}$ Simpson's rule, Composite Simpson's and trapezoidal rules, Computation of solutions of differential equations using (Euler method, Euler modified method, Runge Kutta method of order 4). Numerical solutions of partial differential equations, Optimization problem, Simplex method, Steepest ascent and steepest descent methods.

EL 409 VLSI SYSTEMS DESIGN

HDL: Programming in Verilog.

VLSI Architectures for digital signal processors, adders and multipliers.

Design Methodologies and tools Cell based design, full custom design, platform based design, Design flows Behavioral synthesis design, mixed signal or custom design flow.

Testing and verification: Logic verification principle, design for test, System Verilog for verification.

Practical work of the course will be based on above contents.

MG 482 ORGANIZATIONAL BEHAVIOR

Introduction to organizational behavior, Structure and control in organization.

Individual and work learning, Stress. Individual differences, Motivation and job satisfaction, Group and work, Group and inter-group behavior. Leadership, Patterns of work. Conflict and consent in work. Organizational culture.

EL 422 ROBOTICS

Introduction: Fundamentals of Robotics including definitions, types, uses, history, key components, applications and future developments in the field.

Actuators and Drive Systems: Control Components, Embedded Robot Controller, I/O Interface, and PWM Amplifiers, Control Software, Controller Software and Sensor Inputs.

Sensors: Basic Sensor based Controls; Plan Strategy.

Robot Mechanisms: Overview and analysis of robot mechanisms.

Planar Kinematics: Displacements are rotations or translations. Rotation centers. Kinematic mechanisms. Four-bar linkages.

Differential Motion: The final location of the end effector, but also with the velocity at which the end-effector moves.

Statics: Energy Method, Hybrid Position-force Control, Compliance, End-effector Design, Non-holonomic Systems, Legged Robots, Multi-fingered Hands Dynamics: Computed Torque Control, sensors-2, computer vision, Navigation.

Force and Compliance Controls: complex tasks, including assembly of parts, manipulation of tools, and walking on a terrain, entail the control of physical environment, Interactions and mechanical contacts with the environment.

EL 401 FINAL YEAR DESIGN PROJECT

Final year students will be required to consult the Chairman of Electronic Engineering Department regarding the offering of various projects in the department. The student or group of students will be assigned the project by teacher concerned and will carry out the assignment as required and directed by the teacher. At the end of the academic session, they will submit a written report on work of their project to the Chairman,

preferably in the typed form. Students will be required to appear before a panel of examiners for oral examination.

The Project will be of the following scopes: A detailed theoretical study of some problem in an area related to Electronic Engineering. This may be of investigative research nature or it may be laboratory research oriented.

TC 421 TELECOMMUNICATION NETWORKS

Telecommunications Management Network (TMN), Network Management Tools and Systems. Computer Communication within the framework of the OSI and TCP/IP protocol architectures. Network architectures and switching techniques, characteristics of transmission media. Channel access protocols and their efficiency. Link control protocols, and their efficiency. Routing algorithms and protocols. Interconnection of network at the link level and at the network level, the Internet Protocol (IP) and associated control protocols. End-to-end protocols, with TCP and UDP as examples; congestion control and flow control. cursory view of application-level protocols, including electronic mail, HTTP and DNS. Introduction to network calculus (optional).

MG 481 ENTREPRENEURSHIP

Entrepreneurship Mind-set: The revolution impact of Entrepreneurship, The individual Entrepreneurship Mind-set, Corporate Entrepreneurship Mind-set, The Social and Ethical perspectives of Entrepreneurship, Launching Entrepreneurship Ventures, Creativity and innovations, Methods to initiate ventures, Legal challenges in Entrepreneurship, The search for Entrepreneurship Capital

Formulation of Entrepreneurship Plan: The assessment of function with opportunities, The marketing aspects of new ventures, Financial statements in new ventures, Business plan preparation for new ventures, Strategic Perspectives in Entrepreneurship, Strategies growth in Entrepreneurship, Valuation challenges in Entrepreneurship, Final harvest of a new venture.

EL 421 EMBEDDED ELECTRONICS

Integrated Electronics: An introduction to fundamental concepts, principles and techniques for designing integrated electronic systems,

which include analog, radio, mixed-signal and digital blocks. Most common integration approaches are given using examples.

Sensor enabled Systems: An introduction to sensor enabled systems, with an emphasis on embedded platforms. Areas covered include broad sensor technologies, the physical properties they measure, and how they are used in embedded designs.

Embedded Systems Design Techniques: Introduction to techniques for system design and implementation. Introduction to hardware description languages. Modeling systems with VHDL.

Hardware and Software Algorithms: The logic/FSM and algorithm implementation as Embedded Hardware in a SOC Architecture realized as ASICs or FPGAs. The implementation methodology will be based on logic and high-level synthesis. Coherent knowledge and practical hints of relevant issues of physical (hardware) architecture design (at printed circuits board level & higher levels) of complex electronic systems.

ELECTIVE COURSES

EL 410 NANO ELECTRONICS

Introduction to Nano electronics: Back ground, approaches and scientific revolutions.

Semiconductor Materials and Crystal Properties: Crystal growth of nanostructures, quantum dots, Nanoelectronics Polymers, Energy bands and charge transport, optical properties, Drift, diffusion, Excess carriers.

Semiconductor junctions: PN junction, Metal semiconductor junctions, Hetero junctions, quantum well, Tunnel and photodiode.

Field Effect Transistors: Gate control and electrical characteristics the GaAs MESFET, MOS capacitor, CMOS scaling, Microelectromechanical systems (MEMS), Nanoelectromechanical systems (NEMS). Nano Sensors.

Applications of Nanoelectronics: Basic concept, principles and classification of Nano biotechnology, Function of Biological Nano molecules, DNA computers and microprocessors. Nanomaterials for Environmental engineering, Green nanotechnology, Nano-convergence and Environmental Engineering.

EL 411 OPTOELECTRONICS

Basic Principles of Optoelectronics: Optical rays: Reflection, Refraction and Snell's Law, Total internal Reflection, Diffraction, Mode propagation, Skew Waves, Acceptance angle and Numerical Aperture.

Optical Fiber, Modes of Optical Fiber and Fiber Losses: Modes of Optical Fiber, Step-Index: Multimode Fibers, Graded Index Fiber, Step-Index: Single-mode Fibers.

Transmission characteristics of optical fiber: attenuation due to absorption, scattering, bending losses, Reflectance and optical return losses, Material losses, Scattering, waveguide and Micro bend losses, Dispersion, Intermodal dispersion and Intramodal dispersion.

Optical Sources: LEDs and its types, modulation capabilities and

conversion efficiency, LED drive circuits, Stimulation Emission in Semiconductors, Population inversion and pumping threshold conditions, Laser modes, classes of lasers, single mode operation, Lasing conditions in semiconductors, semiconductors Laser Diodes (SLDs), Types of Semiconductors Laser Diodes, Spectral and output Characteristics, SLD Drive circuits.

Optical Detectors: Photo-detection in semiconductors, Semiconductor photodiodes and its response, PIN and APDs photodiodes.

Couplers, connectors, switches, splicing, optical amplifiers and repeaters.

Passive Optical Networks.

EL 412 MICROWAVE & RF CIRCUITS

Power Theorem and Impedance Matching Networks using Lumped Components: Maximum power transfer theorem, matching network using lumped components (L-matching, pi-matching, T-matching and LL-matching networks).

Transmission Line theory and impedance matching using stubs: Basics, types of transmission lines, Line characteristics impedance and physical parameters. Signal propagation, Waveform distribution and frequency dispersion, Transmission line of finite Lengths, Reflection, Transmission and Propagation constants of transmission line The Lumped-Element circuit model for a transmission line, wave propagation on a transmission line, the lossless line, Special cases of lossless terminated lines.

Smith Chart: Introduction to Smith Chart, Impedance Smith Chart, Admittance Smith Chart and Combined Impedance and Admittance Smith Chart, Impedance View point (Quarter wave transformer), Generator and Load mismatch.

Microwave Network Analysis: Impedance and Equivalent Voltages and currents, impedance and Admittance Matrices, The scattering Matrix. Microwave power divider, coupler, and filter design.