**DEPARTMENT OF
ELECTRONIC ENGINEERING**

SYLLABI OF COURSES
FOR
B.E. (TELECOMMUNICATIONS ENGINEERING)
DEGREE PROGRAMME
(APPLICABLE FROM BATCH 2011-2012 & ONWARDS)

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

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B.E (TELECOMMUNICATIONS ENGINEERING)
COURSES OF STUDIES
Applicable from Batch 2011-12

FIRST YEAR										
Spring Semester						**Fall Semester**				
Course Code	**Course Title**	**Credit Hours**				**Course Code**	**Course Title**	**Credit Hours**		
		Th	**Pr**	**Total**				**Th**	**Pr**	**Total**
EE-119	Fundamentals of Electrical Engineering	3	1	4		EL-102	Basic Electronics	3	1	4
TC-101	Fundamentals of Telecommunications Engineering	2	1	3		CE-105	Engineering Surveying	3	1	4
TC-102	Engineering Drawing and Workshop	1	2	3		TC-103	Programming with C-Language	2	1	3
PH-121	Applied Physics	3	1	4		MT-111	Calculus	3	0	3
HS-101	English	3	0	3		CY-105	Applied Chemistry	3	1	4
						HS-105/ HS-127	Pakistan Studies **OR** Pakistan Studies (for Foreigners)	2	0	2
	Total	**12**	**5**	**17**			**Total**	**16**	**4**	**20**

SECOND YEAR										
Spring Semester						**Fall Semester**				
Course Code	**Course Title**	**Credit Hours**				**Course Code**	**Course Title**	**Credit Hours**		
		Th	**Pr**	**Total**				**Th**	**Pr**	**Total**
TC-201	Digital Logic Design	2	1	3		EL-234	Amplifiers and Oscillators	3	1	4
EE-216	Circuit Theory	3	1	4		TC-202	Signals & Systems	2	1	3
CS-203	Object Oriented Programming	3	1	4		EE-281	Electromagnetic Fields	3	0	3
EE-221	Instrumentation	3	1	4		CS-208	Computer Architecture & Organization	3	1	4
MT-222	Linear Algebra & Ordinary Differential Equations	3	0	3		MT-224	Complex Variable & Fourier Analysis	3	0	3
CS-210	Data Structure & Algorithms	3	1	4		HS-205/ HS-209	Islamic Studies **OR** Ethical Behaviour	2	0	2
	Total	**17**	**5**	**22**			**Total**	**16**	**3**	**19**

B.E (TELECOMMUNICATIONS ENGINEERING)
COURSES OF STUDIES
Applicable from Batch 2011-12

THIRD YEAR										
Spring Semester						**Fall Semester**				
Course Code	**Course Title**	**Credit Hours**				**Course Code**	**Course Title**	**Credit Hours**		
		Th	**Pr**	**Total**				**Th**	**Pr**	**Total**
TC-384	Communication Systems	3	1	4		CS-318	Computer Communications Networks	3	1	4
TC-382	Antenna and Microwave Engineering	3	1	4		TC-387	Wireless & Mobile Communication	3	1	4
EL-333	Integrated Circuits	2	1	3		EE-393	Digital Signal Processing	3	1	4
CS-309	Microprocessor and Assembly Language	3	1	4		EE-374	Feedback Control Systems	3	1	4
EF-303	Applied Economics for Engineers	3	0	3		HS-304	Business Communication and Ethics	3	0	3
MT-335	Probability and Statistics	3	0	3						
	Total	**17**	**04**	**21**			**Total**	**15**	**4**	**19**

FINAL YEAR										
Spring Semester						**Fall Semester**				
Course Code	**Course Title**	**Credit Hours**				**Course Code**	**Course Title**	**Credit Hours**		
		Th	**Pr**	**Total**				**Th**	**Pr**	**Total**
TC-485	Telecommunications Switching Systems	3	1	4		TC-492	Optical Fiber Communication	3	1	4
TC-489	Digital Communication and Information Theory	3	1	4		CS-413	Internet Computing	2	1	3
TC-484	Next Generation Networks	2	1	3		MT-442	Numerical Methods	3	0	3
TC-481	Navigational Aids & Radar Systems	3	1	4		TC-488	Telecommunications Management Network	3	1	4
TC-493/ TC-486	Satellite Communication/ Multimedia Communications (Optional)	3	1	4		TC-490	Telecommunications Engineering Project	0	6	6
*TC-490	Telecommunications Engineering Project*	0	0	0		`				
	Total	**14**	**5**	**19**			**Total**	**11**	**9**	**20**

* Duration one academic year: Requires literature survey and preliminary work during this semester.

FIRST YEAR (SPRING SEMESTER)

EE-119   FUNDAMENTALS OF ELECTRICAL ENGINEERING

Fundamental electric circuit laws and theorems: Energy, Electric charge, current, potential difference, Electric power & energy, Faraday's Law, Lenz's Law, Ohm's Law, KCL, electrical sources (voltage and current source), resistances, capacitances and inductances.

Basics of DC and AC circuit Analysis: Introduction to Loop current and node voltage, Mesh and Nodal analysis, Thevenin Theorem, Norton Theorem, Superposition Theorem, periodic functions, RMS and effective values, the phasor method of analysis, active and reactive power, maximum power transfer theorem, introduction to polyphase.

Magnetic Circuits and Transformers: Magnetic effects of electrical current, magnetic materials and magnetization curves, Hysteresis and eddy currents, self and mutual inductance, Introduction to ideal transformer, equivalent circuit of transformer, losses and efficiency of transformer.

Introduction to DC and AC machines: DC Shunt, series and separately excited machines, internal generated voltage equation, losses in DC machines, speed control of DC machines. AC induction motors, working principle, construction, speed Control, single phase induction motors, Control systems in Machines, introduction to Synchronous machines.

TC-101   FUNDAMENTAL OF TELECOMMUNICATIONS ENGINEERING

Introduction to Computers: Number Systems**;** Structure and organization of computers and computer systems; Introduction to software development process, Introduction to operating systems, Introduction to Databases and information systems.

Overview of Modern Telecommunication Systems: Terminology, RF, Microwave, Wireless and Cellular, Analog Vs Digital Communication, Voice and Data Communications.

Basic of Communication Theory: Bandwidth, Modulation – AM, FM and PM, Multiplexing, Frequency Spectrum, Concepts of Transmitter, Receiver, Channel, Source, Noise, Signal to Noise Ratio and Destination Voice vs. Data.

Introduction to Data Networks: Introduction to operating systems and data communications, LAN and WAN Communications, Network Topologies, Transmission Media- Copper, Fiber, Wireless, Describe Different wireless Applications – RF Broadcast, TV, Radio, Cellular, Directed, Broadcast, Microwave, Satellite.

Overview of Telecommunications Regulations: **ITU History and Structure:** Plenipotentiary Conference, ITU Council, World Radio Communication Conference, Radio Communication Assembly, World Telecommunication Development Conferences, ITU Bureaus, Telecommunication Development Bureau (BDT), ITU-D, Telecommunication Standardisation Bureau, ITU-T, Radio communication Bureau, ITU-R.

Structure and Responsibilities of Pakistan Telecommunications Authority (PTA) : Administration Directorate, Frequency Allocation Board, Law and Regulations, Industrial Development, Finance Division, Enforcement, Licensing Wireless and Licensing Wireless, Future Trends, Security in Telecommunications.

Lab work: The Practical work will be based on the above course.

TC-102   ENGINEERING DRAWING AND WORKSHOP

Mechanical/Civil Drawing: Drawing equipment and the use of instruments. Basic drafting techniques and standards, Geometrical curves including plan curves, Cycloid, Hypocycloid and the Involute. Intersection at various positions of geometrical bodies, such as pyramids, Cylinders and Cones, Development of surfaces, Freehand sketch of locking arrangement, foundation bolts, shaft couplings, foot step bearing, and other related components, Concepts of working drawings of components and parts of machine and engines, dimension and specifications.

Orthographic projections and standard practices, Isometric views with particular reference to piping and ducting.

Plan, Elevations and details of buildings Elements of Perspective drawings.

Electrical Drawing: 11 KV Electric substation building plan including equipment layout, Trenches (for cabling etc.) Manholes, Doors, Windows, Ventilators etc. Cable and Earth continuity conductors plan including the size and specifications. Cable laying in trenches, directly in ground, in pipes while crossing the roads etc. Details of plate type and Rod type, Earthing Electrodes. Schematic Diagrams of substations, lighting and power distribution boards, Electrical Symbols and One line diagrams of a typical power system.

Introduction to Computer Aided Design

PCB Design & Development Workshop

PCB schematic and layout to file generation, CNC drilling, Electroplating, photo- plotting, laminating, developing and exposing, assembling and soldering

Lab work: The practical work will be based on the above course.

PH-121   APPLIED PHYSICS

Introduction: Scientific notation and significant figures. Types of errors in experimental measurements. Units in different systems. Graphical Techniques (Log, semi-log and other non-linear graphs)

Vectors: Review of vectors, Vector derivatives. Line and surface Integrals. Gradient of a scalar.

Mechanics: The limits of Mechanics. Coordinate systems. Motion under constant acceleration, Newton laws and their applications. Galilean invariance. Uniform circular motion. Frictional forces. Work and Energy. Potential Energy. Energy conservation. Energy and our Environment. Angular momentum

Electrostatics and Magnetism: Coulombs Law. Electrostatic potential energy of discrete charges. Continuous charge distribution. Gauss's Law. Electric field around conductors. Dielectrics. Dual trace oscilloscope with demonstration.
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. Simple circuits.

Waves And Oscillations: Free oscillation of systems with one and more degrees of freedom Solution for Modes. Classical wave equation. Transverse modes for continuous string. Standing waves. Dispersion relation for waves. LC network and coupled pendulums. Plasma oscillations.

Optics And Lasers: Harmonic traveling waves in one dimension .Near and far fields. Two-slit interference. Huygens Principle. Single-slit diffraction. Resolving power of optical instruments. Diffraction Grating. Lasers. Population inversion. Resonant cavities. Quantum efficiency. He-Ne, Ruby and CO_2 lasers. Doppler effect and sonic boom.

Modern Physics: Inadequacy Of Classical Physics, Planck's Explanations Of Black Body Radiation Photoelectric Effect, Compton Effect. Bohr Theory Of Hydrogen Atom, Atomic Spectra, Reduce Mass, De-Broglie Hypothesis Braggs Law, Electron Microscope, Uncertainty Relations Modern Atomic Model, .Zeeman Effect, Atomic Nucleus, Mass-Energy Relation,

 Binding Energy, Nuclear Forces And Fundamental Forces, Exponential Decay And Half-Life. Radioactive Equilibrium In A Chain, Secular Equilibrium, Nuclear Stability, Radiation Detection Instruments, Alpha

Decay, Beta Decay, Gamma Decay, Attenuation, Nuclear Radiation Hazards And Safety, Medical Uses Of Nuclear Radiation. Fission Energy Release, Nuclear Reactor, Breeder Reactor, Nuclear Fusion.

Lab work: The practical work will be based on the above course.

HS-101   ENGLISH

Study Skills: Reading, dictionary, library skills, speed reading, writing outlines, note taking.

Oral communication: confidence building, class discussions, speeches, verbal interaction.

Advanced reading comprehension: using texts dealing with science, literature and human rights.

Précis writing: rules of précis writing practice précis.

Controlled & guided writing: pre writing (planning, information gathering, preparing to write). Writing, search for topic sentences, developing a theme, following up ideas and arguments, outline plans etc.

Essay writing: Types of writing – narrative, descriptive, expository, argumentative etc.. Using guided writing to organize essays, Including human rights as essay topics.

Writing short reports: short background of report and its importance, memo report, brief reports on events seen / experienced like visit to an exhibition etc.

Letter writing: format and layout, formal letters, types of letters – invitations (acceptance and refusals), condolence, thanks, congratulations, to the editor, chairman class advisor, dean, vice chancellor etc.

Applied Grammar: morphology, types of sentences, sentence analysis, tenses, jumbled sentences, question tags, homonyms and homophones and their use in sentences, punctuation – sentences and paragraphs, use of idioms.

FIRST YEAR (FALL SEMESTER)

EL-102   BASIC ELECTRONICS

PN Junction Diode: Introduction. PN junction diode, Unbiased diode, Barrier potential, Diffusion & drift current, Forward & reverse bias, Minority carrier current. Diode models: Ideal, practical & complete, Diode

characteristics, Load line, Diode current equation. Capacitive effect on diode operation at high-frequency, Transient current, Temperature effect on diode operation. Diode applications; Rectifier, Switch, Communication, Wave-shaping, Voltage multiplier etc. Breakdown diode, Voltage regulator, Power Supply.

FET: Field effect transistor; Device, Structure & Physical operation of the MOSFET, Current-voltage characteristics. DC analysis of MOSFET circuit, MOSFET as an amplifier and as a switch, Biasing in MOS amplifier circuits.

BJT: Physical structure & operation modes of BJT, operation in the active mode, Large-signal model. DC analysis of BJT. BJT as an amplifier. Small-signal equivalent circuit models, Biasing techniques for discrete-circuit design. BJT as switch: Operation of npn in the cut-off & saturation modes, Basic BJT inverter.

Lab work: The practical work will be based on the above course.

CE-105   ENGINEERING SURVEYING

Basics of Surveying: Definition, Evolution of Surveying, Types and Classes of Surveys, Plane Table Survey, Surveying Instrumentation, Survey References, Units of Measurement, Location Methods, Accuracy and Precision, Errors and Mistakes, Accuracy Ratio, Stationing, Field notes, Field management.

Measurement of Horizontal Distances: Methods of Linear measurement, Types of Measurement, Chains, Tapes, Standard conditions for use of Steel tapes, Taping Accessories and their use, Systematic Taping Errors and Corrections, Random Taping Errors and Mistakes in Taping, Field notes for Taping, Conventional and Electronic Field books.

Leveling: Definitions, Theory of Differential Leveling, Effects of Curvature and Refraction, Types of Levels, Automatic Level, Digital Level, Adjustment of Levels, Types of Leveling Staff, Leveling Operations, Techniques of Leveling, Benchmark Leveling (Vertical Control Survey), Profile and Cross-section Leveling, Reciprocal Leveling, Peg test, Errors in Leveling, Contours and their characteristics, Various methods of Contouring.

Angles and Directions: Horizontal and Vertical Angles, Meridians, Types of Horizontal angles, Azimuths, Bearing, Relationship between Bearings and Azimuths, Reverse Directions, Azimuth and Bearings computations, Magnetic Declination, Types of Compasses.

Theodolites / Tacheometers: Introduction, Types of Theodolites, Repeating, Directional and Electronic Theodolites, Temporary adjustments, Measurement of Horizontal and Vertical Angles, Prolonging a Straight Line, Permanent Adjustments, Use of Tachometers in computation of Horizontal and Vertical Distances.

Traverse Surveys: Open and Closed Traverses, Latitude and Departures, Computation of Error of Closure, and the accuracy of a Traverse, Traversing with Total Station Instruments, Rules of Adjustment, Effects of Traverse Adjustments on the original data, Computation of Omitted Measurements, Area of Closed Traverse Methods, Use of computer programs.

An Introduction to Geomatics and Global Positioning System: Geomatics defined, Branches of Geomatics, Remote Sensing, Techniques of remote sensing, Background information on global positioning, receivers, Satellites, Errors, GPS Surveying techniques and applications**.**

Lab work: The practical work will be based on the above course.

TC-103   PROGRAMMING WITH C-LANGUAGE

The Turbo C Programming environment: Setting up the Integrated Development Environment, File used in C program Development, using the Integrated Development Environment, the Basic Structure of C programs, Explaining the printf( ) Function.

C Building Blocks : Variables, Input/ Output, Operators, Comments.

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

Decisions: The if statement, the if-else statement: the else-if construct. The switch statement, the Conditional operator.

Functions: Simple Functions, Functions that return a value, using arguments to pass data to a function, using more than one functions, external variables, prototype versus classical K and R, Preprocessor directives.

Arrays and strings: Arrays, Referring to individual Elements of the Array, String.

Pointers: Pointer Overview, Returning data from functions, pointers and Arrays, Pointers and Strings, Double Indirection, Pointers to Pointers.

Structures, unions, and ROM BIOS.

Turbo C Graphics Functions: Text-mode Functions Graphics - Mode Functions. Text with Graphics.

Files: Types of Disk I/O, Standard, Input/ Output Binary Mode and Text mode, Record, Input/ Output, Random Access, Error Conditions, System-Level Input/ Output, Redirection.

Advanced Variables: Storage Classes, Enumerated data type, Renaming data type with typedef, Identifiers and Naming classes, type conversion and casting, labels and goto statement.

Lab work: The practical work will be based on the above course.

MT-111   CALCULUS

Set and Functions: Define rational, irrational and real numbers; rounding off a numerical value to specified number of decimal places or significant figures; solving quadratic, and rational inequalities in involving modulus with graphical representation; Definition of set, set operations, Venn diagrams, DeMorgan's laws, Cartesian product, Relation, Function and their types (Absolute value, greatest integer and combining functions). Graph of some well-known functions. Limit of functions and continuous and discontinuous functions with graphical representation.

Propositional Logic: Definition of Proposition, Statement and Argument, Logical Operators, Simple and Compound proposition, various types of connectives, Truth table, tautology, Contradiction, Contingency & Logical equivalence.

Boolean Algebra: Definition, Boolean function, duality, some basic theorems & their proofs, two valued Boolean algebra, Truth functions, Canonical sum of product form, Digital logic Gates & Switching circuit designs.

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)

Differential Calculus: Differentiation and Successive differentiation and its application; Leibnitz theorem, Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, power series, 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, extreme values of a function of two variables with and without constraints. Solution of non-linear equation, using Newton Raphson method.

Integral Calculus: Indefinite integrals and their computational techniques, reduction formulae ,definite integrals and their convergence, Beta and Gamma functions and their identities, applications of integration. Centre of pressure and depth of centre of pressure.

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).

CY-105   APPLIED CHEMISTRY

Gases: Gas Laws, Kinetic Gas Equation, Van Der Vaal's Equation, Critical Phenomenon, Liquidification of gases, Specific heat (molar heat capacity)

Properties of Solution and Liquids : Surface Tension, Viscosity, Osmosis, Osmotic Pressure, pH-Buffer Solution, Spectrophotometry, 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 and protection).

Water and Sewage: Sources of water, impurities, hardness, Water softening, Purification of water for potable and industrial purposes, electrodialysis. Introduction to environmental pollution, main sources and effects. Sewage treatment.

Fuels: Types of fuels, Classification of fossil fuels.

Metals and 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, Glass. Organic Engineering Materials, Polymers, Rubbers, Plastics, Paints, Semiconductors and Dielectric materials.

Lab work: The practical work will be based on the above course.

HS-105   PAKISTAN STUDIES

<u>Historical and Ideological Perspective of Pakistan Movement</u>
Two nation theory: Definition, Significance.
Creation of Pakistan: Factors leading to the creation of Pakistan, Quaid-e-Azam and the demand for Pakistan.

<u>Land of Pakistan:</u>
Geo-physical conditions, Geo-political and strategic importance of Pakistan, Natural resources, water and power.

<u>Constitutional Process:</u>
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, Subsequent constitutional developments.

<u>Contemporary Issues in Pakistan</u>

A brief survey of Pakistan's 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 & solutions, Pakistan's role in preservation of nature through international conventions/efforts.

<u>Foreign Policy</u>
Relations of Pakistan with neighbours, Relations with Super powers, Relations with Muslim world.

<u>Human Rights</u>
Conceptual foundations of Human Rights: What are Human rights? Definition, significance and importance, Comparative analysis of Islamic and western Perspectives of Human rights.
UN System for Protection of Human rights - an over-view: UN Charter, International Bill of Human Rights, Implementation mechanism.
Other important international treaties and conventions: The convention on the elimination of all forms of discrimination against woman, International Convention on the rights of child (CRC), Convention against torture (CAT), 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 the international perspective.

HS 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.

SECOND YEAR (SPRING SEMESTER)

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 realisations, 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.

Minismisation 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 minimisation of product of sums expressions, incompletely specified functions.

Tabular Minimisation: 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, Minimisation of the number of states, Clocked Networks.

Introduction to Verilog HDL and VHDL

Lab work: The Practical work will be based on the above courses.

EE-216 CIRCUIT THEORY

Elementary Transient Analysis : Differential and integral forms of circuit equations, Initial voltage on capacitor, Initial current in an inductor, First-order circuits, Solution of single first order differential equations, Particular and total solution of second order linear time invariant differential equations.

Matrix Analysis : Introduction and review of Matrix theory, determinants and Matrix inversion, Systematic formulation of network equations, Loop variable analysis, State variable analysis, formulation of state equations, source transformations, Duality.

Elementary Time Functions: Introduction to singularity functions, The impulse function and response, The unit step function and response, Ramp function, Exponential function and response.

Exponential Excitation and the Transformed Network: Representation of excitations by exponential functions, Single element response, Forced response with exponential excitation, Introduction to the transformed network, Driving point impedance and admittance.

Laplace Transformation: Analysis of Networks by Laplace transformation, Review of Laplace transformation, Application to network analysis.

Two Port Network: Introduction, Characterization of linear time invariant two-ports by six sets of parameters, Relationship among parameter sets, Interconnection of two ports.

Network Functions and Frequency Response : The concept of complex frequency, transform impedance and transform circuits, Network functions, One and two ports, Poles and zeros of network functions, Restrictions on pole and zero transfer function, magnitude and phase, Complex Loci's plots from the plane phasors.
Lab work: The practical work will base on the above course.

CS-203 OBJECT ORIENTED PROGRAMMEING

Difference Between Conventional and Object Oriented programming; Data Abstraction; Objects; Classes and Methods: Inheritance; Multiple Inheritance; Polymorphism; Defining Objects in C++; Programming in C++; Graphic Objects; Handling Messages; Constructors and Destructors; Overloaded Function Names; Inline and Friend Functions; Data Declarations in C++.

EE-221 INSTRUMENTATION

General Theory : Classification, performance and characteristics, absolute and secondary instruments, indicating, recording and integrating instruments, controlling balancing and damping, static and dynamic characteristics.

Ammeter and Voltmeter: Classification, moving iron, moving coil, thermal, electrostatic and induction type, errors, extension of ranges, CTs and PTs, their burden and accuracy.

Power and Energy Meters: Wattmeter types, Active and Reactive power measurement, Max. demand indicator, Calibration, Classification of energy meter, KWH meter and KVARH meters, p.f. meter.

Electronic Instruments : Electronic and digital voltmeters, counters, digital frequency meter, time interval measurement, RLC meter, Power and energy meter, oscilloscope and its use.

Basic Concepts: Basic concepts of measurement, measurement of resistance, inductance and capacitance, potentiometer and bridge methods.

Magnetic Measurement: Measurement of field strength flux, permeability, B-H curve and hysteresis loop, magnetic testing of materials.

Transducers: Variable resistance and inductance transducers, linear variable differential transformer (LVDT), capacitive, photoconductive, and piezo-electric transducers, thermo electric transducers. Filtering, Instrument amplifiers, A/D conversion.

Measurement of Non-electrical Quantities: Measurement of temperature, pressure, flow, strains, thermal conductivity, motion, speed and vibrations, thermal and nuclear radiations.

High Voltage measurement: Measurement of dielectric strength of insulators, high voltage surges.

Lab work: The practical work will be based on the above course

MT-222   LINEAR ALGEBRA & ORDINARY DIFFERENTIAL EQUATIONS

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), 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, matrix of linear transformations, Eigen value and Eigen vectors of a matrix, Diagonalization. Applications of linear algebra (Scaling, translation, rotation and projection) with graphical representation.

Introduction to ODEs: The Concepts & Terminologies: Order and Degree; Linearity & Non-linearity; A Brief Classification of ODEs; Formulation of ODEs: Concrete Examples; Solutions: General & Particular: Concrete Examples & Applications: Initial Value Problems (IVP) and Boundary Value problems (BVP): A Brief Introduction to Issues related to Existence & Uniqueness of Solutions.

The First Order ODEs: Linear and Non-Linear: Variable Separable Cases & Applications: Growth & Decay Problems, Newton's Law of Cooling, Torricelli's Law, Simple Kinematical Dynamical Applications; Exact and No-Exact ODEs: Solution Procedures and Integrating Factors; The Standard Linear Differential Equation of First Order: Solution Procedures and Applications to RL-Circuits and RC-Circuits, Bernoulli's Equations & Logistical Growth Models, Direction Fields and Euler's and Picard's Iterative Schemes for the 1st Order ODEs,

The Linear Second Order ODEs: Homogeneous and Non-Homogeneous Cases: Linear Second Order Homogeneous ODE with Constant Coefficients: Solution Procedures and the Principle of Linear Superposition and Applications --- Mechanical Systems & Electrical Systems, Undamped and Damped Harmonic Oscillators; Linear Second Order Non-Homogeneous ODEs with Constant Coefficients: Solution Procedures and the Principle of General Linear Superposition: Complementary Functions & Particular Solutions----the Method of Undetermined Coefficients & Variation of Parameters: Applications: Spring-Mass Systems -- Damped & Undamped Harmonic Oscillators with Forcing Terms and their ODEs and Solutions; RCL-Circuits and their ODEs and Solutions; The Physics and Mathematics of the Phenomenon of Resonance in Mechanical & Electrical Systems; Cauchy-Euler ODEs and their Solution Procedures.

Partial Differential Equation: Formation of partial differential equations. Solutions of first order linear and special types of second and higher order differential equations. Homogeneous partial differential equations of order one, Lagrange's multiplier

Advance Calculus & Vector Calculus: Double & triple integral with application (Area, centroid, moment of inertia) vector differentiation & vector integral with applications, Green & Stokes theorem with applications.

CS-210 DATA STRUCTURE & ALGORITHMS

Basic Concepts: Introduction and classification of Data Structures; Basic operations.

Classification of Algorithms: Classification by implementation; Classification by design paradigm.

Sting Processing: Operations on strings; Word Processing; Pattern Matching Algorithms.

Arrays: One-dimensional Arrays: Searching and Sorting Algorithms; Multi-dimensional Arrays: Matrix Multiplication, Sparse Matrices.

Stacks, Queues and Recursion: **Basic concepts and functions;** Polish Notation; Quick-sort; Deques; 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.

Trees: Terminology; Representation in memory; Binary Trees: Traversal Algorithms; Binary Search Trees, Heaps; Heap-sort algorithm.

Graphs: Terminology; Representation in memory; Traversal Algorithms; Shortest Path Algorithms.

Sorting and Searching: Sorting Algorithms; Hashing.

SECOND YEAR (FALL SEMESTER)

EL-234   AMPLIFIERS AND OSCILLATORS

Output Stages: Introduction to classes (A, B, C, AB etc), different circuit topologies employed for implementation of different classes.

Frequency Response: Introduction, High frequency small-signal model of MOSFET, Miller's Theorem, open circuit and short circuit time constants methods, Analysis of Common-Source, Common-Gate, Common-Drain, CS-CS cascade, CS-CD cascade, Cascade, Folded-cascade, Super-source follower circuits for mid-band gain, lower and upper-cut off frequencies.

Active and Passive Filters: Ideal filter characteristics, Passive filters, first and second order active filters. Higher order filters such as Butterworth, Chebyshev etc.
Oscillators: Introduction to feedback and s-plane, Barkhausen criterion, Amplitude limiter, Wein-Bridge oscillator, Phase-shift oscillator, Quadrature oscillator, Colpitts and Hartley, Crystal Oscillator and 555 timer operation.

Feedback: Two-port networks, properties of negative feedback, detailed analysis of the four basic feedback topologies.

Lab work: The practical work will be based on the above course.

TC-202   SIGNALS & 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-281   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 a line charge, field of a sheet of a charge, stream-lines and sketches of fields.

Electric Flux Density Gauss's Law and Divergence: Electric flux density, Gauss's law, application of Guass'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 expanded 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, and Energy density in the electrostatic field.

Conductor Dielectrics and Capacitances: Current and current density continuity of current metallic conductors, conductor properties and bounded conditions, semi conductors, 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.

Poission's and Laplace's Equations: Poison's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, examples of the solution of poison, 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 elements, 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, Maxwell's equation in integral form, the retarded potential.

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

Lab work: The practical work will be based on the above course.

CS-208   COMPUTER ARCHITECTURE & ORGANIZATION

Introduction to Computers: Evaluation of Computer Hardware and Software; Computer Organization and Architecture; Types of Computers.

Computer Interconnection Structures: Computer Components Computer Function; Interconnective Structure, Bus Interconnection.

Execution Unit: Register Sections - General Register design, Combinational shifter Design, Flag Register; Computer Arithmetic; ALU design; Multiplication of Signed and unsigned Integers; Division of Unsigned Integers; Floating Point Numbers; Coprocessors

Memory Organization: Characteristics of Memory Systems; Access Methods; Main Memory Design; Performance Parameters; Memory Hierarchy; Cache Memories; Associative memory Virtual memory and memory Management Concepts.

Input/ Output : Basic Concepts; Programmed I/O; Interrupt I/O - Basic concepts, Main features of Interrupt I/O; Direct Memory Access (DMA); I/O Processor; Parallel and Serial I/O; Synchronous & Asynchronous I/O.

Instruction Sets: Op-code; Addressing Modes; Instruction Types – Data Transfer Instructions; Arithmetic Instructions; Logical Instructions, Program Control Instructions; System Control Instructions; I/O Instructions; Reduced Instruction Set Computers (RISC)

Operating Systems: Operating System Overview, Scheduling; Memory Management; Recommended Reading.

Lab work: The practical work will be based on the above course

MT-224   COMPLEX VARIABLE & FOURIER ANALYSIS

Infinite Series: Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behavior of series.

Complex Variable: Limit, continuity, zeros and poles of a complex function. Cauchy-Reimann equations, conformal transformation, contour integration.

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 and partial differential equations using Laplace transform (I.V.P's & B.V.P's). Z and Inverse Z – transformations, properties of Z – transformation and applications.

Fourier series: Introduction to Fourier series, Euler Fourier formulae, even and odd functions, application of Fourier series, Fourier transform and fast fourier transform and properties with applications.

HS-205   ISLAMIC STUDIES

Quranic Verses: Tauheed: Al–Ambiya – 22, Al–Baqarah – 163 & 164. **Prophet hood:** Al–Imran – 79, Al – Huda – 7, Al–Maidah – 3. **Here-After:** Al–Baqarah – 48, and one Hadith. **Basic Islamic Practices:** Al–Mu' minun-1-11, and two Ahadith

Amer–Bil – Ma ' Roof Wa-Nahi Anil Munkar: the concept of Good & Evil, Importance and necessity of Da'wat-e-Deen   Al-Imran – 110, Method of Da'wat-e-Deen   An-Nehl-125, Al-Imran-104, and two Ahadith

Unity of the Ummah: Al-Imran-103, Al-Hujurat-10, Al-Imran-64, Al-An' am –108, and two Ahadith .

Kasb-e-Halal: Ta ha-81, Al- A'raf-32-33, Al-Baqarah-188, and two Ahadith. **Haquq-ul-Ibad:**   Protection of life (Al-Maidah-32), Right to Property (Al-Nisa-29), Right to Respect & Dignity   (Al-Hujurat –11-12),   Freedom of Expression   (Al-Baqarah-256),   Equality: (Al-Hujurat-13) , Economic Security: (Al-Ma' arij – 24-25),   Employment Opportunity on Merit: (An-Nisa-58), Access to Justice: (An- Nisa-135)

Women's Rights: An-Nehl - 97, Al-Ahzab - 35, An-Nisa - 07. **Relations with Non-Muslims:** Al-Mumtahanah-8-9, Al-Anfa'al –61 and The last   sermon   of   Hajj   of   Holy   Prophet   (PBUH):   Relevant extracts.

Seerat (life) of the Holy Prophet (PBUH): birth, life at Makkah, declaration of prophet hood, preaching & its difficulties, migration to Madina, brotherhood (Mawakhat) & Madina Charter, The Holy Wars of the Prophet (Ghazwat-e-Nabawi), Hujjat-ul-Wida, The last sermon of Khutbatulwida: Translation and important points

Islamic Civilization: a) in the sub continent: pre- Islamic civilizations. The political, social & moral impacts of Islamic civilization (b) EEin the world: academic, intellectual, social & cultural impact of Islam on the world.

HS-209   ETHICAL BEHAVIOUR

Introduction to Ethics: Definition of Ethics, Definition between normative and positive science, problem of freewill, Method of Ethics, Uses of Ethics.

Ethical Theories: History of Ethics, Greek Ethics, Medieval, Modern Ethics, Basic concept of right and wrong: good and evil, Utilitarianism, hedonism, self-realization: egoism, intuitionism, rationalism, 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.

THIRD YEAR (SPRING SEMESTER)

TC-384   COMMUNICATION SYSTEMS

Introduction: Introduction to communication Model, Need for Modulation.

Random Signal Analysis: Review of probability and random variables statistical measures, Probability models, Introduction to random processes.

Analog Communication: Linear Modulation (AM, SSB, DSB, VSB) and demodulation techniques and hardware (Circuits), AM and SSB Receivers, Image Frequency, SSB Filters, Exponential modulation, demodulation techniques and hardware (Circuits), FM Generation Methods, PLL Systems, FM Receivers, Transmission Bandwidth for AM and FM Signals, Pre-emphasis and De-emphasis circuits.

Digital Communications: Digital Transmission, PAM Signals Noise and errors synchronization techniques, Pulse modulation, demodulation and related hardware, band pass digital transmission, Digital CW modulation, Coherent and non Coherent binary systems, Digital modulation error-control coding.

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

TC-382   ANTENNA AND MICROWAVE ENGINEERING

Basic Features of Radio Communication Systems : Radio communication systems, Modulation and Demodulation, Radiowave propagation techniques, Antennas and Aerials, Antenna Arrays, Antenna Distribution systems, Radio receiver properties, Types of receivers.

Microwave Devices: Microwave Hybrids, Attenuators.

Array Antennas : Uniform linear array of Isotropic elements, Polar diagram, Broadside array of equally spaced, equal amplitude radiators, End-fire array of equally spaced, equal amplitude radiators, Scanned line array beamwidth, Optimum element spacing, Array design using the theory of polynominals. Optimum spacing for broadside and end-fire arrays, Harsen Condition, The binomial array, Supergain array, Chebysev array, Pattern synthesis.

Transmission Lines: 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, Transmission line couplers.

Smith Chart and Scattering Parameters: Smith chart Impedance, Admittance manipulation on the chart, Smith chart theory and applications, Reflection coefficient, Impedance of distributed circuits, Impedance matching, S-Parameters.

Lab work: The practical work will be based on the above course.

EL-333   INTEGRATED CIRCUITS

Review of models for active devices in Bipolar and MOS technologies,
Process technologies, passive components, and analog layout considerations, Review of basic single-stage amplifiers, Differential pairs, Current mirrors, active loads and references, Noise sources and noise analysis in integrated circuits, Output stages, MOS and bipolar operational amplifiers, Comparators, Sample-and-hold circuits, Introduction to A/D conversion, circuits, MOS and CMOS inverters, NMOS and CMOS logic gates, Ideal OPAMP, 741 applications, Instrumentation amplifier, Non linear applications of OPAMP, Multi vibrators, Latches and Flip Flops, Better

OPAMP Model, Introduction to logic families, logic gates, ECL and CML logic gates, Pseudo NMOS and CMOS logic, pass transistor and fully differential CMOS logic circuits, BICMOS logic gates.

CS-309   MICROPROCESSORS AND ASSEMBLY LANGUAGE

Introduction to the Microprocessors: The evolution of the microprocessor, Basic microprocessor architecture; the programming model.

Memory Interface: Memory devices, address decoding, memory interface of microprocessors, Dynamic & Static RAM.

Instruction Set and Assembly Language Programming: Data Movement Instructions; Arithmetic and Logic Instructions; Program Control Instructions; Addressing Modes; Two pass Assemblers; Assembly Languages Program Format; Pseudo Instructions; Labels; Macros and Subroutines.

Basic I/O Interface: Serial & Parallel I/O; serial communications, the serial interface and the UART, serial communications line modems; I/O port address decoding, The programmable peripheral interface; The 8279 programmable keyboard/display interface; 8251A programmable communication interface; 8254 programmable interval timer; analog-to-digital (ADC) and digital-to- analog converters (DAC).

Interrupts: Interrupt processing; Hardware interrupts; Expanding interrupt structure; 8259A programmable interrupt controller, real time clock.

The Microcontroller: Single-chip microprocessor; An introduction to microcontrollers, The 8051 internal RAM and registers; The 8051 instruction set; Other microcontrollers in the 8051 family.

Developing Microprocessor-Based Products: An introduction to the design process; preparing the specification; Developing a design; Implementing and testing the design.

Lab work: The practical work will be based on the above course.

EF-303   APPLIED ECONOMICS FOR ENGINEERS

Introduction: Basic concepts, Engineering economy defined, Measures of financial effectiveness, Nomonetary values.

The Economic Environment: Consumer and producer goods, Measures of economic worth, Price, Supply, Demand Relationship.

Selection between Alternatives: Present economy, Selection among materials, techniques designs etc. A basic investment philosophy. Alternatives having identical lives. Alternatives having different lives.

Value Analysis: Important cost concepts, Cost-benefit analysis feasibility studies, Value analysis in designing and purchasing.

Linear Programming: mathematical statement of linear programming problems. Graphic solution, Simplex procedure. Duality problem.

Depreciation and Valuation: Types of Depreciation economic life, Profit and interest. Returns to capital. Discrete and continuous compounding. Discounting sinking fund problems.

Capital Financing and Budgeting: Types of ownership, types of stock, partnership and joint stock companies, banking and specialized credit institution.

Theory of Production: Factors of production, Laws of Returns, Breakeven charts and relationships.

Industrial Relationship: Labour problems, Labour organizations prevention and settlement of disputes

MT-335   PROBABILITY & STATISTICS

Introduction to Statistics: Introduction, Types of Data & Variables, Presentation of Data, Object, Classifications, Tabulation, Frequency distribution and their types, Graphical representation, Simple, Multiple and component bar diagrams, Pie-chart, Histogram, Frequency Polygon, Frequency Curves.

Measures Of Central Tendency And Dispersion: Statistics Averages, Median, Mode, Quartiles, Range, Moments, Skewness & Kurtosis, Quartile Deviation, Mean Deviation, Standard Deviation, Variance & its coefficient.

Probability: Basic concepts, Permutation & Combination, Definitions of probability, Laws of probability, Conditional probability, Bayes' rule.

Random Variables and Random Process: Introduction, Discrete & Continuous Random variables, Random Sequences and transformations, Probability distribution, Probability Density function, Distribution function, Mathematical expectations, Moment Generating Function (M.G.F.), Introduction to Random Process and Time Series, Statistical Averages of Random Processes, Stationary, Auto-Correlation of Wide Sense Stationary Random Processes, Time Averaging, Ergodicity, Markov Chain and Queuing theory.

Probability Distributions: Introduction, Discrete probability distributions, Binomial, Poisson, Hypergeometric & Negative Binomial Distributions, Continuous probability Distribution, Uniform, Exponential & Normal distributions.

Sampling And Sampling Distributions: Introduction, Population, Parameter & Statistic, Objects of sampling, Sampling Distribution of Mean, Standard Errors, Sampling & Non-Sampling Errors, Random Sampling, Sampling with & without Replacement, Sequential Sampling, Central limit Theorem.

Statistical Inference And Testing Of Hypothesis: Introduction, Estimation, Types of Estimates, Confidence Interval, Tests of Hypothesis, Chi-Square Distribution/Test, One and Two Tails Tests.

Simple Regression & Correlation: Introduction, Scatter Diagrams, Correlation & its Coefficient, Regression Lines, Rank Correlation & its Coefficient, Probable Error (P.E.)

THIRD YEAR (FALL SEMESTER)

CS-318   COMPUTER COMMUNICATION NETWORKS

Markov chains and queuing theory, Open and closed networks of queues, Priority queuing, Performance models of communication networks, Network design, Protocols, Evaluating, Circuit and data flow graph, Routing, Local area networks, Satellite protocols, Broadcast networks, Ring networks.

Lab work: The practical work will be based on the above course.

TC-387   WIRELESS & MOBILE COMMUNICATION

Introduction to Wireless Communication Systems: Evolution of Mobile Radio Communications, Examples of Wireless Communication Systems, Paging Systems, Cordless Telephone Systems, Cellular Telephone Systems.

The Cellular Concept-System Design Fundamentals: Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference & System Capacity, Improving Coverage & Capacity in Cellular Systems Trunking & GoS

Mobile Radio Propagation: Large Scale Path Loss, Basic Propagation Mechanisms, Free Space propagation Model, Outdoor Propagation Models, Indoor Propagation Models, Practical Link Budget Design.

Small Scale Fading & Multipath: Multipath Propagations, Parameters of Mobile Multipath Channels, Types of Small Scale Fading.

Modulation Techniques for Mobile Radio: FM vs AM, Overview of Digital Modulation, Spread Spectrum Modulation Techniques, Modulation Performance in Fading & Multipath Channels.

Multiple Access Techniques for Wireless Communication: Frequency Division Multiple Access, Time Division Multiple Access, Spread Spectrum Multiple Access, Space Division Multiple Access, Packet Radio.

Wireless Networking: Limitations in Wireless Networking, Development of Wireless Networks, Traffic Routing in Wireless Networks, Mobile IP.

Wireless Systems and Standards: AMPS System Overview, GSM (Architecture, Channel Types, Call Scenarios, Frame Structure).

Wireless Application Protocol (WAP): WAP Architecture, WAP Protocol.
Wireless Markup Language (WML): WML Structure
Bluetooth: Applications, Protocol Architecture, Base band Specification, Security
Emerging Wireless Communication Technologies

Lab work: The practical work will be based on the above course.

EE-393   DIGITAL SIGNAL PROCESSING

Relationship between sampling frequency and Shannon's theorem, continuous time and discrete time signals, Z-transform, inverse Z transform, discrete Fourier transform, fast Fourier transform, elements of FIR and IIR filter design, filter structures, FFT techniques for high speed, convolution, windowing process, aliasing error its reduction, quantization effects.

Lab work: The practical work will be based on the above course.

EE-374   FEED BACK CONTROL SYSTEMS

Introduction to control System, Linear systems and differential equations, Time response of linear systems, Laplace transforms, z-transform, block diagram algebra, control systems characteristics, root locus, Introduction to digital controls, linear difference equations, stability analysis in z-domain, discrete equivalents of Laplace-transfer functions and PID Controller.

Lab work: The practical work will be based on the above course.

HS-304   BUSINESS COMMUNICATION & ETHICS

N.B. (Item marked with an astericks (*) will be taught but not examined)

PART-I   (BUSINESS COMMUNICATION)
Writing formal & business letter, Writing formal memos, Drafting notices and minutes of meeting, Drafting tender notices, Theoretical knowledge & Comprehension of contracts & agreements, Preparing proposal and technical report, Conducting & Writing a project report on a mini research (sessional

work), Conducting seminar and interviews (*), Writing and presenting conference papers (*), Solving IELTS type papers (*)

PART-II (ENGINEERING ETHICS)

1. **Introduction:** Objectives of the course, Definite of the course, Define needs for a code of ethics

2. **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

3. **Comparing / Contrasting:** Review of PECs' Code of Ethics, Code of Conduct, Comparison between PECs Codes and those of similar international bodies

FINAL YEAR (SPRING SEMESTER)

TC-485   TELECOMMUNICATIONS SWITCHING SYSTEMS

Circuit Switching System Fundamental: Introduction, Space Division Switch (Cross bar switch & Multistage switch), Time Division Switch (Time Slot Interchange & TDM Bus), Space and Time division switch combination.

The Public Switched Telephone Network (PSTN): Network Topology, PSTN Hierarchy, Network Timing, Central Office, Evolving the PSTN to the Next Generation.

Signaling System 7: Pre-SS7 Systems, Introduction to SS7, SS7 Network Architecture, SS7 Protocol Stack, Message Transfer Part 2, Message Transfer Part 3, ISDN User Part, Signaling Connection Control Part, Transaction Capabilities Application Part

Implementation of Signaling system 7 over Cellular Network: Network Architecture, Interfaces and Protocols (BSSAP, MAP), Mobility Management and Call Processing.

Intelligent Networks (IN): Intelligent Network, Service Logic and Data, IN Services, IN and SS7 Protocol, IN/1, Advanced Intelligent Network, intelligent Network Application Protocol.

IP TELEPHONY: Introduction VOIP, Transport of Voice over IP, IP Signaling Protocols (H.323/ SIP).

INTEGRATION OF PSTN AND IP TELEPHONE NETWORK: Next Generation Architecture, Media Gateways, Media Gateway Protocol, SIGTRAN, SS7 and SIP/H.323 Internetworking.

Lab work: The practical work will be based on the above course.

TC-489   DIGITAL COMMUNICATION AND INFORMATION THEORY

Introduction to Digital Communication: Why Digital?, Elements of Digital Communication System, Basic transmission, Bits, Baud, Timing, Distortion and Channel Capacity, Digital input-output Devices, Digital Transmission on Analog Channel

Formatting & Base Band Modulation: Analog to Digital Conversion, Sampling Theory, Quantization & its Types, Pulse Code Modulation (Linear & Companded), Delta Modulation, Waveform Representation of Binary Digits, PCM Waveform Types, M-ary Modulation Waveforms

Base Band Demodulation/Detection Theory: Basic Detection Theory & Optimum Receiver Design, Detection of Binary Signal in Gaussian Noise, The Matched Filter, Inter Symbol Interference, Equalization.

Digital Modulation Techniques: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), and Phase Shift Keying (PSK, DPSK, QPSK), Detection of Modulated Signal, M-Ary Digital Modulation Schemes, Sampled Matched Filter.

Multiplexing, Framing & Synchronization
Information Theory: Information measure, Entropy, Information rate, Shannon's Theorem, Coding for discrete memory less source. Information Transmission on Discrete Channel, Discrete Channel Capacity, Linear Block Codes, Cyclic codes.

Lab work: The practical work will be based on the above course.

TC-484   NEXT GENERATION NETWORKS

Introduction to Next Generation Networks (NGN): Voice, video and data over packet, Overview of IP network, NGN core, NGN access, Packet core next generation, Broadband Wireless alternatives, xDSL alternatives packet cable, WiMAX and Mobile WiMAX, LTE (Long Term Evolution), IP Networks and Real-Time Applications, Voice and Video over IP, IPTV and HDTV, Mobile TV, DVB-H/IPDC, Multimedia Broadcast/ Multicast Services (MBMS), Mobile TV Platforms, Entertainment and interactive content, IMS (IP Multimedia Subsystem), Ethernet's ongoing evolution, IPv6, MPLS and MPLS/VPNs.

NGN Requirements, Architecture and Protocols: Architecture and protocols, |End to end QoS, Service platforms, Network management for NGN, Lawful interception, Security.

NGN Architectural Components: NGN core network, Broadband, QoS-enabled transport technologies, Overview of Video Technologies, Ideas behind Softswitches, Wired and wireless acess networks, NGN convergence.

NGN Protocols and Standards: European Telecommunications Standards Institute (ETSI), 3rd Generation Partnership Project (3GPP), ETSI TIPHON, IETF and Internet Protocol (IP) standards, IP Multimedia Subsystem (IMS)

NGN Applications & Architecture: All IP core, WebTV/ IPTV, Metro and Long-distance Ethernet/ VPN services, IP Multimedia Subsystem (IMS), Broadband Wireless Architecture, Wi-Fi/802.1 In, WiMAX, MIMOs, Mobile Networks, 3GPP/3GPP2/TISPAN IMS, 4G Wireless Architecture, LTE (Long Term Evolution), The X2 and S1 Interfaces, LTE/SAE Signaling Procedures, Evolution of CDMA2000 1Xev-do, MIMO, SDMA and Beamforming, NGOSS, eTOM and SID, Telecom Fraud and Billing, Fixed-Mobile Convergence.

Lab work: The practical work will be based on the above course.

TC-481   NAVIGATIONAL AIDS AND RADAR SYSTEMS

An Introduction to Radar: Basic Radar, The simple form of the Radar Equation, Radar block diagram, Radar frequencies, Application of the Radar, Origin of the Radar.

Radar Equations: Introduction, detection of signals in noise, receiver noise and signal to noise ratio, Probability density function, Probability of detection and false alarm, Integration of the Radar pulses, Radar cross section of targets, Transmitter power pulse repetition frequency.

MTI and Doppler Radar: Introduction to Doppler and MTI radar, Delay line cancellors, Staggered pulse repetition frequencies, Limitation to MTI performance.

Tracking Radar: Tracking with Radar, Monopulse tracking, Conical scan and sequential lobing.

Radar Transmitters: Introduction, Linear beam power tubes, Solid state RF power sources, Magnetron, Cross field amplifiers, Other RF power sources, Other aspects of Radar transmitters.

Radar Receivers: The Radar receiver, The receiver noise figure, Super Heterodyne receiver, Duplexers and receiver protectors, Radar displays.

Propagation of the Radar Waves: Introduction, Forward Scattering from a flat earth, Scattering from the round earth surface, Atmospheric Refraction, Standard propagation, Non standard propagation, Diffraction, Attenuation by atmospheric gases, External environmental noise, Other propagation effects.

Navigational aids:
Terminology used in navigational Systems, Direction finding, GPS, Laser Gyro, Decca, Loran, Beacon system.

Lab work: The practical work will be based on the above course.

TC-493   SATELLITE COMMUNICATION

Origin of Satellite Communication, Current state of Satellite Communication, Overview of satellite systems engineering, Orbital mechanics, Look angle determination, Orbital perturbations, Orbital effects in communication system performance space craft and its subsystem, Earth station (brief description). Space Link, Satellite Access and Services

Lab work: The practical work will be based on the above course.

TC-486   MULTIMEDIA COMMUNICATION (OPTIONAL)

Introduction: What is Multimedia, Multimedia scorecard: The PC, The Television, and The Telephone.

Digital Audio: Analog to digital conversion techniques, sample rates and size, Codecs, Compression techniques, Audio synthesis, FM synthesis, IBM PC sound cards.

Television Basic: Picture elements, Horizontal and vertical scanning, Video signal information, Motion pictures, Frame and field frequencies, Horizontal and vertical scanning frequencies, Horizontal and vertical synchronization, Horizontal and vertical blanking, The 3.58-MHz Color signal, Picture qualities, The 6-MHz television broadcast channel, standards of the television, TV Receiver Block Diagram.

Digital Video: Building a digital picture, PC graphics controller, RGB and YUV Color representation, VGA and SVGA standards, Mixing video and graphics.

Digital Picture Compression: Compression techniques, JPEG and motion JPEG, JBIG.

Digital Video Compression : Video compression techniques, MPEG1 overview,MPEG1 video compression, MPEG1 video compression process, MPEG1 audio compression overview, The MPEG1 audio compression process, MPEG1 systems, MPEG2 overview, MPEG2 video compression, MPEG2 audio, MPEG2 systems, MPEG decoder, Indeo, Wavelet compression, Fractel compression, MPEG4, MPEG7

CD-ROMs: CD-ROM technology, CD-ROM, Recordable CD-ROMs, Digital video disc.
 Access Network for Multimedia: DSL, HFC & 802.16

Multimedia Conferencing: What is multimedia conferencing, Achieving interoperability, Delivering conferencing data, H.320 multimedia conferencing standards, H.320 overview, H.261 video coding and decoding, H.320 terminals, Moving an H.320 cell, Conferencing applications, Transcoding

Digital Video Broadcasting: The delivery mechanism, Encoding techniques, coping with burst errors, DVB data streams, Digital audio broadcasting.

The Multimedia PC: Overview of MCI for audio-visual control, Overview of TSPI for Telecommunications, POTS call, making a fax call, Identifying the media stream, Switched video sources, Mixed source dialing.

Lab work: The practical work will be based on the above course.

TC-490   TELECOMMUNICATIONS ENGINEERING PROJECT

The final year students will be required to consult the Chairman of Electronic Engineering Department regarding the offering of various projects in the department and industry. 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 and / or external supervisor. At the end of the academic session, they will submit the written report on work of their project to the Chairman, preferably in the typed form. The 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 Telecommunications. This may be of investigative research nature or it may be laboratory research oriented. The report may be purely economic, technical or both and may include the comparative study of different choice for the solution of the problems.

FINAL YEAR (FALL SEMESTER)

TC-492   OPTICAL FIBER COMMUNICATION

Introduction: Comparison between optical and electrical mediums, basic optical communication system, Snell's law, refractive index, line width, optical and electrical bandwidth.

Basics of optical fiber: Step index fiber, graded index fiber, refractive index profiles, meridional and skew rays, acceptance angle and acceptance con, numerical aperture for meridional and skew rays

Wave theory of light for optical fibers: EM waves, modes, modes in planar wave guides, wave guide condition, evanescent waves, phase velocity, group velocity, group index, modes in cylindrical fibers, Parameters for single mode fiber (cutoff wavelength, mode field diameter, effective refractive index, group delay)

Transmission characteristics of optical fiber: Attenuation due to: (i) absorption, (ii) scattering (iii) bending losses Dispersion, Reflectance and optical return losses, special types of fibers.

Elements of Optical communication system: Optical sources, modulators and modulating schemes, line coding, optical detectors, demodulator and demodulation methods , couplers, connectors, switches, splicing , optical amplifiers and repeaters , Optical time division multiplexing, wavelength division multiplexing (techniques and devices) link budgeting w.r.t time and power

Optical Networks: LAN system, FDDI, SONETS and SDH, Wavelength routing based optical networks, Optical burst switching.

Lab work: The practical work will be based on the above course.

CS-413   INTERNET COMPUTING

Introduction to internet systems & internet development, Technical project management, Transmission protocols, Current and emerging standards, Introduction to programming in JAVA, Control structure arrays etc, Object oriented techniques, Web page designing.

Lab work: The practical work will be based on the above course

MT-442   NUMERICAL METHODS

Error Analysis: Types of errors (relative, Absolute, inherent, round off, truncation), significant digits and numerical instability, flow chart. Use any Computational tools to analyze the Numerical Solutions.

Linear Operators: Functions of operators, difference operators and the derivative operators, identities.

Difference Equations: Linear homogeneous and non homogeneous difference 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 the solutions of system of linear equations (Gauss- Elimination, Gauss-Jordan Elimination, triangularization, Cholesky, Jacobi and Gauss – Seidel).

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

Numerical Integration & Differentiation: Computation of integrals using simple Trapezoidal rule, Simpson's rule, 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.

TC-488   TELECOMMUNICATIONS MANAGEMENT NETWORK

Network Management in TCP/IP Environments, Networks Management Station (NMS), Network Management Requirements, Fault (Configuration and Accounting), Performance & Security Management, Network Management Protocols, Abstract Syntax Notation One (ASN.1), OID/MIB, CMIS/CMIP, SNMP (V1, V2, V3), Structure of Management Information (SMI), Remote Monitoring (RMON), SNMP Commands, Telecommunications Management Network (TMN), Network Management Tools and Systems, TCL/TK Scripting for SNMP Agents.

Lab work: The practical work will be based on the above course.

TC-490   TELECOMMUNICATIONS ENGINEERING PROJECT

The final year students will be required to contcsult the Chairman of Electronic Engineering Department regarding the offering of various projects in the department and industry. 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 and / or external supervisor. At the end of the academic session, they will submit the written report on work of their project to the Chairman, preferably in the typed form. The 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 Telecommunications. This may be of investigative research nature or it may be laboratory research oriented. The report may be purely economic, technical or both and may include the comparative study of different choice for the solution of the problems.

Department of Telecommunications Engineering

Inter Disciplinary Courses

Following courses are offered by the Department of Telecommunications Engineering to other disciplines in N.E.D. University of Engineering and Technology.

TC-383   COMMUNICATION SYSTEMS

Introduction: Communication System, Model elements of digital communication system, Fundamental limitations.

Deterministic Signal Analysis: Representation and classifications of signals, Fourier transform theory, Transmission loss and decibels, Filter and filtering. Signal through linear system: LTI Systems, Convolution, Correlation, PSD and ESD.

Random Signal Analysis: Review of probability and random variables statistical measures, Probability models, Introduction to random processes.

Analog Communication: Signal and system models of linear CW Modulation and exponential modulation, CW modulation system, introduction to sampling.

Pulse Modulation
PAM, Pulse shaping and ISI, PWM, PPM Signal to noise ratios in analog pulse modulation, PCM.

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

This Course is offered in TE (CIS)

TC 391 COMMUNICATION SYSTEMS - I

Introduction: Fundamental terms and definitions, Information, Message, Signal, Analog and digital signals, Elements of communication systems, Modulation and coding, Need for modulation, Coding methods and benefits.

Signals and Spectra: Methods of signal representation, Time and frequency domain, Mathematical representation of signals, Fourier series and Fourier transform, Power in a signal, Parseval's power theorem, Rayleigh energy theorem, Properties of Fourier transform, Convolution of signals, Some specific signals types as impulse step and signum functions.

Signal Transmission and Filtering: Linear time invariant systems, Impulse response and superposition integral, Transfer function, Block diagram analysis, Distortion and equalizers, Transmission loss and repeater, Ideal and real filters quadrature filters and Hilbert transform, Correlation and spectral density.

Probability and Random Variables: Probability functions, Probability models and distributions, Statistical averages.

Random Signals and Noise: Random process, Ensemble and time average, Stationary and ergodic process, Noise, Thermal noise, White noise and filtered noise, Noise equivalent BW, Analog base band transmission.

Linear Modulation: Band pass systems and signals, AM, DSB, SSB, VSB, Power in modulated signals modulator, Balanced modulator, Switching modulator, SSB generation, Demodulators, Synchronous detection, Homodyne detection, Envelope detection.

Transmission Lines: Fundamentals of transmission line, Theory of radio frequency, Basic theory of wave guide, Transmitting and receiving antennas, Channel characteristics.

The practical work will be based on the above course.

This Course is offered in TE (Electronic Engg. and Electrical Engg.)

TC 492   COMMUNICATION SYSTEMS - II

Exponential CW Modulation: Frequency and phase modulation, Bandwidth criteria, Generation methods, Receivers, De-emphasis and pre-emphasis filtering.

Pulse Modulation and Digital Modulation: Sampling theory, Ideal sampling and reconstruction, Aliasing, PAM, PWM, PPM, TDM, PCM, DPCM, ASK, PSK, FSK, Multi-level signaling.

Telephony: Modern telephone systems, Transmission aspects, System organization, Distribution system, Electromechanical and electronic exchanges, EPABX, Mobile phones.

Television: Scanning format of video signal, Block diagram of B/W receiver, Transmitter, Color TV fundamentals, PAL and NTSC systems.

Satellite Communication: Introductory remarks and historical C background, Orbital mechanics, Locating, Satellite in orbit and w.r.t. earth, Look angles and their determination, Effect of earth's oblateness, Sun and moon, Orbital effect in communication system performance, Transponders, Reliability, Low orbit earth satellites. Multi access formats.

Information Theory: Information contents in message, Units of information, Source coding, Entropy and information rate, Compact codes and channel capacity.

Error Detection and Correction: Linear block encoding, Humming codes, Pulse code, Pre codes and Hoffman codes etc. Automatic repeat request system (ARQ).

Microwave Tubes and Circuits: Microwave triode, Klystron types.

Semiconductor Microwave Devices: Transistors, Varactors, Gunn effect.

The practical work will be based on the above course.

This Course is offered in BE (Electronic Engg. and Electrical Engg.)