First Year Syllabus

FIRST SEMESTER

Sl. No.	Paper Code	Paper Name	Contact Hours / week				Credit Point
			L	T	P	Total	
A. THEORY							
1	HU 102	Economics for Engineers	3	0	0	3	3
2	CH 101	Chemistry - I	3	1	0	4	4
3	EE 101	Basic Electrical Engineering	3	1	0	4	4
4	EC101	Basic Electronics Engineering	3	1	0	4	4
5	M 101	Mathematics – I	3	1	0	4	4
Total of Theory						**19**	**19**
B. PRACTICAL							
6	CH 191	Chemistry –I Laboratory	0	0	3	3	2
7	EC 191	Basic Electronics Engineering Lab	0	0	3	3	2
8	EE 191	Basic Electrical Engineering Lab	0	0	3	3	2
9	ME 192	Workshop Practice	0	0	3	3	2
Total of Practical						**12**	**8**
Total of Semester						**31**	**27**

SECOND SEMESTER

A. THEORY							
1	HU201	English Language & Technical Communication	2	0	0	2	2
2	PH 201	Physics –I	3	1	0	4	4
3	CS201	Principles of Computer Programming	3	1	0	4	4
4	ME 201	Engineering Mechanics	3	1	0	4	4
5	M 201	Mathematics – II	3	1	0	4	4
Total of Theory						**18**	**18**
B. PRACTICAL							
6	PH 291	Physics – I Lab	0	0	3	3	2
7	CS 291	Principles of Computer Programming Lab	0	0	3	3	2
8	ME 291	Engineering Drawing & Graphics	0	0	3	3	2
Total of Practical						**9**	**6**
C. SESSIONAL							
9	HU 281	English Language & Technical Communication	0	0	3	3	2
10	XC 281	Extra Curricular Activities (NSS/NCC/NSO etc)	0	0	2	2	1
Total of Sessional						**5**	**3**
Total of Semester						**32**	**27**

3rd SEMESTER

A. THEORY							
SL. No.	**Field**	**Theory**	**Contact Hours/Week**				**Credit points**
			L	**T**	**P**	**Total**	
1.	M(CS)301	Numerical Methods	2	0	0	2	2
2.	M302	Mathematics-III	3	1	0	4	4
3.	EC301	Circuit Theory & Networks	3	1	0	4	4
4.	EC302	Signal & Systems	3	0	0	3	3
5.	CH301	Basic Environmental Engineering & Elementary Biology	3	0	0	3	3
6	EC303	Analog Electronics	3	1	0	4	4
Total of Theory						**21**	**20**
B. PRACTICAL							
1.	M(CS)391	Numerical Lab	0	0	3	3	2
2.	EC391	Circuit Theory & Network Lab	0	0	3	3	2
3.	EC392	Signal & Systems lab	0	0	3	3	2
4	EC393	Analog Electronics lab	0	0	3	3	2
Total of practical						**11**	**8**
Total of Semester						**32**	**28**

SECOND YEAR SECOND SEMESTER

A. THEORY							
SL. No.	**Field**	**Theory**	**Contact Hours/Week**				**Credit points**
			L	**T**	**P**	**Total**	
1.	HU401	Values and ethics in Profession	3	0	0	3	3
2.	PH401	Physics-II	3	1	0	4	4
3.	EC 401	Digital Electronics	3	0	0	3	3
4.	EC 402	Analog Communication	3	1	0	4	4
5.	EC 403	Solid state devices	3	0	0	3	3
6	EC 404	EM theory & Transmission Line	3	0	0	3	3
Total of Theory						**20**	**20**
A. PRACTICAL / SESSIONAL							
1.	HU481	Technical Report Writing & Language Lab Practice	0	0	3	3	2
2.	PH491	Physics-II Lab	0	0	3	3	2
3.	EC491	Digital Electronics lab	0	0	3	3	2
4.	EC492	Analog Communication lab	0	0	3	3	2
Total of practical						**12**	**8**
Total of Semester						**32**	**28**

THIRD YEAR FIRST SEMESTER

A. THEORY							
SL. No.	**Field**	**Theory**	**Contact Hours/Week**				**Credit points**
			L	**T**	**P**	**Total**	
1.	EC-501	Digital Communication	3	1	0	4	4
2.	EC-502	Microprocessors & Microcontrollers	3	1	0	4	4
3.	EC-503	Antenna & Propagation	3	0	0	3	3
4.	EC-504	Control Systems	3	0	0	3	3
5.	FE-I: EC-505	A. Data structure & C B. Power Electronics	3	0	0	3	3
6	PE-I: EC-506	A. Telecommunication switching systems B. Computer Architecture	3	0	0	3	3
Total of Theory						**20**	**20**
B PRACTICAL							
1.	EC-591	Digital Communication lab	0	0	3	3	2
2.	EC-592	Microprocessors & Microcontrollers lab	0	0	3	3	2
3	EC-593	Antenna lab	0	0	3	3	2
4.	EC-594	Control Systems lab	0	0	3	3	2
Total of practical						**12**	**8**
Total of Semester						**32**	**28**

***: PE: Professional Elective; FE: Free Elective.**

THIRD YEAR SECOND SEMESTER

A. THEORY							
SL. No.	**Field**	**Theory**	**Contact Hours/Week**				**Credit points**
			L	**T**	**P**	**Total**	
1.	HU-601	Principles of Management	2	0	0	2	2
2.	EC601	Digital Signal Processing	3	1	0	4	4
3.	EC602	VLSI circuit & systems	3	0	0	3	3
4.	EC603	Material Science	3	0	0	3	3
5.	PE-II: EC604A EC604B	A. Information theory & coding B. Computer-communication & Networking	3	0	0	3	3
6.	FE-II: EC605	A. Object Oriented Programming B. Electronic measurement & Instrumentation	3	0	0	3	3
Total of Theory						18	18
B PRACTICAL							
1.	EC691	Digital Signal Processing lab	0	0	3	3	2
2.	EC692	VLSI circuit & System lab	0	0	3	3	2
3.	FE-II Lab.: EC694	A. OOP lab B. Electronic Measurement & Instrumentation lab	0	0	3	3	2
4.	EC693	Electronic Circuit Design lab	0	0	0	3	2
Total of practical						12	8
Total of Semester						30	26

***: PE: Professional Elective; FE: Free Elective**

FOURTH YEAR FIRST SEMESTER

A. THEORY							
SL. No.	**Field**	**Theory**	**Contact Hours/Week**				**Credit points**
			L	**T**	**P**	**Total**	
1.	EC701	Wireless Communication	3	1	0	4	4
2.	EC702	Microwave Engineering & Radar	3	1	0	4	4
3.	PE-III: EC703	A. Fiber Optic Communication B. FPGA & Reconfigurable Computing	3	1	0	4	4
4	PE-IV: EC704	A. Embedded systems B. Modern Control Engineering	3	0	0	3	3
5.	FE-III: EC705B	A. Artificial Intelligence B. Data Base Management System	3	0	0	3	3
Total of Theory						18	18
B PRACTICAL / SESSIONAL							
1.	PE-III Lab. : EC793	Fiber optic Communication lab FPGA and Reconfigurable Computing lab	0	0	3	3	2
2	EC792	Microwave lab	0	0	3	3	2
3.	EC781	Industrial Training	0	0	3	3	2
4.	EC782	Project I	0	0	0	3	2
5.	EC 783	Group Discussion	0	0	3	3	2
Total of practical						15	10
Total of Semester						33	28

***: PE: Professional Elective; FE: Free Elective.**

FOURTH YEAR SECOND SEMESTER

A. THEORY							
SL. No.	**Field**	**Theory**	**Contact Hours/Week**				**Credit points**
			L	**T**	**P**	**Total**	
1.	HU 801	Financial Management and Accounts	3	0	0	3	3
2.	PE-V EC801	A. Nanotechnology B. Upper Atmospheric Propagation C. Remote Sensing D. Radar & Navigation	4	0	0	4	4
3.	FE-IV EC802	A. Digital Image Processing B. Mobile Computing C. Software Engineering D. Internet Technology E. Advance Engineering Mathematics.	4	0	0	4	4
Total of Theory						11	11
B PRACTICAL / SESSIONAL							
1.	EC881	Seminar.	0	0	3	3	2
2.	EC882	Project II	0	0	9	9	6
3.	EC893	Grand viva	0	0	0	0	5
Total of practical						15	13
Total of Semester						23	24

***: PE: Professional Elective; FE: Free Elective.**

1st semester:

HU-102 Economics for Engineers 3-0-0-3-3:

1. **Financial Accounting**: Meaning, Nature and scope of Financial Accounting, Accounting concepts & conventions, Business Transactions, Different types of Vouchers, Analysis of Transactions, Recording in Journals and cash books, Posting of Ledgers, Preparation of Trial balance, Preparation of Final Accounts (Trading Account, Profit & Loss A/C and Balance Sheet)
2. **Cost Accounting:** Introduction, Classification of Costs; Break-even Analysis; Budgeting & Budgetary Control, Objectives, Advantages & Limitations of Budgeting, Cash Budget, Flexible Budget, Master Budget, etc
3. **Financial Management:** Cost of Capital: Capital Budgeting, Working Capital Management
4. **Economics**

   Introduction: Scarcity and Choice. Definition and Scope of Economics. Concept of Equilibrium. Concept of Market.

   Demand and Revenue Analysis: Meaning of demand, Determinants of demand, Exception to the law of demand. Elasticity of demand- Meaning, Price Elasticity of demand. Price Elasticity of Supply.

   Cost and Production Analysis: Cost concept: Classification of cost- Cost output relationship- Cost function and its determinants, uses of Cost function. Production: Meaning, Factors of production- Land, Labour, capital and organization.

References

1 Modern Accountancy A. Mukherjee & M. Hanif Tata McGraw- Hill
2 Accountancy (Vol.1) Dr. S.K. Paul New Central Book Agency
3 Practice in Accountancy S. P. Basu & Monilal Das Rabindra Library
4 Modern Economic Theory K.K. Dewett S.Chand
5 Fundamentals of Economic Principles and problems : A. Banerjee & D. Maumder; ABS Publishing House
6 Economics for Business John Sloman & Mark Sutdiffe Pearson Education
7 Management Accounting R.K. Sharma & S. Gupta Kalyani Publishers
8 Financial Management Dr. S. Kr. Paul New Central Book Agency
9 Financial Management Dr. D. Majumder; Sk. Raju Ali & Lutfun Nesha; ABS Publishing
10. S. A. Sherlekar & V.S. Sherlekar : Modern Business Organization & Management, Himalay Publishing House

EE-101: Basic Electrical Engineering 3-1-0-4-4

Introduction: Overview of Source of energy, Generation, Transmission and Distribution of Electric Power.

DC Network: Introduction of Electric Circuit, Loop Analysis, Node-voltage analysis. Star - Delta & Delta-star Transformations, Superposition Theorem, Thevenin's Theorem, Norton's theorems, Analysis of dc network in presence of one non-linear element, Transients in R-L , R-C and R-L-C circuits.

Single-phase AC Network: Single-phase AC Circuits, Generation of Sinusoidal Voltage Waveform (AC) and Some Fundamental Concepts, Representation of Sinusoidal Signal by a Phasor, Current and Resonance in R-L-C Series and parallel Circuits.

Three-phase AC Network: Three-phase AC Circuits, Three-phase Balanced Supply, Three-phase Delta-Connected Balanced Load, Power in a Three-phase Circuit.

Magnetic Circuits: Magnetic circuits, Core losses, Eddy Current & Hysteresis Loss.

Transformer: Ideal & Practical Transformer, Testing, Efficiency & Regulation, Three Phase Transformer, Auto-Transformer, Problem solving on Transformers

Three-phase Induction Motor: Construction, Principle of Operation, Rotating Magnetic Field, Equivalent Circuit, Power Flow Diagram, Torque-Slip (speed) Characteristics in Three-phase Induction Motor, Starters for Induction Motor.

DC Machines: , Constructional Features, Principle of Operation, EMF & Torque Equation of D.C Machines, D.C Generators, D.C Motors, Losses, Efficiency and Testing of D.C. Machines, Problem Solving on D.C Machines.

Measuring Instruments: Study of DC-AC Measuring Instruments, Study of Electro-Dynamic Type Instrument, Study of Single Phase Induction Type Energy Meter.

General structure of electrical power system: Power generation to distribution through overhead lines and under ground cables with single lone diagram.

Text books:

1. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition
2. Fundamental of electrical Engineering, Rajendra Prasad, PHI, Edition 2005.
3. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition
4. Basic Electrical Engineering, J.P. Tewari, New age international publication

Reference books:

1. Basic Electrical Engineering(TMH WBUT Series), Abhijit Chakrabarti & Sudipta Nath, TMH
2. Electrical Engineering Fundamental, Vincent.D.Toro, Pearson Education, Second Edition.
2. Hughes Electrical & Electronics Technology, 8/e, Hughes, Pearson Education.
3. Basic Electrical Engineering, T.K. Nagsarkar & M.S. Sukhija, Oxford
4. Introduction to Electrical Engineering, M.S. Naidu & S, Kamakshaiah, TMH
5. Basic Electrical Engineering, J.J. Cathey & S.A Nasar, TMH, Second Edition.

EE-191: Basic Electrical Engineering Lab. 0-0-3-3-2

List of Experiments:

1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. (a) Verification of Thevenin's theorem.
   (b) Verification of Norton's theorems.
4. Verification of Maximum power theorem.
5. Verification of Superposition theorem
6. Study of R-L-C Series circuit
7. Study of R-L-C parallel circuit
8. Calibration of ammeter and voltmeter.
9. Open circuit and Short circuit test of a single phase Transformer.
10. No load characteristics of D.C shunt Generators
11. Starting and reversing of speed of a D.C. shunt
12. Speed control of DC shunt motor.
13. Measurement of power in a three phase circuit by two wattmeter method

CH-101 Chemistry 3-1-0-4-4:

Module 1:Chemical Thermodynamics

Concept of Thermodynamic system: Definition with example of diathermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property.

Introduction to first law of thermodynamics: Different statements, mathematical form.

Internal energy: Definition, example, characteristics, physical significance, mathematical expression for change in internal energy, expression for change in internal energy for ideal gas.

Enthalpy: Definition, characteristics, physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas. **3L**

Heat Capacity: Definition, classification of heat capacity (C_p and C_V): Definition and general expression of C_p–C_V. Expression of C_p–C_V for ideal gas.

Reversible and irreversible processes: Definition, work done in isothermal reversible and isothermal irreversible process for ideal gas, adiabatic changes: Work done in adiabatic process, interrelation between thermodynamic parameters (P, V and T), slope of P–V curve in adiabatic and isothermal process.

Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's law of constant heat summation, Kirchhoff's law. **3L**

2nd law of thermodynamics: Statement, mathematical form of 2nd law of thermodynamics (Carnot cycle). Joule Thomson and throttling processes; Joule Thomson coefficient for ideal gas, concept of inversion temperature. Evaluation of entropy: Characteristics and expression, entropy change in irreversible cyclic process, entropy change for irreversible isothermal expansion of an ideal gas, entropy change of a mixture of gases. **2L**

Work function and free energy: Definition, characteristics, physical significance, mathematical expression of ΔA and ΔG for ideal gas, Maxwell's Expression (only the derivation of four different forms), Gibbs Helmholtz equation, condition of spontaneity and equilibrium reaction. **2L**

Module 2:Industrial Chemistry and Polymerization

Industrial chemistry

Solid Fuel: Coal, classification of coal, constituents of coal, carbonization of coal (HTC and LTC), coal analysis: Proximate and ultimate analysis.

Liquid fuel: Petroleum, classification of petroleum, refining, petroleum distillation, thermal cracking, octane number, cetane number, aviation fuel (aviation gasoline, jet gasoline), and bio-diesel.

Gaseous fuels: Natural gas, water gas, coal gas, bio-gas. **5L**

Polymerization: Concepts, classifications and industrial applications

Polymer molecular weight (number avg. weight avg. viscosity avg.: Theory and mathematical expression only), Poly dispersity index (PDI). Polymerization processes (addition and condensation polymerization), degree of polymerization, copolymerization. Preparation, structure and use of some common polymers: plastic (PE: HDPE, LDPE), rubber (natural rubber, SBR), fibre (nylon 6.6). Vulcanization, conducting and semi-conducting polymers. **3L**

Module 3:Reaction dynamics, and structure and reactivity of organic molecules

Reaction dynamics: Reaction laws: rate and order; molecularity; zero, first and second order kinetics. Pseudounimolecular reaction, Arrhenius equation. Mechanism and theories of reaction rates (Transition state theory, Collision theory:). Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics). **3L**

Structure and reactivity of Organic molecules: Electronegativity, electron affinity, hybridization, Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals. Brief studies on some addition, elimination, and substitution reactions. **3L**

Module 4: Electrochemistry

Conductance: Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration (strong and weak electrolyte). Kohlrausch's law of independent migration of ions, transport numbers, and hydration of ions. Conductometric titrations: SA vs SB & SA vs WB; precipitation titration KCl vs $AgNO_3$. **2L**

Electrochemical cell: Cell EMF and its thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half cell, quinhydrone half cell and calomel half cell (construction, representation, cell reaction, expression of potential, discussion, application). Storage cell, fuel cell (construction, representation, cell reaction, expression of potential, discussion, application). Application of EMF measurement on (a) ascertain the change in thermodynamic function (ΔG, ΔH, ΔS) (b) ascertain the equilibrium constant of a reversible chemical reaction (c) ascertain the valency of an ion.

Module 5: Solid state and coordination chemistry

Solid state Chemistry: Introduction to stoichiometric defects (Schottky & Frenkel) and non – stoichiometric defects (Metal excess and metal deficiency). Role of silicon and germanium in the field of semiconductor. **2L**

Coordination chemistry: Double salt, complex salt, Werner's theory of coordination compounds, coordination number, ligand, chelate, stability constant: stepwise and overall. **2L**

Reference Books

1. P. C. Rakshit, Physical Chemistry, Sarat Book House (7th Edition).
2. S. Glasstone, Text Book of Physical Chemistry, Macmillan India Limited.
3. S. Pahari, Physical Chemistry, New Central Book Agency.
4. S. Sarkar, Fuels and Combustion, Taylor & Francis (3rd Edition), 2009
5. P. Ghosh, Polymer Science and Technology of Plastics and Rubbers, Tata McGraw Hill Publishing Company Limited.
6. F.W. Billmeyer: Textbook of Polymer Science is published by Wiley India
7. Joel R. Fried, Polymer Science and Technology, Pearson Education (2nd Edition).
8. I. L. Finar, Organic Chemistry, Addison Wesley Longman, Inc.
9. Physical Chemistry, Atkins, 6th Edition, Oxford Publishers.
10. Organic Chemistry, Mark Loudon, 4th Edition, Oxford Publishers.
11. Inorganic Chemistry–R. L. Dutta, Current Distributors

CH-191 Chemistry Lab. 0-0-3-3-2:

List of Experiments

1. To Determine the alkalinity in a given water sample.
2. Redox titration (estimation of iron using permanganometry)
3. To determine calcium and magnesium hardness of a given water sample separately.
4. Estimation of available chlorine in bleaching powder.
5. To determine chloride ion in a given water sample by argentometric method (using chromate indicator solution).
6. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water)
7. Viscosity of solutions (determination of percentage composition of sugar solution from viscosity)
8. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
9. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
10. Determination of dissolved oxygen present in a given water sample.
11. Estimation of available oxygen in pyrolusite.

M-101 Mathematics-II 3-1-0-4-4:

Module I

***Ordinary differential equations (ODE)- First order and first degree*:** Exact equations, Necessary and sufficient condition of exactness of a first order and first degree ODE (statement only), Rules for finding Integrating factors, Linear equation, Bernoulli's equation. General solution of ODE of first order and higher degree (different forms with special reference to Clairaut's equation). **6L**

Module II

***ODE- Higher order and first degree*:** General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods for finding P.I., Method of variation of parameters, Cauchy-Euler equations, Solution of simultaneous linear differential equations. **7L**

Module III

Partial Differential Equations: Origin of PDE, its order and degree, concept of solution in PDE. Solution of First Order Partial differential equation by Lagrange's Method, Integral Surfaces passing through a given curve, Solution of non-linear first order partial differential equations by Charpit's method, Solution of Second order Linear partial Differential equations with constant coefficients and with variable coefficients. **14L**

Module IV

***Improper Integral*:** Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations. **3L**

Laplace Transform (LT): Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property; LT of $\frac{f(t)}{t}, t^n f(t), f^{(n)}(t)$ and $\int f(u)du$. Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT**:** Definition and its properties; Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT. **10L**

Total 40 Lectures

Suggested Reference Books:

1**. Advanced Engineering Mathematics**, Erwin Kreyszig, (Wiley Eastern)
2. **Engineering Mathematics:** B.S. Grewal (S. Chand & Co.)
3. **Engineering Mathematics (Volume 2):** S. S. Sastry (Prentice-Hall of India)
4. **Advanced Engineering Mathematics, 3E**: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), Indian Edition
5. **An Introduction to Differential Equations**, R.K. Ghosh and K.C.Maity (New Central Book Agency)
6. **Elements of Partial Differential Equations**, I. N. Sneddon, (McGraw-Hill International)
7. **Laplace Transforms**, M. R. Spiegel(MGH)

EC-101 Basic Electronics Engineering 3-1-0-4-4:

Pre-requisite: Knowledge of class XII level Physics and Mathematics

Introduction: Basic ideas on different circuit components (Resistor,Inductor,Capacitor) 1L

Module – 1: Semiconductors: **4L**

Crystalline material: Mechanical properties, Conductors, Semiconductors and Insulators: electrical properties. Energy band theory, Fermi levels; Semiconductors: intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P-type and N-type semiconductors, drift and diffusion carriers.

Module – 2: Diodes and Diode Circuits: 3L+3L = 6L

Formation of P-N junction, energy band diagram, built-in-potential, forward and reverse biased P-N junction, formation of depletion region, Junction capacitance, V-I characteristics of diode, Simple diode circuits, load line, linear piecewise model; Rectifier circuits: half wave, full wave, (PIV, DC voltage and current, ripple factor, efficiency), idea of regulation, rectifier filter circuits, clipper, clamper, voltage multiplier circuits, breakdown mechanism of diodes, Zener diode,Varactor diode.

Module – 3: Bipolar Junction Transistors **5L+2L=7L**

Formation of PNP / NPN junctions, energy band diagram; current flow diagram, transistor mechanism and transistor principles, CE, CB, CC configuration, transistor input output characteristics: amplification factors for CB,CC and CE modes. Biasing and Bias stability: calculation of stability factor; small signal analysis, h-parameter model.

Module – 4: Field Effect Transistors: **5L**

Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD

amplifier configurations, FET parameters, small signal equivalent circuits for different configurations; CMOS: Basic Principles.

Module – 5: Feed Back Amplifier and Operational Amplifiers: **4L+4L = 8L**

Positive and negative feed back, close loop gain, open loop gain, topologies of feed back amplifier,:output impedance, input impedance, sensitivities (qualitative), bandwidth stability; effect of positive feed back: instability and oscillation, condition of oscillation, Barkhausen criteria. Introduction to integrated circuits, open loop characteristics of operational amplifier; Application of operational amplifier; inverting and non-inverting mode of operation, Adders, Subtractors, Constant gain multiplier, Voltage follower, Comparator, Integrator, Differentiator. OPAMP parameters: CMRR, OFFSET parameters, slew rate.

Module – 6: Special Semiconductor devices: **3L**

SCR, DIAC, TRIAC, UJT, IGBT- structure, characterization, principle of operation and applications.

Module – 7: Cathode Ray Oscilloscope (CRO) **4L**

CRT structure**,** block diagram, operation, Deflection systems, sweep circuit operation, basic block of CRO, applications of CRO, Frequency,phase and amplitude measurement using CRO, Lissajous figure.

Module – 8:Digital Electronics: **2L**

Introduction to binary number; Basic Boolean algebra;,De Morgan's Theorem, Logic gates.

Outcome: The students will be able to select proper electronics component and device depending on the requirement.The student should be able to use required rectifier circuit and to calculate it's different parameters. The students must be able to design a transistor amplifier.

Recommended Books:

Text.

1. Chattopadhyay & Rakshit:Electronics Fundamentals & Applications
2. Millman & Halkias: Integrated Electronics References:
1. Boylestad & Nashelsky: Electronic Devices & Circuit Theory
2. Sanjeev Gupta: Electrinics Devices Circuits
3. Malvino: Electronic Principle

EC-191 Basic Electronics Engineering Lab. 0-0-3-3-2:

There will be a couple of familiarization lectures before the practical classes are undertaken where basic concept of the instruments handled Eg: CRO, Multimeters etc will be given.

List of Experiments:

1. Familiarisation with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multimeters etc.
2. Familiarisation with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs.
7. Study of Characteristic curves for CB, CE and CC mode transistors
8. Study of I-V characteristics of Field Effect Transistors.
9. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
10. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
11. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.

ME-192 Workshop Practice 0-0-3-3-2:

Jobs:

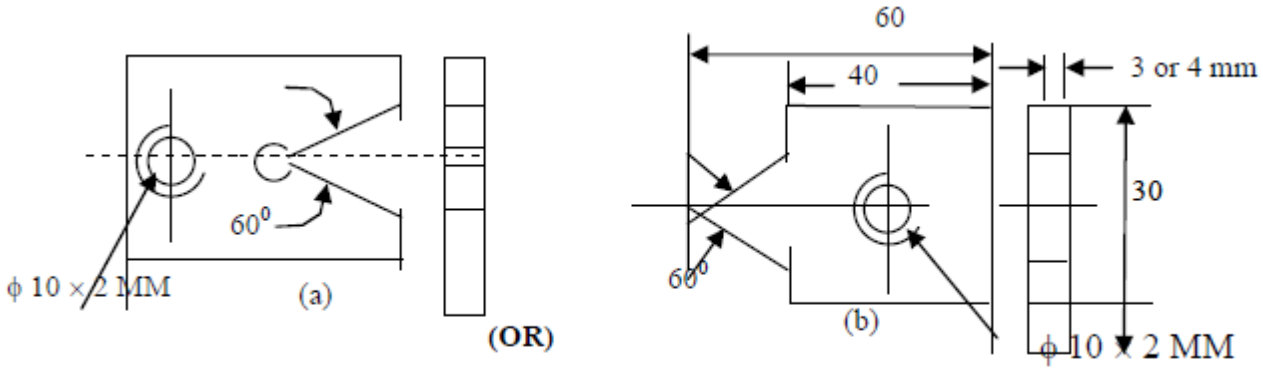

Fig.1: Job for fitting practice

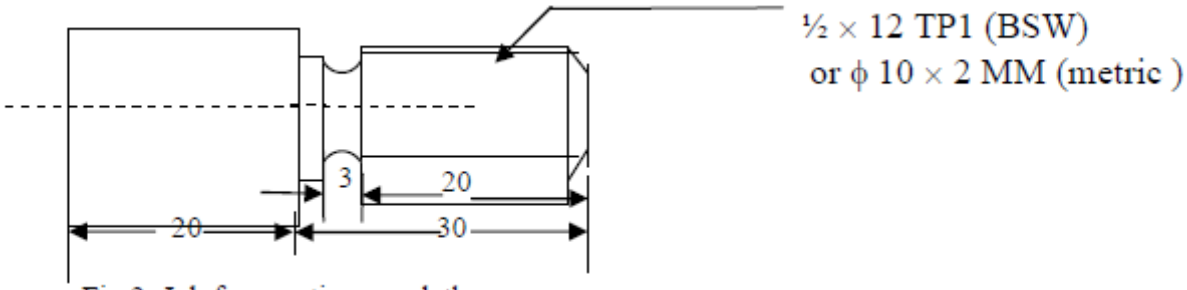

Fig.2: Job for practice on a lathe

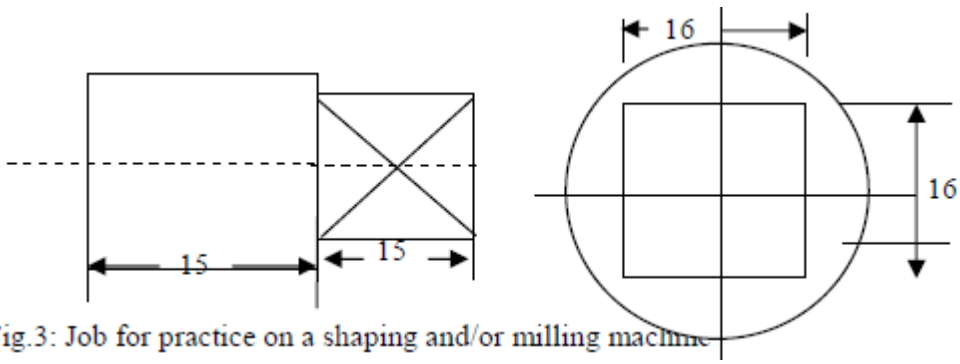

Fig.3: Job for practice on a shaping and/or milling machine

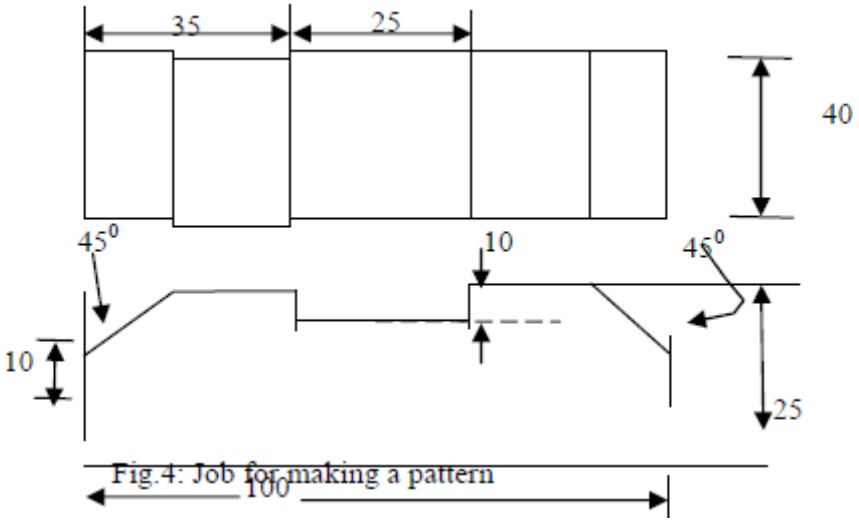

Fig.4: Job for making a pattern

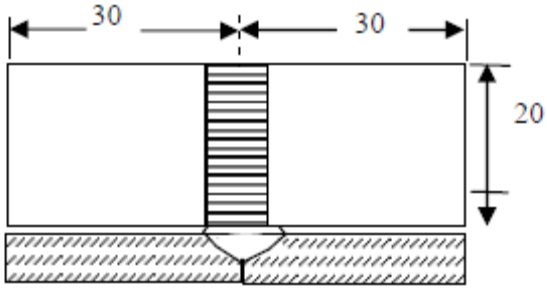

Fig.5: Welding specimen for practice

1. FITTING : Making a gauge from MS plate as shown in Fig.1.
   Operations required:
   a. Squaring and finishing of the blank by filing
   b. Making the Vee-portion by sawing and filing
   c. Drilling (in machine) and tapping (hand)
2. MACHINING : To make a pin as shown in Fig.2 from a □20mm mild steel rod in a lathe.
3. MACHINING : To make a MS prism as shown in Fig.3 from a □20mm mild steel rod in a shaping and / or
   milling machine.
4. PATTERN MAKING, SAND MOULDING AND CASTING: To make a wooden pattern and a sand mould with that pattern for casting a cast iron block as shown in Fig.4.
5. WELDING (GAS WELDING): To join two thin mild steel plates or sheets (1 to 3mm thick) as shown in Fig. 5 by gas welding.
6. WELDING (ARC WELDING) : To join two thick (6mm) MS plate as shown in Fig. 5 by arc welding.
7. SHEET METAL WORK (in 1 day or 3 hours); Forming a cone, for example.

2nd semester:

HU-201 English Language & Technical Communication 2-0-0-2-2:

Guidelines for Course Execution:

Objectives of the Course: This Course has been designed

1. To impart advanced skills of Technical Communication in English through Language Lab. Practice Sessions to 1st Semester UG students of Engineering &Technology.
2. To enable them to communicate confidently and competently in English Language in all spheres.

Desired Entry Behaviour:

The students must have basic command of English to Talk about day-to-day events and experiences of life. Comprehend Lectures delivered in English. Read and understand relevant materials written in English. Write grammatically correct English. Strategies for Course Execution:

1. It is a Course that aims to develop Technical Communication Skills. It is, therefore, *Lab*- based and practical in orientation. Students should be involved in Practice Sessions.
2. The content topics should be conveyed through real-life situations. Lecture classes should be conducted as Lecture cum Tutorial classes.
3. Keeping in view the requirements of students, the teachers may have to prepare some learning aids task materials.
4. Some time should be spent in teaching stress and intonation.
5. In teaching 'Speaking skill,' emphasis should be on *clarity, intelligibility, fluency, (as well as accepted pronunciation).*
6. Micro Presentation and Group Discussion Sessions should be used for developing Communicative Competence
7. The Language Lab, device should be used for giving audio-visual inputs to elicit students' responses by way of Micro-Presentation, Pair Conversation, Group Talk and Class Discussion.
8. The teacher must function as *a creative monitor in the Language Lab for the following:*

A. **Developing Listening Comprehension Skill;**

1. Developing Listening Comprehension through Language Lab Device
2. Developing sub skills of the Listening Skill by Conversational Practice Sessions
3. Focusing on intelligent and advanced Listening Sessions e.g. Seminars, Paper Presentation, Mock Interviews etc.
4. Conducting Conversational Practice: Face to Face & Via Media (Telephone, Audio, Video + Clips)

B. **Developing Speaking Competence:**

a) Helping students in achieving *clarity and fluency*; manipulating paralinguistic features of speaking (*voice modulation ,pitch , tone stress , effective pauses)*

Conducting *Task oriented interpersonal ,informal and semiformal Speaking / Classroom Presentation* 4

b) Teaching strategies for Group Discussion

Teaching Cohesion and Coherence

Teaching effective communication & strategies for handling criticism and adverse remarks

Teaching strategies of Turn- taking, effective intervention, kinesics (use of body language) and courtesies and all componentss of softskills.

C. **Developing Reading Comprehension Skill:**

a) Developing Reading Skill through Non Technical (Literary) Texts (See Recommended Book 5)

1. The Thief by Ruskin Bond
2. The Open Window by Saki
3. Marriage is a private Affair by Chinua Achebe
4. The Moon in the Earthen Pot by Gopini Karunakar

b) Developing Reading Skill through Radio Commentary, Technical Texts and Case Studies (Refer to Recommended Book 1.) * Freedom by G. B. Shaw (Radio Commentary)

a) Guiding students for Intensive & Extensive Reading(See Recommended Book 1)

D. **Developing Writing Competence:**

a) Teaching all varieties of Technical Report, Business Letters and Job Application (Expressing Ideas within restricted word limit through paragraph division, Listing Reference Materials through Charts , Graphs ,Tables and Diagrams);
b) Teaching correct Punctuation & Spelling, Semantics of Connectives, Modifiers and Modals, variety of sentences and paragraphs
c) Teaching Organizational Communication: Memo, Notice, Circular, Agenda / Minutes etc.

SYLLABUS -- DETAILED OUTLINES

A. ENGLISH LANGUAGE GRAMMAR: 5L

Correction of Errors in Sentences, Building Vocabulary, Word formation, Single Word for a group of Words, Fill in the blanks using correct Words, Sentence Structures and Transformation, Active & Passive Voice, Direct & Indirect Narration, (MCQ Practice during classes)

B. READING COMPREHENSION:

Strategies for Reading Comprehension 1L
Practicing Technical & Non Technical Texts for Global/Local/Inferential/Referential comprehension; 3L
Precis Writing

C. TECHNICAL COMMUNICATION

The Theory of Communication –Definition & Scope, Barriers of Communication, Different Communication Models, Effective Communication (Verbal / Non verbal), Presentation / Public Speaking Skills 5L
(MCQ Practice during classes) 5

D. MASTERING TECHNICAL COMMUNICATION

Technical Report (formal drafting) 3L
Business Letter (formal drafting) 4L
Job Application (formal drafting) 3L
Organizational Communication (see page 3) 3L
Group Discussion –Principle & Practice 3L
Total Lectures 30

MARKS SCHEME (Written Examination) Total Marks 70
1. 10 Multiple Choice Questions(Communication & Eng. Language-Vocabulary & Syntax) Marks 10
2. Short Questions & Precis writing on unseen passages Marks 15 (10+5)
3. 3 Essay type Questions on Technical Communication (Technical Report / Business Letter / Job Application /
Organizational Communication etc,) Marks 45-15*3

MARKS SCHEME (Internal Examination) Total Marks 30
1. Attendance Marks 5
2. Testing Speaking Ability Marks 5
3. Testing Listening Ability Marks 5
4. 2 Unit Tests Marks 15

HU -281 English Language & Technical Communication Lab 0-0-3-3-2:

a) Honing 'Listening Skill' and its sub skills through Language Lab Audio device; 3P
b) Honing 'Speaking Skill' and its sub skills; 2P
c) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech; 2P
j) Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone , Mobile phone & Role Play Mode); 2P
k) Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success; 2P

f) G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD; 4P
g) Honing 'Reading Skills' and its sub skills using Visual / Graphics/Diagrams /Chart Display/ Technical/Non Technical Passages; Learning Global / Contextual / Inferential Comprehension; 2P
h) Honing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input; Practice Sessions 2P
Total Practical Classes 17

Books Recommended:

Dr. D. Sudharani: Manual for English Language Laboratory Pearson Education (WB edition),2010
Board of Editors: Contemporary Communicative English for Technical Communication Pearson Longman, 2010

PH-_201 Physics-I 3-1-0-4-4:

Module 1: Oscillation:

1.1 Simple Harmonic motion: Preliminary concepts, Superposition of Simple Harmonic motions in two mutually perpendicular directions: Lissajous figure.
1.2 Damped vibration: Differential equation and its solution, Logarithimic decrement, Quality Factor.
1.3 Forced vibration: Differential equation and its solution, Amplitude and velocity resonance, Sharpness of resonance. Application in L-C-R circuit. (2L+3L+3L)

Module 2: Optics I:

2.1 Interference of electromagnetic waves: Condition for sustained interference, double slit as an example. Qualitative idea of Spatial and Temporal Coherence, conservation of energy and intensity distribution, Newton's ring.
2.2 Diffraction of light: Fresnel and Fraunhoffer class. Fraunhoffer diffraction for single slit and double slit. Intensity distribution of N-slits and plane diffraction grating (No deduction of the intensity distributions for N-slit), Missing orders. Rayleigh criterion, resolving power of grating and microscope. (3L+5L)

Module3: Optics II

3.1 Polarization: General concept of polarization, Plane of vibration, Qualitative discussion on plane, circularly and elliptically polarized light. Polarization through reflection and Brewster's law. Double refraction (birefringence) – Ordinary and Extra-ordinary rays. Nicol's prism, Polaroid, Half wave and quarter wave plate.
3.2 Laser: Spontaneous and Stimulated emission of radiation, Population inversion, Einstein's A & B co-efficient (derivation of the mutual relation), Optical resonator and condition necessary for active Laser action, Ruby Laser, He-Ne Laser, application of laser.
3.3 Holography: Theory of holography, viewing of hologram, applications. (4L+4l+3L)

Module 4: Quantum Physics:

4.1 Concept of dependence of mass with velocity, mass energy equivalence, energy-momentum relation (no deduction required), Blackbody radiation: Rayleigh Jean's law (derivation without the calculation of number of states), Ultraviolet catastrophe, Wien's law, Planck's radiation law (calculation of average energy of the oscillator), Derivation of Wein's law and Stephan's law from Planck's radiation law. Rayleigh Jean's law and Wien's law as limiting case of Planck's law. Compton's effect (calculation of Compton wavelength is required).
4.2 Wave-particle duality and de Broglie's hypothesis. Concept of matter waves, Davission-Germer experiment, Concept of wave packets and Heisenberg's uncertainty principle. (5L+4L)

Module 5: Crystallography:

5.1 Elementary ideas of crystal structure: Lattice, Basis, Unit cell, fundamental types of lattice-Bravais Lattice, simple cubic, FCC and BCC lattices (use of models in class during teaching is desirable), Miller indices and Miller planes, coordination number and atomic packing factor.

5.2 X-rays: origin of characteristic and continuous x-rays, Bragg's law (no derivation), determination of lattice constant.

PH-_291 Physics-I Lab. 0-0-3-3-2:

Group 1: Experiment from Higher Secondary knowledge of Physics

1. Determination of thermal conductivity of a good conductor by Searle's method.
2. Determination of thermal conductivity of a bad conductor by Lees and Charlton's method.
3. Determination of dispersive power of the material of given prism.
4. Use of Carry Foster's bridge to determine unknown resistance.

Group 2: Experiments on General properties of matter

5. Determination of Young's modulus by Flexure method and calculation of bending moment and shear force at a point on the beam.
6. Determination of modulus of rigidity by static / dynamic method.
7. Determination of co-efficient of viscosity by Poiseulle's capillary flow method.

Group 3: Optics

8. Determination of wavelength of light by Newton's ring method.
9. Determination of wavelength of light by Fresnel's bi-prism method.
10. Determination of wavelength of light by Laser diffraction method.
11. Determination of numerical aperture and the energy losses related to optical fibre experiment.

Innovative experiment:

One more experiment designed by the student or the concerned teacher or both.

CS-_201 Introduction to Computing 3-1-0-4-4:

Fundamentals of Computer:

History of Computer, Generation of Computer, Classification of Computers 2L

Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output Devices 3L

Binary & Allied number systems representation of signed and unsigned numbers. BCD, ASII. Binary Arithmetic & logic gates 6L

Assembly language, high level language, compiler and assembler (basic concepts) 2L

Basic concepts of operating systems like MS DOS, MS WINDOW, UNIX, Algorithm & flow chart 2L

C Fundamentals:

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements3L

Operators & Expressions:

Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation. Input and Output: Standard input and output, formatted output -- printf, formatted input scanf. 5L

Flow of Control:

Statement and blocks, if - else, switch, loops - while, for do while, break and continue, go to and labels 2L

Fundamentals and Program Structures:

Basic of functions, function types, functions returning values, functions not returning values, auto, external, static and register variables, scope rules, recursion, function prototypes, C preprocessor, command line arguments. 6L

Arrays and Pointers:

One dimensional arrays, pointers and functions, multidimensional arrays. 6L

Structures Union and Files:
Basic of structures, structures and functions, arrays of structures, bit fields, formatted and unformatted files. 5L

Recommended reference Books:

Introduction To Computing (TMH WBUT Series), E. Balagurusamy,TMH

Kerninghan, B.W.	The Elements of Programming Style
Yourdon, E.	Techniques of Program Structures and Design
Schied F.S.	T heory and Problems of Computers and Programming
Gottfried	Programming with C Schaum
Kerninghan B.W. & Ritchie D.M.	The C Programming Language
Rajaraman V.	Fundamental of Computers
Balaguruswamy	Programming in C
Kanetkar Y.	Let us C
M.M.Oka	Computer Fundamentals,EPH
Leon	Introduction to Computers,Vikas
Leon-	Fundamental of Information Technology,Vikas
Ram B.	Computer Fundamentals, New Age International
Ravichandran D.	Programming in C, New Age International
Xavier C. C	Language & Numerical Methods, New Age Inter.
Xavier C.	Introduction to Computers, New Age International
Rao S.B.	Numerical Methods with Programs in Basic Fortran Pascal & C++,
Dutta N.	Computer Programming & Numerical Analysis, Universities Press
Bhanu Pratap	Computer Fundamentals
Rajaram	Computer Concepts & C Program, Scitech

CS-_291 Principles of Computer Programming Lab 0-0-3-3-2:

Exercises should include but not limited to:
1. DOS System commands and Editors (Preliminaries)
2. UNIX system commands and vi (Preliminaries)
3. Simple Programs: simple and compound interest. To check whether a given number is a palindrome or not, evaluate summation series, factorial of a number , generate Pascal's triangle,find roots of a quadratic equation
4. Programs to demonstrate control structure : text processing, use of break and continue, etc.
5. Programs involving functions and recursion
6. Programs involving the use of arrays with subscripts and pointers
7. Programs using structures and files.

M-201 Mathematics-II 3-1-0-4-4:

Module I

Matrix: Determinant of a square matrix, Minors and Cofactors, Laplace's method of expansion of a determinant, Product of two determinants, Adjoint of a determinant, Jacobi's theorem on adjoint determinant. Singular and non-singular matrices, Adjoint of a matrix, Inverse of a non-singular matrix and its properties, orthogonal matrix and its properties, Trace of a matrix. Rank of a matrix and its determination using elementary row and column operations, Solution of simultaneous linear equations by matrix inversion method, Consistency and inconsistency of a system of

homogeneous and inhomogeneous linear simultaneous equations, Eigen values and eigen vectors of a square matrix (of order 2 or 3), Caley-Hamilton theorem and its applications. **9L**

Module II

Successive differentiation: Higher order derivatives of a function of single variable, Leibnitz's theorem (statement only and its application, Problems of the type of recurrence relations in derivatives of different orders and also to find $(y_n)_0$. **2L**

Mean Value Theorems & Expansion of Functions: Rolle's theorem and its application, Mean Value theorems – Lagrange & Cauchy and their application, Taylor's theorem with Lagrange's and Cauchy's form of remainders and its application, Expansions of functions by Taylor's and Maclaurin's theorem, Maclaurin's infinite series expansion of the functions: $\sin x, \cos x, e^x, log(1+x), (a+x)^n$, *n* being an integer or a fraction. **5L**

Reduction formula: Reduction formulae both for indefinite and definite integrals of types

$$\int sin^n x\,dx, \int cos^n x\,dx, \int sin^m x cos^n x\,dx, \int cos^m x \sin nx\,dx, \int \frac{dx}{(x^2+a^2)^n}$$

where m, n are positive integers. **2L**

Module III

Calculus of Functions of Several Variables: Introduction to functions of several variables with examples, Knowledge of limit and continuity, Partial derivatives and related problems, Homogeneous functions and Euler's theorem and related problems up to three variables, Chain rules, Differentiation of implicit functions, Total differentials and their related problems, Jacobians up to three variables and related problems, Maxima, minima and saddle points of functions and related problems, Concept of line integrals, Double and triple integrals. **9L**

Module IV

Infinite Series: Preliminary ideas of sequence, Infinite series and their convergence/divergence, Infinite series of positive terms, Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test and Raabe's test (statements and related problems on these tests), Alternating series, Leibnitz's Test (statement, definition) illustrated by simple example, Absolute convergence and Conditional convergence. **5L**

Module-V

Vector Algebra and Vector Calculus: Scalar and vector fields – definition and terminologies, dot and cross products, scalar and vector triple products and related problems, Equation of straight line, plane and sphere, Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative. Related problems on these topics. Green's theorem, Gauss Divergence Theorem and Stoke's theorem (Statements and applications). **8L**

Total 40 Lectures

Suggested Reference Books

1. **Advanced Engineering Mathematics** 8e by Erwin Kreyszig is published by Wiley India
2. **Engineering Mathematics**: B.S. Grewal
5**. Calculus**: M. J. Strauss, G. L. Bradley and K. L. Smith (3PrdP Edition, 1PstP Indian Edition 2007, Pearson Education)
6**. Engineering Mathematics**: S. S. Sastry (PHI)
7. **Advanced Engineering Mathematics, 3E**: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP),Indian Edition.
8. **Differential Calculas**, Ghosh & Maity (Central)
9. **Integral Calculus**, Ghosh & Maity (Central)
10. **Higher Algebra-Classical & Modern**, J.G. Chakravorty and P.R. Ghosh(U.N. Dhur)

11. **Vector Analysis (Schaum Series),** M. R. Spiegel (MGH)

ME-201 Engineering Mechanics 3-1-0-4-4:

Module – 1: Importance of mechanics in Engg.;Introduction to Statics; Concept of particle and Rigid Body; Types of Forces: 2L

Introduction to Vector Algebra; Parallelogram Law; Triangle and Polygon Law; Addition and Subtraction of Vector; Dot product and Cross product of Vectors; Unit Vector; Dot product and Cross product of Vectors and their applications. Types of Vectors (Sliding Vector, Bound Vector). 4L+1T

Two dimensional force system, Resolution of forces; Moments; Varignon's theorem; Couple; Equivalence of Force and Force –Couple system. 4L+2T

Module – II

Equilibrium of a body under two dimensional force system and under two dimensional force-moment system; Free body diagram; Lami's Theorem. 3L+1T

Friction; Co-efficient of friction; Laws of friction; Angle of Repose; Wedge friction. 3L+1T

Module – III

Centroid and Centre of Gravity; Centroid of Triangle, Quadrant of a circle and rectangle; Centroid of a composite area. 3L+1T

Moment of Inertia of a plane figure about Co-planer axes; Parallel axis theorem; Polar Moment of Inertia; Mass Moment of Inertia of cylinder, sphere and cone about the axis of symmetry. 3L+1T

Module – IV

Introduction to Dynamics; Kinematics and Kinetics; Newton's Laws of motion; Plane rectilinear motion under uniform and non-uniform acceleration; 3L+1T

x-t, v-t and a-t graphs; Motion under gravity; Plane Curvilinear motion; Circular motion; Projectile motion. 3L+1T

Module –V

Kinetics of particles; Newton's second Law; D' Alembert's principle; Principle of work, Energy and power; Principle of conservation of energy. 3L+1T

Module –VI

Concept of stresses and strains; Normal stress; Shear stress; Normal strain; Shear strain; Hooke's Law; Poisson's ratio; Stress-strain diagram of ductile material and brittle material; Elastic Modulus and Shear Modulus; Factor of safety-basic idea; bulk Modulus; Volumetric strain. 3L+1T

Books Recommended :

1. Engineering mechanics : Statics and dynamics by I.H. Shames, 4th ed. – PHI.
2. Engineering mechanics by Timoshenko, Young and Rao, Revised 4th ed. – TMH.
3. Elements of Strength of Materials by Timoshenko & Young, 5th ed. – E.W.P.
4. Fundamentals of Engineering Mechanics by Debabrata Nag & abhijit Chanda – Chhaya Prakashani.
5. Engineering Mechanics by Basudeb Bhattacharya- Oxford University press.
6. Engineering Mechanics: Statics & Dynamics by Hibbeler & Gupta, 11th ed. – pearson.
7. Engineering mechanics [vol-1 & II] by Meriam & kraige, 5th ed. – Wiley india.

ME-291 Engineering Drawing & Graphics Lab. 0-0-3-3-2:

A. THEORETICAL PART

1. Introduction to Lines , Lettering, Dimensioning, Scales. – 1L
2. Geometrical Construction and curves. – 1L
3. Projection of points, Lines and Surfaces. – 2L
4. Projection of solids. – 2L
5. Isometric Views. – 1L
6. Sectional Views. - 1L
7. Development of Surfaces. – 1L
8. Introduction to Computer Aided Drafting. – 3L

B. PRACTICAL PART

1. LINES, LETTERING, DIMENSIONING, SCALES: Plain scale, Diagonal scale. - 6hrs.
2. GEOMETRICAL CONSTRUCTION AND CURVES : Construction of Polygons, Parabola, Hyperbola , Ellipse. – 6 hrs.
3. PROJECTION OF POINTS, LINES, SURFACES : Orthographic projection – 1st and 3rd angle projection, Projection of lines and surfaces – Hexagon. – 3 hrs.
4. PROJECTION OF SOLIDS : Cube, Pyramid, prism, Cylinder, Cone. – 6 hrs.
5. DRAWING ISOMETRIC VIEW FROM ORTHOGONAL / SECTIONAL VIEWS OF SIMPLE SOLID OBJECTS. – 3 hrs.
6. FULL AND HALF SECTIONAL VIEWS OF SOLIDS. – 3 hrs.
7. DEVELOPMENT OF SURFACES : Prism , Cylinder, Cone. – 3 hrs.

Books Recommended :

1. Narayana, K.L. and Kannaiah, P. Text Book of engineering Drawing " Engineering Graphics", scitech Publication.
2. Bhatt, N.D. "Elementary Engineering Drawing", Charotar Book Stall, Anand,1998.
3. Lakhsminarayanan, v. and Vaish Wanar, R.S., " Engineering Graphics", Jain brothers, New Delhi,1998.
4. Chandra, A.M. and Chandra Satish, " Engineering Graphics", Narosa, 1998.
5. Jolhe, " Engineering Graphics", Tata Mc Graw –Hill – WBUT Series.
6. Gill, P.S., " A Text Book of Engg Drawing", Katson Publishing House (Kataria and Sons).
7. Venugopal, K., " Engineering Drawing & Graphics+ AUTO CAD", New Age International.
8. Venkata Reddy K., " Text Book of Engineering Drawing (2nd Edition)", BS Publication.

XC -281 Extra Curricular Activities 0-0-2-2-1:

a) Creating awareness in social issues
b) Participating in mass education programmes
c) Proposal for local slum area development
d) Waste disposal
e) Environmental awareness
f) Production Oriented Programmes
g) Relief & Rehabilitation work during Natural calamities

Creating awareness in social issues:

1. Women's development – includes health, income-generation, rights awareness.
2. Hospital activities – Eg. Writing letters for patients, guiding visitors
3. Old age home – visiting the aging in-mates, arranging for their entertainment.
4. Children's Homes – visiting the young in-mates, arranging for their entertainment
5. Linking with NGOs to work on other social issues. (Eg. Children of sex-workers)

6. Gender issues- Developing an awareness, to link it with Women's Cell of college
Participating in mass education programmes
1.Adult education
2. Children's education
Proposal for local slum area development
One or two slums to be identified and according to the needs, activities to be developed and proposals and reports are to be submitted.
Environmental awareness
• Resource conservation – Awareness to be developed on water, energy,soil.
• Preservation of heritage monuments- Marches, poster campaigns
• Alternative energy consciousness amongst younger school-children.
• Plantation and beautification- Plantation of trees, their preservation and upkeep, developing NSS parks.
• Waste disposal- Proper methods of domestic waste disposal.
Production Oriented Programmes
5. Working with people and explaining and teaching improved agricultural practices
6. Rodent control land pest control practices;
7. Soil-testing, soil health care and soil conservation;
8. Assistance in repair of agriculture machinery;
9. Work for the promotion and strengthening of cooperative societies in villages;
10. Assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
11. Popularization of small savings and
12. Assistance in procuring bank loans
Relief & Rehabilitation work during Natural calamities
g) Assisting the authorities in distribution of rations, medicine, clothes etc.;
h) Assisting the health authorities in inoculation and immunization, supply of medicine etc.;
i) Working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;
j) Assisting and working with local authorities in relief and rescue operation;Collection of clothes and other materials, and sending the same to the affected areas;

3rd Semester

CIRCUIT THEORY & NETWORKS
Code : EC 301 Contacts : 3L +1T =4hrs Credits :4

1. **a)** ***Resonant Circuits***: Series and Parallel resonance , (*) ***Impedance and Admittance Characteristics,*** *Quality Factor, Half Power Points, Bandwidth , Phasor diagrams, Transform diagrams , Practical resonant and series circuits, Solution of Problems,*

b) Mesh Current Network Analysis: Kirchoff's Voltage law, Formulation of mesh equations, Solution of mesh equations by Cramer's rule and matrix method , Driving point impedance, Transfer impedance , Solution of problems with DC and AC sources

2. **a) Node Voltage Network Analysis**: Kirchoff's Current law, Formulation of Node equations and solutions, driving point admittance, transfer Admittance, Solution of problems with DC and AC sources
b) Network Theorems: Definition and Implication of Superposition Theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Compensation theorem, maximum Power Transfer theorem,

Millman's theorem, Star delta transformations, Solutions and problems with DC and AC sources. 3. ***Graph of Network***: Concept of Tree and Branch, tree link, junctions, ***(*) Incident matrix, Tie set matrix, Determination of loop current and node voltages***

Coupled Circuits: Magnetic coupling, polarity of coils, polarity of induced voltage, concept of Self and mutual inductance, Coefficient of coupling, Solution of Problems.

Circuit transients: DC transients in R-L and R-C Circuits with and without initial charge, ***(*) R-L-C Circuits, AC Transients in sinusoidal R-L, R-C and R-L-C Circuits, Solution of Problems.*** 4. **Laplace transform**: Concept of Complex frequency, transform of f(t) into F(s), transform of step, exponential, over damped surge, critically damped surge, damped and un-damped sine functions, properties of Laplace transform], linearity, real differentiation, real integration, initial value theorem and final value theorem, inverse Laplace transform, application in circuit analysis, Partial fraction expansion, Heaviside's expansion theorem, Solution of problems.***(*) Laplace transform and Inverse Laplace transform]***.

Two Port Networks: Relationship of Two port network variables, short circuit admittance parameters, open circuit impedance parameters, transmission parameters, relationship between parameter sets, network functions for ladder network and general network.

Text Books:

1. Valkenburg M. E. Van, "Network Analysis", Prentice Hall./Pearson Education
2. Hayt "Engg Circuit Analysis" 6/e Tata McGraw-Hill
3. D.A.Bell- Electrical Circuits- Oxford

Reference Books:

1. A.B.Carlson-Circuits- Cenage Learning
2. John Bird- Electrical Circuit Theory and Technology- 3/e- Elsevier (Indian Reprint)
3. Skilling H.H.: "Electrical Engineering Circuits", John Wiley & Sons.
4. Edminister J.A.: "Theory & Problems of Electric Circuits", McGraw-Hill Co.
5. Kuo F. F., "Network Analysis & Synthesis", John Wiley & Sons.
6. R.A.DeCarlo & P.M.Lin- Linear Circuit Analysis- Oxford
7. P.Ramesh Babu- Electrical Circuit Analysis- Scitech
8. Sudhakar: "Circuits & Networks:Analysis & Synthesis" 2/e TMH
9. M.S.Sukhija & T.K.NagSarkar- Circuits and Networks-Oxford
10. Sivandam- "Electric Circuits and Analysis", Vikas

11. V.K. Chandna, "A Text Book of Network Theory & Circuit Analysis",Cyber Tech
12. Reza F. M. and Seely S., "Modern Network Analysis", Mc.Graw Hill .
13. M. H. Rashid: "Introduction to PSpice using OrCAD for circuits and electronics", Pearson/PHI
14. Roy Choudhury D., "Networks and Systems", New Age International Publishers.
15. D.Chattopadhyay and P.C.Rakshit: "Electrical Circuits" New Age

Circuits and Networks Laboratory
Code: EC391

Contacts: 3P

Credits: 2

1. Characteristics of Series & Parallel Resonant circuits
2. Verification of Network Theorems
3. Transient Response in R-L & R-C Networks ; simulation / hardware
4. Transient Response in RLC Series & Parallel Circuits & Networks ; simulation / hardware
5. Determination of Impedance (Z), and Admittance (Y) parameters of Two-port networks
6. Generation of periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, and ramp signals using MATLAB
7. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in s-domain and cascade connection of second-order systems using MATLAB
8. Determination of Laplace Transform, different time domain functions, and Inverse Laplace
9. Transformation using MATLAB

Note: An Institution / college may opt for some other hardware or software simulation wherever possible in
place of MATLAB

Paper Name:-	Basic Environmental Engineering & Elementary Biology
Paper Code:-	CH301
Contacts:-	3-0-0-3
Credit Point:-	3

Syllabus:-Basic ideas of environment, basic concepts, man, society & environment, their interrelationship. Mathematics of population growth and associated problems, Importance of population study in environmental engineering, Definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis Population growth, Sustainable Development.

Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function.

Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and Control/management; anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.

Ecology: Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function.

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundarban); Food chain [definition and one example of each food chain], Food web.

Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]

Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.

Air pollution and control:

Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause.

Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.

Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food.Global warming and its consequence, Control of Global warming.

Earth's heat budget.
Lapse rate: Ambient lapse rate adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).
Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.
Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant.
Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN.
Smog, Photochemical smog and London smog.
Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other greenhouse gases, effect of ozone modification.
Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). 1L
Water Pollution and Control
Hydrosphere, Hydrological cycle and Natural water.
Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application,
Heavy metals, pesticides, volatile organic compounds.
River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of
Oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH.
Lake: Eutrophication [Definition, source and effect].
Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)
Standard and control: Waste water standard [BOD, COD, Oil, Grease],
Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening]
Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition.
Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic
Land Pollution:
Lithosphere; Internal structure of earth, rock and soil.
Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling.
Solid waste management and control (hazardous and biomedical waste).
Noise Pollution
Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise]
Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, 10 L (18hr Index), Ldn.
Noise pollution control.
Environmental Management:
Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol.

Reference

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd.,
2. De, A. K., "Environmental Chemistry", New Age International.

Paper Name:-	Numerical Methods
Paper Code:-	-M(CS) 301
Contacts:-	3-0-0-3
Credit Point:-	3

Syllabus:-

What is Numerical Analysis?

Errors in Numerical computation : Gross error, Round off error, Truncation error, Approximate numbers. Significant figures. Absolute, relative and percentage error. Definition of Operators: $\Delta, \nabla, E, E^{-1}, \mu, \delta$ and simple relation among them.

Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.

Numerical Differentiation based on Newton's forward and backward and Lagrange's formulae.

Numerical Integration : Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Expression for corresponding error terms.

Numerical solution of a system of linear equations : Gauss elimination method, Matrix inversion, LU factorization method, Gauss-Seidel iterative method, Gauss-Jacobi method.

Numerical Solution of Algebraic equation : Bisection method, Regula-Falsi method, Newton-Raphson method.

Numerical Solution of Ordinary Differential Equation : Euler's method, Modified Euler's method, Runge-Kutta methods, Picard's method, Taylor's Method.

Reference

1.Numerical Analysis & Computational Proc... Mollah Sa, Sa.
2. N. Dutta : Computer Programming & Numerical Analysis, Universities Press.
3. E.Balagurusamy, Numerical Methods.
4. Aitkinsion : Elementary Numerical Analysis

Paper Name:-	Numerical Methods Lab
Paper Code:-	M(CS) 391
Contacts:-	0-0-2-2
Credit Point:-	2

Syllabus:-

Assignments on Newton forward /backward, Lagrange's interpolation.

Assignments on Interpolation, Newton's Divided difference.

Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule.

Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.

Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton-Raphson methods.

Assignments on ordinary differential equation: Euler's and Runga-Kutta methods.

M-302 Mathematics-III 3-1-0-4-4:

Fourier Series: Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed wave, Triangular wave.

Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π, Fourier Series for functions

of period 2l, Dirichlet's conditions, Sum of Fourier series. Examples. Theorem for the convergence of Fourier Series (statement only). Fourier Series of a function with its periodic extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity (statement only).Examples.

Fourier Transform: Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine & Sine Transforms of elementary functions. Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples.Fourier Transform of Derivatives.Examples.Convolution Theorem (statement only), Inverse of Fourier Transform, Examples.

Calculus of Complex Variable : Complex functions, Concept of Limit, Continuity and Differentiability. Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient condition for a function to be

analytic. Harmonic function and Conjugate Harmonic function, related problems. Construction of Analytic functions: Milne Thomson method, related problems**.**

Concept of simple curve, closed curve, smooth curve & contour. Some elementary properties of complex Integrals. Line integrals along a piecewise smooth curve. Examples. Cauchy's theorem (statement only).Cauchy-Goursat theorem (statement only).Examples. Cauchy's integral formula, Cauchy's integral formula for the derivative of an analytic function, Cauchy's integral formula for the successive derivatives of an analytic function. Examples. Taylor's series, Laurent's series. Examples.

Zero of an Analytic function, order of zero, Singularities of an analytic function. Isolated and non-isolated singularity, essential singularities. Poles: simple pole, pole of order m. Examples on determination of singularities and their nature. Residue, Cauchy's Residue theorem (statement only), problems on finding the residue of a given function, evaluation of definite integrals:

$$\oint_0^{\infty} \frac{\sin x}{x}\,dx,\ \int_0^{2\pi} \frac{d\theta}{a+b\cos\theta+c\sin\theta},\ \oint_C \frac{P(z)}{Q(z)}dz$$

(elementary cases, P(z) & Q(z) are polynomials of 2nd order or less).

Concept of transformation from z-plane to w-plane. Concept of Conformal Mapping. Idea of some standard transformations. Bilinear Transformation and determination of its fixed point.

Probability: Classical definition of probability and its limitation. Axiomatic definition of probability. Conditional probability. Independent events and related problems. Baye's theorem (Statement only) & related problems. One dimensional random variable. Probability distributions-discrete and continuous.

Expectation and Varience. Binomial, Poisson, Uniform, Exponential, Normal distributions and related problems.

Partial Differential Equation (PDE): Solution by Separation of variables and Integral Transform(Laplace & Fourier transform) methods:(i) One dimensional Wave equation (ii) One dimensional Heat equation, (iii) Two dimensional Laplace equation.

Series solution of Ordinary Differential Equation (ODE): Validity of the series solution of an ordinary differential equation. General method to solve $a_0(x)\,y'' + a_1(x)y' + a_2(x)\,y = 0$ and related problems. Series solution, Bessel function, recurrence relations of Bessel's Function of first kind. Legendre's equation: Series solution, Legendre function, recurrence relations and orthogonality relation.

Text Books:

1. Brown J.W and Churchill R.V: Complex Variables and Applications, McGraw-Hill.
2. Das N.G.: Statistical Methods, TMH.
3. Grewal B S: Higher Engineering Mathematics, Khanna Publishers.
4. James G.: Advanced Modern Engineering Mathematics, Pearson Education.
5. Lipschutz S., and Lipson M.L.: Probability (Schaum's Outline Series), TMH.

References:

1. Sneddon, I. N..: Elements of Partial Differential Equations, McGraw-Hill International
2. Kreyzig E.: Advanced Engineering Mathematics, John Wiley and Sons.
3. Potter M.C, Goldberg J.L and Aboufadel E.F.: Advanced Engineering Mathematics, OUP.
4. Ramana B.V.: Higher Engineering Mathematics, TMH.
5. Spiegel M.R. , Lipschutz S., John J.S., and Spellman D., : Complex Variables, TMH.
6. Sneddon, I. N..: Fourier Transforms, Dover
7. Sneddon, I. N..: Use of Integral Transforms, MGH
8. Bhatia, R, Fourier Series, MAA

Signal & Systems

Code : EC 302 **Contacts : 3L +0T =3hrs** **Credits :3**

Module No	Topic	Hrs
1.	Introduction to signal and systems : Continuous and discrete time signals: Classification of Signals – Periodic aperiodic even – odd – energy and power signals – Deterministic an d random signals – complex exponential and sinusoid al signals – periodicity –unit impulse – unit step – Transforma tion of independent variable of signals: time scaling, time shifting. System properties: Linearity, Causality, time invariance and stability. Dirichlet's conditions, Determination of Fourier series coefficients of signal	**8**
2.	Signal Transformation : Fourier transformation of continuous and discrete time signals and their properties. Laplace transformation- analysis with examples and properties. Parseval's theorem; Convolution in time (both d iscrete and continuous) and frequency domains with magnitude and phase	**8**

	response of LTI systems.	
3.	Laplace Transform:Recapitulation, Analysis and characterization of LTI systems using Laplace transform: Computation of impulse response and transfer function using Laplace transform.	**2**
4.	Sampling Theorem : Representation of continuous time signals by its sample –Types of sampling, Sampling theorem. Reconstruction of a Signal from its samples, aliasing –sampling of band pass signals.	**4**
5.	Z-Transforms:Basic principles of z-transform - z-transform definition –, Relationship between z-transform and Fourier transform, region of convergence – properties of ROC – Properties of z-transform – Poles and Zeros – inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion	**6**
6.	Random Signals & Systems: Definitions, distribution & density functions, mean values & moments, function of two random variables, concepts of correlation, random processe s, spectral densities, response of LTI systems to random inputs.	**4**

Text Books:
1.A.V.Oppenheim, A.S.Willsky and S.H.Nawab -Signals &Systems, Pearson
2.S.Haykin & B.V.Veen, Signals and Systems- John Wiley
3.P.Ramesh Babu & R.Anandanatarajan- Signals and Systems 4/e- Scitech
References:
1.J.G.Proakis & D.G.Manolakis- Digital Signal Processing Principles, Algorithms and Applications, PHI.
2.C-T Chen- Signals and Systems- Oxford
3.E WKamen &BS Heck- Fundamentals of Signals and Systems Using the Web and Matlab- Pearson
4.B.P.Lathi- Signal Processing & Linear Systems- Oxford
5.6.M.J.Roberts, Signals and Systems Analysis using Transform method and MATLAB, TMH
6..S Ghosh- Signals and Systems- Pearson
7.M.H.Hays- Digital Signal Processing ", Schaum's outlines, TMH
8.Ashok Ambardar, -Analog and Digital Signal Processing- Thomson.
9.Phillip, Parr & Riskin- Signal, Systems and Transforms- Pearson

Analog Electronics

Code : EC 303 **Contacts : 3L +1T =4hrs** **Credits :4**

Module No	**Topic**	**Hrs**

1.	Transistor Biasing and Stability: Q-point, Self Bias-CE, Compensation techniques, h-model of transistors. Expression for voltage gain, current gain, input and output impedance, trans-resistance & trans-conductance; Emitter follower circuits, High frequency model of transistors	**6**
2.	1. Transistor Amplifiers: RC coupled amplifier, functions of all components, equivalent circuit, derivation of voltage gain, current gain, input impedance and output impedance, frequency response characteristics, lower and upper half frequencies, bandwidth, and concept of wide band amplifier. [6] 2. FET amplifier: CS and CD amplifier operations. Equivalent circuit [4]. 3. Feedback Amplifiers & Oscillators: Feedback concept, negative & positive feedback, voltage/ current, series/shunt feedback, Berkhausen criterion, Colpitts, Hartley's, Phase shift, Wein bridge and crystal oscillators. [4]	**14**
3.	1. Operational Amplifier: Ideal OPAMP, Differential Amplifier, Constant current source (current mirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive& negative), inverting & non-inverting amplifiers, voltage follower/buffer circuit. [6] 2. Applications of Operational Amplifiers: adder, integrator & differentiator, comparator, Schmitt Trigger. Instrumentation Amplifier, Log & Anti-logamplifiers, Trans-conductance multiplier, Precision Rectifier, voltage to current and current to voltage converter, free running oscillator. [6]	**12**
4.	1. Power amplifiers – Class A, B, AB, C, Conversion efficiency, Tuned amplifier [4] 2. Regulators: series and shunt voltage regulator, percentage regulation, 78xx and 79xx series, concept of SMPS. [3] 3. Special Functional Circuits: VCO and PLL. [1]	**8**

Text Books:

1. Sedra & Smith-Microelectronic Circuits- Oxford UP
2. Franco—Design with Operational Amplifiers & Analog Integrated Circuits , 3/e, McGraw Hill
3. Boylested & Nashelsky- Electronic Devices and Circuit Theory- Pearson/PHI

Reference Books:

1. Millman & Halkias – Integrated El;ectronics, McGraw Hill.
2. Rashid-Microelectronic Circuits-Analysisand Design- Thomson (Cenage Learning)
3. Schilling & Belove—Electronic Circuit:Discrete & Integrated , 3/e , McGraw Hill
4. Razavi- Fundamentals of Microelectronic s- Wiley
5. Malvino—Electronic Principles , 6/e , McGraw Hill
6. Horowitz & Hill- The Art of Electronics;Cambridge University Press.
7. Bell- Operational Amplifiers and Linear ICs- Oxford UP
8. Tobey & Grame – Operational Amplifier: Design and Applications, Mc GrawHill.
9. Gayakwad R.A -- OpAmps and Linear IC's, PHI

Signals and Systems Laboratory

Code: EC 392 Contacts: 3P Credits: 2

1. To study different signals & their properties.
2. To study salient properties of systems.
3. To demonstrate how analog signals are sampled and how different sampling rates affect the outputs.
4. To study linear convolution of two sequences.
5. To compare Fourier and Laplace transformations of a signal
6. To study Z- transform of different sequences.
7. To study sampling theorem for low pass signals and band pass signals
8. To determine the components of Square wave

Analog Electronics Laboratory

Code:EC393. Contacts: 3P Credits: 2

Any 8 experiments. A College has to design a new design oriented experiment.

1. Study of Diode as clipper & clamper
2. Study of Zener diode as a voltage regulator
3. Study of ripple and regulation characteristics of full wave rectifier without and with capacitor filter
4. Study of characteristics curves of B.J.T &F.E.T .
5. Design a two-stage R-C coupled amplifier &study of it's gain & Bandwidth.
6. Study of class A & class B power amplifiers.
7. Study of class C & Push-Pull amplifiers.
8. Realization of current mirror & level shifter circuit using Operational Amplifiers.
9. Study of SMPS & construction of a linear voltage regulator using regulator IC chip.
10. Design a simple function generator using IC.
11. Realization of a V-to-I & I-to-V converterusing Op-Amps.
12. Realization of a Phase Locked Loop using Voltage Controlled Oscillator (VCO).

HU-401 VALUES & ETHICS IN PROFESSION 3-0-0-3-3:

Science, Technology and Engineering as knowledge and as Social and Professional Activities.

Effects of Technological Growth: Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development

Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics,

Appropriate Technology Movement of Schumacher; later developments Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.

Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

Ethics of Profession: Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Profession and Human Values: Values Crisis in contemporary society

Nature of values: Value Spectrum of a good life
Psychological values: Integrated personality; mental health
Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.
Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity
Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.
Books:
1. Stephen H Unger, Controlling Technology: Ethics andthe Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

PH401 : :Physics-II Contacts : 3L + 1T Credits : 4
Module 1:Vector Calculus:
1.1 Physical significances of grad, div, curl. Line integral, surface integral, volume integral- physical examples in the context of electricity and magnetism and statements of Stokes theorem and Gauss theorem [No Proof]. Expression of grad, div, curl and Laplacian in Spherical and Cylindrical co-ordinates.
Module 2 :Electricity
2.1 Coulumbs law in vector form. Electrostatic field and its curl. Gauss's law in integral form and conversion to differential form . Electrostatic potential and field, Poisson's Eqn. Laplace's eqn (Application to Cartesian, Spherically and Cylindrically symmetric systems – effective 1D problems) Electric current, drift velocity, current density, continuity equation, steady current.
2.2 Dielectrics-concept of polarization, the relation $D=\varepsilon_0 E+P$, Polarizability. Electronic polarization and polarization in monoatomic and polyatomic gases.
Module 3: Magnetostatics & Time Varying Field: Lorentz force, force on a small current element placed in a magnetic field. Biot-Savart law and its applications, divergence of magnetic field, vector potential, Ampere's law in integral form and conversion to differential form. Faraday's law of electro- magnetic induction in integral form and conversion to differential form.
Module 4: Electromagnetic Theory:
4.1 Concept of displacement current Maxwell's field equations, Maxwell's wave equation and its solution for free space. E.M. wave in a charge free conducting media, Skin depth, physical significance of Skin Depth, E.M. energy flow, & Poynting Vector.Module
5:Quantum Mechanics: 5.1 Generalised coordinates, Lagrange's Equation of motion and Lagrangian, generalised force potential, momenta and energy. Hamilton'sEquation of motion and Hamiltonian. Properties of Hamilton and Hamilton's equation of motion.
Course should be discussed along with physical problems of 1-D motion
5.2 Concept of probability and probability density, operators, commutator. Formulation of quantum mechanics and Basic postulates, Operator correspondence, Time dependent Schrödinger's equation, formulation of time independent Schrödinger's equation by method ofseparation of variables, Physical interpretation of wave function ψ (normalization and probability interpretation), Expectation values,

Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well), Discussion on degenerate levels. Module
6: Statistical Mechanics:
3.1 Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (No deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics Fermi distribution at zero & non-zero temperature, Calculation of Fermi level in metals, also total energy at absolute zero of temperature and total number of particles, Bose-Einstein statistics – Planck's law of blackbody radiation.

Physics-II Lab.
Code: PH-491
Contacts: (3P)
Credit: (2)
Group 1: Experiments on Electricity and Mangentism
1. Determination of dielectric constant of a given dielectric material.
3. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
4. Determination of the thermo-electric power at a certain temperature of the given thermocouple.
5. Determination of specific charge (e/m) of electron by J.J. Thomson's method.
Group 2: Quantum Physics
6. Determination of Planck's constant using photocell.
7. Determination of Lande'g factor using Electron spin resonance spetrometer.
8. Determination of Stefan's radiation constant
9. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
10. Determination of Rydberg constant by studying Hydrogen/ Helium spectrum
Group 3: Modern Physics
11. Determination of Hall co-efficient of semiconductors.
12. Determination of band gap of semiconductors.
13. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.
a) A candidate is required to perform 3 experiments taking one from each group. Initiative should be taken so that most of the
Experiments are covered in a college in the distribution mentioned above. Emphasis should be given on the estimation of error in the data taken.
b) In addition a student should perform one more experiments where he/she will have to transduce the output of any of the above experiments or the experiment mentioned in c] into electrical voltage and collect the data in a computer using phoenix or similar interface.
c) Innovative experiment: One more experiment designed by the student or the concerned teacher or both.

DIGITAL ELECTRONICS

Code : EC 401 **Contacts : 3L =3hrs** **Credits :3**

Module No	Topic	Hrs
1.	**a)** Number systems & Codes; Binary, Octal and Hexadecimal representation and their conversions; BCD,ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic.[5] **b)** Venn diagram, Boolean algebra; Various Logic gates- their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-map method [6]	**11**
2.	a) Combinational circuits- Binary Adder and Subtractor,BCD Adder/Substractor , Series & Parallel Adder,Carry Look Ahead,Comparator Circuit,BCD to 7-segment LED display,Parity generator & Checker Circuit; Applications and circuits of Encoder,Decoder, Comparator, Multiplexer, De-Multiplexer.[5] Memory Systems: RAM, ROM, EPROM, EEROM [4] b) esign of combinational circuits-using ROM, Programming logic devices and gate arrays. (PLAs and PLDs) [4]	**13**
3.	Sequential Circuits- Basic memory element-Latch, Flip Flops -S-R, J-K, D and T, various types of Registers ,Synchronous/Asynchronous counters and their design,Propagation delay through Counter,Irregular counter, State table and state transition diagram & their design. [6]	**6**
4.	a) Different types of A/D and D/A conversion techniques. [4] **b)** Logic families-TTL,ECL,MOS and CMOS, their operation and specifications. [6]	**10**

Textbooks:

1. Morries Mano- Digital Logic Design- PHI
2. Kharate- Digital Electronics- Oxford
3. Floyed & Jain- Digital Fundamentals-Pearson

Reference:

1. R.P.Jain—Modern Digital Electronics, 2/e , Mc Graw Hill
2. S.K.Mandal, Digital Electronics Principles and Applications- Mc Graw Hill.
3. P.Raja- Digital Electronics- Scitech Publications
4. S.Aligahanan, S.Aribazhagan, Digital Circuit & Design- Bikas Publishing

Analog Communication

Code : EC 402 **Contacts : 3L +1T =4hrs** **Credits :4**

Pre-requisites:

Basic Electronics and Engineering Mathematics

Module No	Topic	Hrs
1.	Introduction: Historical Review, Elements of an Electrical Communication System, Communication Channel and their Characteristics, Mathematical Models for Communication Channels.	**3**
2.	Frequency Domain Analysis of Signals and Systems: The Fourier Transform,	**8**

	Properties of the Fourier Transform, Rayleigh's Energy Theorem, the inverse relationship between time and frequency, Dirac Delta Function, Fourier transform of Periodic signals, transformation of signals through Linear systems, Paley-Wiener Criterion, Hilbert transform, Band Pass signals, Transmission of Band Pass signals, Phase and group delay.	
3.	Analog Signals Transmission and Reception : Introduction, Amplitude Modulation, Double side Band Suppressed carrier Amplitude Modulation, Single side band Amplitude Modulation, Vestigial side band Modulation, Implementation of AM Modulators and De-Modulators, Frequency division Multiplexing, Analog Modulation, representation of FM and PM signals, Spectral Characteristic of Analog Modulated Signals, Implementation of Angle Modulators and De-Modulators, AM Radio Broadcasting, FM Radio Broadcasting , Introduction to Mobile Radio System.	**12**
4.	Random Process: Probability and Random Variables, Statistical Averages, Basic concept of Random Process, Stationarity, Mean, Correlation and Covariance function, Ergodicity, Transmission of a Random Process through a linear fitter, Power spectral Density Gaussian process and white process, Noise, Noise Equivalent Bandwidth.	**6**
5.	Effect of Noise on Analog communication System: Effect of Noise on AM, Effect of Noise on DSB-SCAM, Effect of Noise on SSBAM, Carrier Phase Estimation with Phase Locked loop, Effect of Noise on Angle Modulation, Threshold Effect in Angle Modulation, Pre-emphasis and De-emphasis in FM.	**7**

Text books:

1. Communication Systems — Simon Haykin, John Willey & Sons
2. Communication Systems Engineering — Proakis&Salehi, Pearson Education.

Solid State Devices

Code : EC 403 **Contacts : 3L +0T =3hrs** **Credits :3**

Module No	Topic	Hrs
1.	Energy Bands and Charge Carriers in Semiconductors- Energy-band (E-k) diagram, effective mass, wave vector, Debye length, Direct & indirect band-gap semiconductors; Carrier distribution, Fermi-level, Intrinsic & Extrinsic semiconductors, Non-equilibrium in carrier distribution; drift, diffusion, scattering; Piezo & Hall effects. [8L] Details: [Recapitulation of Conductor, Insulator & Semiconductor with special emphasis on the concept of energy bands and band-gaps, E-k diagrams for direct and indirect band-gap semiconductors (1L)]; Concept of the effective mass & crystal momentum, concept of wave-vector 'k'; Intrinsic & extrinsic semiconductors, idea about degeneracy and non-degeneracy.(2L) Carrier concentration in terms of bulk Density of states and Fermi-Dirac distribution (no derivation, expression and significance only); Concept of Fermi	**8**

	level, F.L. shift with doping & temperature; (2L) Non-equilibrium condition: Drift & diffusion of carriers with simple expressions; Hall effect & Piezo-electric effect, Carrier scattering (basic idea only). Generation and re-combination, quasi-Fermi energy level (concept only) (3L)	
2.	Rectifier and detector diodes: P-N junction & Schottky junction physics, I-V relation, Junction capacitances, Diode switching, Optical devices & Solar cells, Tunnel diode. [10] Details: Homo- and Hetero-junctions – examples of semiconductor-semiconductor junction (Homo) & Metal-metal, Metal-S.C. junctions (Hetero-) (1L); [Recapitulation of the rectifying properties of these two types of junctions;] Homo-junction – Semiconductor-semiconductor p-n junction & rectification (recapitulation) (1L); Plot of junction voltage, field and depletion charge with distance by solving simple 1D Poisson's Equation (Gradual Channel & Depletion Approximations) (1L); Schottky contact & Schottky diode (1L); Junction capacitances in p-n diodes (recapitulation) and their expressions; Application of Diode capacitance in Varactor Diodes (1L); Derivation for Forward and Reverse current, piece-wise linear diode-characteristics, concept of Diode resistance & Differential diode resistance, (1L); Diode switching & diode switch, properties of rectifier and switching diodes (1L); Importance of reverse current in optical detectors, photo-diodes, solar cells (1L); Spontaneous emission & Stimulated emission - optical devices (basic idea only) (1L).], Tunnel diode -(basic principle only - importance of negative resistance) (1L).	**10**
3.	Bipolar Junction Transistors: Physical mechanism, current gain, minority current distribution; Punch-through and avalanche effect; High voltage and high power transistors; Frequency limitations, high frequency transistors, Power transistors. [8] Details: [Emphasis on BJT as a current controlled device, amplification property of BJT (1L); I-V characteristics (input & output) with derivation, input & output characteristics for CB. CE & CC mode, current amplification factors α for CB mode and β for CE mode (2L); Eber's Moll model for Static behaviour & Charge controlled model (without derivation) for dynamic behaviour, equivalent circuits. (2L); Basic idea about Photo-transistors & Power transistors (only their features Vis-à-vis the ordinary transistors) (1L); PNPN transistors - simple working principle,I-V characteristics, triggering, mention of Triacs, Diacs & Thyristors.(2L)	**8**
4.	Field Effect Transistors: JFETS, IJFETS and MOSFETs; MOS-capacitors, flat band and threshold voltages; P and N-channel MOSFETS, CMOS and VLSI MOSFETS, Semiconductor sensors and detectors. [9] Details: [Concept of Field effect device (recapitulation), channel modulation & channel isolation (1L);] JFET - behaviour, characteristics (1L); MOSFET - channel inversion, Ideal Threshold voltage (1L), MOS capacitances, depletion width, surface field and potential (by solving Poisson's equation with gradual channel & depletion approximations) (2L); Real MOSFET & Threshold voltage for real MOSFET, (1L); I-V characteristics with expressions for saturation and non-saturation regions (concepts but no detail derivations, empirical relations to be used for solving problems) (1L); Equivalent circuit for MOSFET (1L); MOSFET for VLSI - scaling issues (basic concept of Short Channel Effects only) (1L);]	**6**

Text Books :

1. Neamen- Semiconductor Physics and Devices TMH
2. Bhattacharya & Sharma- Solid State Electronic Devices- Oxford
3. Maini & Agrawal- Electronics Devices and Circuits- Wiley

Reference Books :

1. Milman, Halkias & Jit- Electronics Devices and Circuits- TMH
2. Bell-Electronics Devices and Circuits-Oxford
3. Bhattacharya & Sharma- Solid State Electronic Devices- Oxford
4. Singh & Singh- Electronics Devices and Integrated Circuits –PHI
5. Bogart, Bisley & Rice- Electronics Devices and Circuits- Pearson
6. Kasap-Principles of Electronic Materials and Devices- TMH
7. Boylestad & Nashelsky- Electronics Devices and Circuit Theory- Pearson
8. Salivahanan, Kumar & Vallavaraj- Electronics Devices and Circuits- TMH

ELECTROMAGNETIC THEORY & TRANSMISSION LINES

Code : EC 404 **Contacts : 3L +0T =3hrs** **Credits :3**

Module No	Topic	Hrs
1.	Vector calculus - orthogonal Coordinate System, Transformations of coordinate systems; Del operator; Gradient, Divergence, Curl - their physical interpretations; Laplacian operator.	**4**
2.	Coulomb's law, electric field intensity, charge distribution; Gauss' law, flux density and electric field intensity. Divergence theorem. Current Densities, Conductors, Poisson's & Laplace's equations. Uniqueness theorem, Biot-Savart law, Ampere's law, Relation between J & H, Vector magnetic Potential, Stokes' theorem	**5**
3.	Faraday's law & Lenz's law. Displacement Current, Jc - Jd Relation, Maxwell's equations, Time-harmonic fields, Wave Equation, Boundary Conditions between media interface; Uniform Plane wave; Plane Wave Propagation in Lossy Dielectric, Loss-less Dielectric, Good Conductor, Free space; Poynting Theorem, Power flow, Poynting vector, Skin Depth, Surface Resistance; Reflection and Transmission for normal incidence	**11**
4.	Transmission Lines; Concept of Lumped parameters and Distributed parameters. Line Parameters, Transmission line equations and solutions, Physical significance of the solutions, Propagation constant, Characteristic Impedance; Wavelength; Velocity of Propagation; Distortion-less Line, Reflection and Transmission coefficients; Standing Waves, VSWR, Input Impedance, Smith Chart - Applications; Load Matching Techniques / Quarter wave Matching, Bandwidth problem; Low loss RF transmission lines, line as circuit elements.	**12**
5.	Types of transmission line (open 2-wire, coaxial line, micro-strip waveguide), applications and limitations: Design principle, Power handling capacity. Power Dissipation, Breakdown with coaxial line and micro strip line as examples.	**4**

Text Books

1. Principles of Electromagnetics, 4th Edition, Matthew O H Sadiku, Oxford University Press.
2. Electromagnetic waves & radiating systems- Edward C Jordon, Keith G Balmain, 2nd Edition,Prentice hall,
3. Electromagnetic Field Theory & Transmission Lines, G.S.N. Raju, Pearson Education
4. Electromagnetic Waves Shevgaonkar, Tata-McGaw-Hill

Reference Books

1. Engineering Electromagnetics, 2ed Edition - Nathan Ida, Springer India
2. Fields & Waves in Communication Electronics, S. Ramo, J. R. Whinnery & T. Van Duzer, JohnWiley
3. Electromagnetic Theory & Applications, A. K. Saxena, Narosa Publishing House Pvt. Ltd.
4. Electromagnetics, 2ed Edition – J A Edminister, Tata-McGraw-Hill.
5. Electromagnetic Waves and Transmission Lines- by G.Prasad, J.Prasad and J.Reddy- Scitech

Digital Electronic Laboratory

Code: EC491 Contacts: 3P Credits: 2

1. Realization of basic gates using Universal logic gates.
2. Code conversion circuits- BCD to Excess-3 and vice-versa.
3 Four-bit parity generator and comparator circuits.
4. Construction of simple Decoder and Multiplexer circuits using logic gates.
5. Design of combinational circuit for BCD to decimal conversion to drive 7-segment display using multiplexer.
6. Construction of simple arithmetic circuits-Adder, Subtractor.
7. Realization of RS-JK and D flip-flops using Universal logic gates.
8. Realization of Universal Register using JK flip-flops and logic gates.
9. Realization of Universal Register using multiplexer and flip-flops.
10. Construction of Adder circuit using Shift Register and full Adder.
11. Realization of Asynchronous Up/Down counter.
12. Realization of Synchronous Up/Down counter.
13. Design of Sequential Counter with irregular sequences.
14. Realization of Ring counter and Johnson's counter.
15. Construction of adder circuit using Shift Register and full Adder.

Analog Communication Laboratory

Code: EC 492: Contact: 3P Credits: 2

1. Measurement of modulation index of an AM signal.
2. Measurement of output power with varying modulation index an AM signal for both DSB& SSB.
3. Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB).
4. Measurement of power of different frequency components of a frequency modulated signal & the measurement of the bandwidth.
5. Design a PLL using VCO & to measure the lock frequency.

6. Design a FM demodulator using PLL.
7. Measurement of selectivity, sensitivity, fidelity of a super heterodyne receiver.
8. One innovative experiment

HU-481 Technical Report Writing Practice 0-0-2-2-1:
Guidelines for Course Execution:
Objectives of this Course: This course has been designed:
1. To inculcate a sense of confidence in the students.
2. To help them become good communicators both socially and professionally.
3. To assist them to enhance their power of Technical Communication.
Detailed Course Outlines:
Technical Report Writing:
1. Report Types (Organizational / Commercial / Business / Project)
2. Report Format & Organization of Writing Materials
3. Report Writing (Practice Sessions & Workshops)
Interview Sessions;
a) Training students to face Job Interviews confidently and successfully
b) Arranging Mock Interviews and Practice Sessions for integrating Listening Skill with Speaking Skill in a formal situation for effective communication
4. Presentation:
a) Teaching Presentation as a skill
b) Strategies and Standard Practices of Individual /Group Presentation
c) Media & Means of Presentation: OHP/POWER POINT/ Other Audio-Visual Aids
5. Competitive Examination:
a) Making the students aware of Provincial /National/International Competitive Examinations
b) Strategies/Tactics for success in Competitive Examinations
c) SWOT Analysis and its Application in fixing Target

Books – Recommended:
Nira Konar: English Language Laboratory: A Comprehensive Manual PHI Learning, 2011
D. Sudharani: Advanced Manual for Communication Laboratories & Technical Report Writing Pearson Education (W.B. edition), 2011

Digital Communication

Code : EC 501 **Contacts : 3L +1T =4hrs** **Credits :4**

Pre-requisites:
Fourier Transform & Signal transmission basics

Module No	Topic	Hrs
1.	Introduction: A historical perspective in the development of Digital Communication, Elements of a digital communication system, Analog versus Digital communication system[3L]	**3**
2.	Pulse modulation: Introduction, sampling process, pulse amplitude modulation, TDM, PPM, PDM, bandwidth-noise trade-off, quantization process, PCM, DPCM, DM, Adaptive DPCM, sub-band coding, linear predictive coding [7L]	**7**
3.	Base band pulse transmission: Introduction, matched filter, error rate due to noise, inter	**4**

	symbol interference, NYQUIST'S criterion for distortion less base band binary transmission, correlative level coding. [4L]	
4.	Digital pass-band transmission: Introduction, pass band transmission model, Gram Schmidt orthogonalization procedure, geometric representation of signals, response of bank of correlators, to noisy input, coherent detection of signals in noise, probability of error, correlation receiver, detection of signals with unknown phase, hierarchy of digital modulation techniques, coherent binary PSK, coherent binary FSK, coherent QPSK, coherent minimum shift keying, differential phase shift keying, comparison of binary & quaternary modulation schemes, M-ary modulation techniques, power spectra, bandwidth efficiency, synchronization. [10L]	**10**
5.	Mathematical models of information sources, a logarithmic measure of information, source coding theorem, source coding algorithms- the Huffman source coding algorithm & the Lempel-Ziv source coding. **[6L]**	**6**
6.	Channel capacity & coding: Modeling of communication channels, channel capacity, bounds on communication, coding for reliable communication, linear block codes, cyclic codes, convolutional codes. [6L]	**6**

Text books:

1. Communication Systems: Simon Haykin, John Willey & Sons
2. Communication Systems Engineering Proakis&Salehi, Pearson Education.

Microprocessors & Microcontrollers

Code : EC 502 **Contacts : 3L +1T =4hrs** **Credits :4**

Module No	Topic	Hrs
1.	Introduction to Microcomputer based system. Evolution of Microprocessor and microcontrollers & advantages and disadvantages.	**1**
2.	Architecture, Address / Data Bus multiplexing and demultiplexing. Status and Control signal generation. Instruction set of 8085 Microprocessor. Classification of instructions, addressing modes, timing diagram of the instructions. Assembly language programming: Introduction to 8085 Instructions, Programming Techniques with Additional Instructions, Counters and Time Delays, Stack and Subroutines, Code Conversion, BCD Arithmetic, and 16-Bit Data Operations	**10**
3.	8051 architecture: 8051 micro controller hardware, input/output pins, ports, external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts. Assembly language Programming using 8051. Moving data: External data moves, code memory read only data moves, PUSH and POP op-codes, data exchanges. Logical operations: Byte-level, bit-level, rotate and swap operations. Arithmetic operations: Flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic. Jump and call instructions: Jump and call program range, jump, call and subroutines, interrupts and return.	**7**
4.	The 8086 microprocessor: Architecture: Pin details, memory segmentation, addressing modes, Familiarization of basic Instructions, Interrupts. Assembly language programming: Addition, Multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallest number etc.	**7**
5.	Interfacing Peripheral devices: Data Transfer Scheme, Types of Transmission, 8257 (DMA), 8255 (PPI), 8251,8259,Interfacing 0f 8253,8254 programmable timer,	**7**

	organization & interfacing with 80S5, 8279 keyboard& display, controller, organization & interfacing with 8085, analog & digital interfacing using 8255,keyboard/display interfacing using 8255 & 8279, ADC / DAC interfacing with 8085, 8086 & 8051.	

TEXT BOOKS:

1. Microprocessor architecture, programming and application with 8085 – R. Gaonkar (Penram International)
2. The 8051 microcontroller - K. Ayala (Thomson)
3. Ray & Bhurchandi, Advanced Microprocessors & Peripherals, TMH
4. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (PEARSON)
5. An Introduction to Microprocessor and Applications –Krishna Kant (Macmillan)

References:

1. Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan (Oxford university press).
2. 8086 Microprocessor –K Ayala (Cengage learning)

Antenna & Propagation

Code : EC 503 **Contacts : 3L +0T =3hrs** **Credits :3**

Module No	Topic	Hrs
1.	Review of Maxwell's Equation; Radiation of e.m waves and introducing Antenna; Vector Potential and Retarded Vector Potential; Radiation fields of a Hertzian dipole(electric) (3)	**3**
2.	Antenna Characteristics: Radiation Pattern, Beam Width; Radiation Resistance and efficiency; Directivity and Gain; Impedance, VSWR, Polarization; Effective height and Receive Aperture; Noise Temperature of Antenna. (3)	**3**
3.	Radiation fields and Characteristics of λ/2 dipole; discussion on λ/4 monopole antenna; Current distribution and Radiation patterns of center-fed dipoles of length λ, 3λ/2 and 2 λ.	**4**
4.	Antenna Arrays: electric Field due to 2 element arrays, 3 element Arrays; Pattern Multiplication; Uniform Linear Array: End fire and Broad side; Phased array. (5)	**5**
5.	Characteristics and properties of :Travelling Wave Antenna, Helical Antenna, Folded Dipole, Yagi-Uda Array, Loop Antenna, Broad Band Antenna (Log periodic Antenna), Microstrip Patch Antenna. Radiation from an aperture: Sectoral and Pyramidal Horn Antennas, Design of Optimum Horn Antenna; Parabolic and Corner Reflectors and feed systems.	**10**
6.	Methods of Propagation: Ground Wave Propagation, Friss Transmission Formula Components of ground wave, Field strength dependence on physical factors. Sky wave Propagation; Ionospheric Layers; Virtual Height, Critical Frequency, MUF, Skip distance, Sporadic Reflections. Space wave propagation: Tropospheric Scatter, Ducting Super refraction, Sub refraction	**10**

Recommended (Text Books)

1. Antenna (for all application), John D. Kraus and Ronald J. Marhcfka; Tata- MacGraw Hill, 3rd Edition
2. Antenna & Wave Propagation, K.D Prasad; Satya Prakashan, New Delhi, 3rd Edition
3. Antenna Theory: Analysis & Design, Constantine A. Balanis; Willey, 3rd Edition

Reference Book

1. Elements of Electromagnetics; Mathew N.O. Sadiku, Oxford University Press, 5th Edition(2010)
2. Electromagnetic Waves & Radiating Systems, EC Jordan & K.G. Balmain; Pearson Education, 2nd Edn.
3. Microstrip Antenna Design Handbook- Ramesh Garg; Artech House (2001)

CONTROL SYSTEMS

Code : EC 504 **Contacts : 3L +0T =3hrs** **Credits :3**

Module No	Topic	Hrs
1.	Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems.	**4**
2.	TRANSFER FUNCTION REPRESENTATION: Transfer Function of linear systems, Block diagram representation of systems considering electrical systems as examples -Block iagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula.	**5**
3.	TIME RESPONSE ANALYSIS : Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants.	**5**
4.	STABILITY ANALYSIS IN S-DOMAIN: The concept of stability – Routh's stability criterion – limitations of Routh's stability. Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.	**5**
5.	FREQUENCY RESPONSE ANALYSIS: Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots. b) : STABILITY ANALYSIS IN FREQUENCY DOMAIN: Polar Plots, Nyquist Plots, Stability Analysis and Gain/Phase margin from Nyquist Plot.	**6**
6.	CLASSICAL CONTROL DESIGN TECHNIQUES: Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers. STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS.	**5**
7.	Concepts of state, state variables and state model, derivation of state models from block diagrams & differential equation, State Transition Matrix and it's Properties ,eigen value & eigen Vector,Concepts of Controllability and Observability.	**6**

TEXT BOOKS:

1. Automatic Control Systems 8th edition– by B. C. Kuo 2003– John Wiley and son's.,
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 2nd edition.

REFERENCE BOOKS:

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd ed. , 1998.
2. Control Systems Engg. by NISE 3rd Edition – John Wiley
3. Linear Control System by B.S.Manke-Khanna Publication

Data Structure & C

Code : EC 505A **Contacts : 3L +0T =3hrs** **Credits :3**

Module No	Topic	Hrs
1.	Introduction (2L): Why we need data structure? , Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code. Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.	**8**

	Array (2L): Different representations – row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials. Linked List (4L): Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.	
2.	[Stack and Queue (5L): Stack and its implementations (using array, using linked list), applications. Queue, circular queue, dequeue. Implementation of queue- both linear and circular (using array, using linked list), applications. Recursion (2L): Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi, Eight Queens Puzzle.	**7**
3.	Nonlinear Data structures : Trees (9L): Basic terminologies, forest, tree representation (using array, using linked list). Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-recursive traversal algorithms using threaded binary tree, expression tree. Binary search tree- operations (creation, insertion, deletion, searching). Height balanced binary tree – AVL tree (insertion, deletion with examples only). B- Trees – operations (insertion, deletion with examples only). Graphs (6L): Graph definitions and concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut-vertex/articulation point, pendant node, clique, complete graph, connected components – strongly connected component, weakly connected component, path, shortest path, isomorphism). Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi-list. Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, forward-edge), applications. Minimal spanning tree – Prim's algorithm (basic idea of greedy methods).	**15**
4.	Searching, Sorting (10L): Sorting Algorithms (5L): Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap, application – priority queue), radix sort. Searching (2L): Sequential search, binary search, interpolation search. Hashing (3L): Hashing functions, collision resolution techniques.	**10**

Pre-requisites: CS 201 (Basic Computation and Principles of C), M101 & M201 (Mathematics), basics of set theory

Recommended books:

1. "Data Structures And Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
3. "Data Structures in C" by Aaron M. Tenenbaum.
4. "Data Structures" by S. Lipschutz.
5. "Data Structures Using C" by Reema Thareja.
6. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
7. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

Power Electronics

EC505B **Contacts: 3L** **Credits: 3**

Module	Topic	Hrs
Module I	**Advances in Power Electronics** Power Semiconductor Switches: Rectifier diodes, fast recovery diodes, Schottky	6

	barrier diode, Power BJT, Power MOSFET, SCR, TRIAC, IGBT and GTO. Ratings, Static and Dynamic Characteristics, Trigger, driver and switching-aid circuits and cooling. SCR turn –on and turn - off methods, Triggering circuits, SCR Commutation circuits, SCR Series and Parallel operation, Snubber Circuit.	
Module II	Rectifiers Single phase and three phase controlled Rectifiers with inductive loads, RL load Effect of source inductance- performance parameters .Dual Converters.	6
Module III	Step up and Step down choppers Time ratio control and current limit control, Buck, Boost, Buck Boost and Cuk Converters, Concept of Resonant Switching.	4
Module IV	Single phase and three phase inverters – PWM techniques, Sinusoidal PWM, modified Sinusoidal PWM - multiple PWM Voltage and harmonic Control – Series resonant inverter-Current Sources Inverter.	6
Module V	AC Voltage Controllers, Single phase and three phase Cycloconveters – Power factor control and Matrix Converters.	4
Module VI	**DC and AC Drives:** DC Motor Speed control, Induction Motor Speed Control Synchronous Motor Speed Control.	8
	Total Lecture Hours	**34**

Books:

a) P.C. Sen, Power Electronics
b) M.H. Rashid, Power Electronics, PHI/ Pearson Education
c) C.W. Lander, Power Electronics, McGraw Hill
d) B.K.Bose, Modern Power Electronics, JAICO
e) Mohan, N Undeland, TM & Robbins, WP- Power Electronics, John Wiley & Sons

Telecommunication switching systems

Code : EC 506A **Contacts : 3L =3hrs** **Credits :3**

Pre-requisites:

Principles of Electronic Communication Systems

Module No	Topic	Hrs
1	**Introduction:** Evolution of Telecommunication, telecommunication networks, switching system**.**	**3L**
2	**Switching Systems:** Strowger switching system, crossbar switching system, Electronics space division switching, Time division switching**[**	**5L**
3	**Traffic Engineering:** Traffic load, grade of service, blocking probability, modeling switching systems, incoming traffic and service time characterization, blocking models and loss estimates, delay systems.	**8L**
4	**Telephone Networks:** Subscriber Loop System, Switching Hierarchy and Routing, Transmission plan & System, Numbering plan, Charging Plan, Signaling Techniques, InchannelSignaling, Common Channel Signaling.	10L
5.	**Data Networks :** Data Transmission in PSTN, Switching Technique for Data Transmission, Basics of Data Communication Architecture, Data Network Standards, Protocol Stacks, ISDN Networks.	10L

References:

1. Telecommunication Switching Systems and Network – ThiagarajanViswanathan
2. Telecommunication Switching Traffic and Networks – J.E Flood.

Computer Architecture

Code: EC506B **Contact: 3L** **Credits: 3**

Pre-requisite: Basic Electronics in First year, Introduction to Computing in second semester, Digital Electronic & Integrated Circuits in 4th semester.

Module No	Topic	Hrs
1	Instruction set: Instruction format&types**:** Computer Organization & Architecture, Basic functional Unit, Computer component structure [Eg. Structure of IAS Computer, IBM Machine configuration], Harvard & Von Neumann architecture, BUS architecture, ALU designs [combinational ALU & sequential ALU]	**8L**
2	Memory Organization: Memory system overview, Cache memory organizations, Techniques for reducing cache misses; Hierarchical memory technology: Inclusion, Coherence and locality properties; Virtual memory organization, mapping and management techniques, memory replacement policies.	10L
3	CPU Organization: Fundamentals, Processor-memory communication [Clock cycles and Timing Diagram], Instruction cycle, RISC & CISC based architecture.	**4L**
4	Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards, Flynn's classification – SISD, SIMD, MISD, MIMD architectures, Pipeline optimization techniques.	**7L**
5	Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super pipelined and VLIW processor architectures, Array and Vector processors.	**6L**
6	Overview of HDL: VHDL basics programming concept, Structural, dataflow, behavioural & mixed style modeling techniques.	**3L**

Text & Reference books:

1. William Stallings —" Computer Organization & Architecture Designing for performance" , 8/e , Pearson
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky —"Computer Organization", 5/e, MGH
3. Mano M.M—"Computer System Architecture", 3/e,Pearson
4. Kai Hwang & Naresh Jotwani-- " Advanced Computer Architecture Parallelism, Scalability,Programmability",2/e, MGH
5. Pedroni---"Circuit Design And Simulation With VHDL", 2/e, PHI

EC – 591: - Digital Communication Laboratory

Contact: 3P **Credits: 2**

Sl. No.	Experiment
1.	Study of PAM and demodulation.
2.	Study of PCM and demodulation.
3.	Study of line coders: polar/unipolar/bipolar NRZ, RZ and Manchester.
4.	Study of DM & ADM modulator and demodulator.
5.	Study of BPSK modulator and demodulator.
6.	Study of BFSK modulator and demodulator.
7.	Study of ASK modulator and demodulator.
8.	Study of QPSK modulator and demodulator.

Microprocessors & Microcontrollers Lab

Code:EC-592 **Contact: 3P** **Credits: 2**

Sl. No.	Name of the Experiments	No.of hours
a)	Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical) Assignments based on above.	**3**
b)	a) Familiarization with 8085 & 8051simulator on PC. Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator. Assignments based on above	**3**
c)	**Programming using kit and simulator for:** i) Table look up ii) Copying a block of memory iii) Shifting a block of memory iv) Packing and unpacking of BCD numbers v) Addition of BCD number	**6**
d)	Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly.	**3**
e)	Interfacing of 8255**: Keyboard and Multi-digit Display with multiplexing using 8255**	**6**
f)	Study of 8051 Micro controller kit and writing programs as mentioned in S/L3. Write programs to interface of Keyboard, DAC and ADC using the kit.	**3**
g)	Serial communication between two trainer kits	**3**

Antenna lab

Code:EC-593 Contacts:3P Credits:2

1. Radiation Pattern of dipole antenna.
2. Radiation Pattern of a folded-dipole antenna.
3. Radiation pattern of a 3-element Yagi-Uda Antenna.
4. Beam width, gain and radiation pattern of a 3-element, 5-element and 7-element. Yagi-Uda antenna - Comparative study.
5. Radiation pattern, Gain, Directivity of a Pyramidal Horn Antenna.
6. Study of Smith chart on Matlab platform.

Control System Lab

Code: EC594 **Contact: 3P** **Credits: 2**

Sl.No.	Name of the Experiment	Periods
1.	Familiarization with MATLAB Control System tool Box,standard Test Signals Generation	3
2.	Determination of step response for 1^{st} order & 2^{nd} order system with unity feedback, calculation of control system specifications for variations of system design.	3
3.	Simulation of step response & impulse response for Type-I & Type-II system with unity feedback using MATLAB	3
4.	Determination of Root locus, Bode-plot, Nyquist Plot, using MATLAB control system toolbox for a given 2^{nd} order transfer function & determination of different control system specifications.	6
5.	Determination of PI, PD, and PID controller action on 1^{st} order simulated process.	3

6.	Determination of approximate transfer function experimentally using Bode Plot.	3
7.	Evaluation of steady-state error, setting time, percentage peak overshoots, gain margin, phase margin with addition of lead compensator in forward path transfer functions using MATLAB.	3
8.	Study of position control system using servomotor.	3
9.	Design and hardware implementation of a temperature controller using microprocessor/microcontroller.	6

Sixth Smester:

Paper Name:-	PRINCIPLE OF MANAGEMENT
Paper Code:-	HU 601
Contacts:-	3-0-0-3
Credit Point:-	3
Syllabus:- Basic concepts of management: Definition – Essence, Functions, Roles, Level. Functions of Management: Planning – Concept, Nature, Types, Analysis, Management by objectives; Organization Structure – Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organizational Effectiveness. Management and Society– Concept, External Environment, CSR, Corporate Governance, Ethical Standards. People Management– Overview, Job design, Recruitment & Selection, Training & Development, Stress Management. Managerial Competencies– Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship Leadership: Concept, Nature, Styles. Decision making: Concept, Nature, Process, Tools & techniques. Economic, Financial & Quantitative Analysis– Production, Markets, National Income, Accounting, Financial Function & Goals, Financial Statement & Ratio Analysis, Quantitative Methods – Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control. Customer Management– Market Planning & Research, Marketing Mix, Advertising & Brand Management. Operations & Technology Management– Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.	
Refferencess: 1. Management: Principles, Processes & Practices – Bhat, A & Kumar, A (OUP). 2. Essentials for Management – Koontz, Revised edition, Tata McGraw Hill (TMH) 3. Management – Stoner, James A. F. (Pearson) 4. Management - Ghuman, Tata McGraw Hill(TMH)	

Digital Signal Processing

EC- 601 **Contracts: 3L+1T =4** **Credits- 4**

Module No	Topic	Hrs
1	***Discrete-time signals & systems:***Concept of discrete-time signal, sequences – periodic, energy, power, unit-sample, unit-step, unit-ramp, real & complex exponentials, arithmetic operations on sequences, Properties of Discrete time systems, LTI system-definition, representation,impulse response,derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution, properties of convolution, recursive and non-recursive systems.	**5L**

2	***Z-Transform:***Definition, convergence and ROC, properties of Z-transform, mapping between s-plane and z-plane, Relation between Z transform and Fourier transform, characteristic families of signals along with ROCs, initial value theorem, Perseval's relation, inverse Z-transform by power series & partial-fraction expansions method, output response of a system using Z Transform, pole-zero representation & stability analysis. ***Discrete Fourier Transform:*** Concept and relations –DTFT & DFT,IDFT; Twiddle factors and their properties, computational burden on direct DFT, DFT/IDFT as linear transformations, computation of DFT/IDFT by matrix method, multiplication of DFTs, circular convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods; linear filtering using DFT, aliasing error, filtering of long data sequences – Overlap-Save and Overlap-Add methods. ***Fast Fourier Transform:*** Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithms, signal flow graphs, Butterflies, computations in one place, bit reversal, DIT & DIF FFT Butterfly computations and Computational complexities.	**6L** **8L** **6L**
3	***Filter Design:***Basic concepts of IIR and FIR filters-Butterworth & Chebyshev filters, difference equations, design of analog filters, design of IIR digital filter using impulse invariant and bilinear transforms, design of linear phase FIR filters using rectangular, Hamming and Blackman windows, quantization error & Finite word length effects.	**5L**
4	***Digital Signal Processor:*** Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs in Assembly Language. ***FPGA:***Architecture, different sub-systems, design flow for DSP system design, mapping of DSP algorithms onto FPGA.	**4L** **3L**

TEXT BOOKS:

1. Digital Signal Processing –Principles, Algorithms & Applications, J.G.Proakis & D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.
4. VLSI Digital Signal Processing Systems Design and Implementation, Wiley International Publication.
5. Digital Signal Processing with Field Programmable Gate Arrays, U.Meyer-Baese, Springer.

REFERENCE BOOKS:

1. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing; A Hands on Approach, C. Schuler & M.Chugani, TMH Publishing Co.
4. Digital Signal Processing, A. Nagoor Kani, TMH Education
5. Digital Signal Processing S. Poornachandra & B. Sasikala, MH Education
6. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, OUP
7. Texas Instruments DSP Processor user manuals and application notes.
8. Xilinx FPGA user manuals and application notes.

VLSI circuit & systems

EC602 **Contacts: 3L** **Credits: 3**

Module No	Topic	Hrs
1.	**Introduction to VLSI Design:** VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI	**6L**

	– basic idea only), Design principles (Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural), Review of MOSFET characteristics, scaling and small-geometry effects.	
2	**Analog VLSI Circuits:** Analog VLSI design steps; Basic building blocks of Analog VLSI chips; MOS switch; Active load / resistors; Voltage dividers; CMOS Current source & sink; CMOS Voltage references/voltage dividers [Basic circuits only]; CMOS Differential amplifier; Output amplifiers [Basic circuits only]; CMOS OPAMP; Switched capacitor filter.	**8L**
3.	**CMOS for Digital VLSI Circuits:** CMOS, CMOS inverter characteristics; CMOS logic circuits, NAND & NOR Gates, Complex logic circuits, CMOS Full Adder, CMOS Transmission GATE, Advanced CMOS Logic circuits; Sequential CMOS logic circuits; SR Latch circuit, clocked JK Latch/ Master-Slave JK, CMOS D-latch & Edge triggered flip-flop.	**10L**
4.	**Micro-electronic Processes for VLSI Fabrication:** Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative photo-resist; Basic CMOS Technology – (Steps in fabricating CMOS), Basic n-well CMOS process, p-well CMOS process, Twin tub process. CAD Tools for VLSI Design: - VHDL Syntax: Basic concepts in VHDL and VHDL grammar, Structural specification, VHDL description of Inverter, NAND gate, Full adder. Layout design rules, Layout of inverters, NAND, NOR gates using LASI.	**10L**

Text Books:
1. Digital Integrated Circuit, J.M.Rabaey, Chandrasan, Nicolic, Pearson Education.
2. CMOS Digital Integrated Circuit, S.M.Kang & Y.Leblebici, TMH.
3. Modern VLSI Design, Wayne Wolf, Pearson Education.
4. VHDL, Bhaskar, PHI.
5. CMOS Analog Circuit Design by P.E. Allen & D.R. Holberg; OUP

References:
1. Digital Integrated Circuits, Demassa & Ciccone, John Willey & Sons .
2. Modern VLSI Design: system on silicon, Wayne Wolf; Addison Wesley Longman Publisher
3. Basic VLSI Design, Douglas A. Pucknell & Kamran Eshranghian, PHI
4. CMOS Circuit Design, Layout & Simulation, R.J.Baker, H.W.Lee, D.E. Boyee, PHI
5**. VLSI design and EDA tools, Dr. Angsuman Sarkar; Dr. Swapnadip De; Dr. Chandan Kumar Sarkar, Scitech Publications.**

Material Science & Engineering

EC:603 **Contacts: 3L** **Credits: 3**

Module No	**Topic**	**Hrs**
1	Structure of Solids : Atoms and their binding, Bonds, Crystal Systems, Bravais LatticeMiller Indices, Crystalline, Polycrystalline and Amorphous Materials; Metals, Semiconductors and Insulators, Lattice defects-Qualitative ideas of point, line, surface and volume defects.	5
2	Dielectric Propertise : Dielectric Polarization and Mechanism- Internal or local field, Dielectric Loss, Temperature and Frequency dependence of dielectric constant, Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric Materials and its Applications.	**4**
3	Magnetic Properties : Elementary ideas of classification of magnetic materials –	**2**

	Diamagnetism, Paragnetism, Ferrognetism, Ferrimagnetism, Magnetic Domains.	
4	Superconductors : Basic concepts of superconductivity, Transition temperature, Meissner effect High-T superconductors, Haed and Soft Materials, SQUID.	**3**
5	Optical properties : Absorption, Emission, Luminescence, Electro-optic and Acousto-optic effects, Photorefractive effects.	**3**
6	Materials for Optical Communication : LED and Laser Materials, Optical Fibre.	**3**
7	Materials for Data Storage : Magnetic Cores, Tapes, Disks, Hard disk, Floppy disk, Magneto-optic devices, Bubble memories, Magnetoelectronic Materials, CD, DVD, CCD.	**5**
8	Materials for Display Devices : CRT, LED, LCD, TFT, Plasma Display.	**3**
9	Advanced Materials : Metallic Glasses, Nanomaterials, etc.	**2**

Books:

1. Electrical Engineering Materials – A. J. Dekker (PHI)
2. Material Science and Engineering–A First Course – V. Raghavan (PHI Learning Pvt. Ltd)
3. Principles of Electronic Materials and Devices – S. Kasap (McGraw-Hill)
4. An Introduction to Solid State Physics - Charles Kittel (John Wiley & sons)
5. An Introduction to Electronic Materials for Engineers – W. Kao, Z. Lee and N. Sannes (World Scientific)

Information theory & coding

Code : EC 604A **Contacts : 3L =3hrs** **Credits :3**

Pre-requisites:

Principles of Electronic Communication Systems

Module No	Topic	Hrs
1	Information Thoery: Entropy and mutual information for discrete ensembles;	**4L**
2	Asymptotic equipartition property; Markov chains; Entropy Rates of a Stochastic Process; Shannon's noiseless coding theorem;	**6L**
3	Encoding of discrete sources; Universal Source Coding; Discrete memoryless channels; Shannon's noisy coding theorem and converse for discrete channels;	**8L**
4	Calculation of channel capacity and bounds for discrete channels; Differential entropy; Calculation of channel capacity for Gaussian chanels; Rate distortion function; Large Deviation	**8L**
5	Theory; Chernoff Information; Fisher Information and the Cramer-Rao inequality; Network Information Theory Multiple-access Channel, Broadcast Channel, Relay Channel; Information Theory applications in Portfolio Theory;	**10**

Texts/ References:

1. T. M. Cover and J. A. Thomas, .Elements of Information Theory, John Wiley, New York, 1991
2. RW Yeung, Information Theory And Network Coding, Springer, 2008
3. RG Gallagar, Information Theory and Reliable Communication, John Wiley & Sons, 1976.
4. R.B. Ash, Information Theory, Prentice Hall, 1970

Computer Communication &Networking

EC604B **Contacts: 3L** **Credits: 3**

Module No	Topic	Hrs
1	**Overview of Data Communication and Networking:**	**[4L]**

	Introduction; Data communications: components, data representation (ASCII,ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN,WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.	
2	**Physical Level:** Overview of data(analog & digital), signal(analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;	**[6L]**
3	**Data link Layer:** Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC;	**[5L]**
4	**Medium Access sub layer:** Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet(in brief);	**[5L]**
5	**Network layer:** Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : IP addressing, subnetting; Routing : techniques, static vs. dynamic routing , Unicast Routing Protocols: RIP, OSPF, BGP; Other Procols: ARP, IP, ICMP, IPV6;.	**[8L]**
6	**Transport layer:** Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,	**[4L]**
7	**Application Layer :** Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls.	**[5L]**
8	**Modern topics:** ISDN services & ATM, DSL technology, Cable Modem: Architecture & Operation in brief . Wireless LAN: IEEE 802.11, Introduction to blue-tooth.	**[5L]**

Text Books:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
2. A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas
7. Miller, Digital & Data Communication, Jaico
8. Shay, Understanding Data Communication & Network, Vikas

Reference Books:

1. Kurose and Rose – " Computer Networking -A top down approach featuring the internet" – Pearson Education
2. Leon, Garica, Widjaja – "Communication Networks" – TMH
3. Walrand – "Communication Networks" – TMH.
4. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" – Pearson Education/PHI

Object Oriented Programming

Code: EC605A **Contact: 3L** **Credits: 3**

Module No	Topic	Hrs
1	**Object oriented design**	**[10**

	Concepts of object oriented programming language, Major and minor elements, Object, Class, relationships among objects, aggregation, links, relationships among classes- association, aggregation, using, instantiation, meta-class, grouping constructs	**L]**
2	**Object oriented concepts [4 L]:** Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism	**4**
3	**Basic concepts of object oriented programming using Java [2 L]:** Implementation of Object oriented concepts using Java. **Language features to be covered.**	**2**
4	**Class & Object properties [6L]** Basic concepts of java programming – advantages of java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested & inner classes, basic string handling concepts- String (discuss charAt() , compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray() , toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods) & StringBuffer classes (discuss append(), capacity(), charAt(), delete(), deleteCharAt(), ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(),toString() methods), concept of mutable and immutable string, command line arguments, basics of I/O operations – keyboard input using BufferedReader & Scanner classes.	**6**
5	**Reusability properties[6L]** – Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes & methods, interfaces. Creation of packages, importing packages, member access for packages.	**6**
6	**Exception handling & Multithreading [6L]** – Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes. Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads.	**6**
7	**Applet Programming (using swing) [4L]** – Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets, concept of delegation event model and listener, I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text fields.	**4**

.Textbooks/References:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

ELECTRONIC MEASUREMENT AND INSTRUMENTATION

Code: EC605B **Contact: 3LCredits: 3**

Module No	Topic	Hrs

1	**Basic Measurement Concepts:**Measurement systems – Static and Dynamic Characteristics – Units and Standards of measurements, –errors analysis, –moving iron meters, moving coil pmmcdynamometer, wattmeter– – Bridge measurements, Wheatstone Bridge, Kelvin, Wein, Maxwell, Hay, Schering and Anderson Bridges.	6
2	**Basic Measurement Concepts:**Electronic Ammeter Volt meter(with DC and AC voltage)Multimeter Current measurement with analog electronic instruments. Chopper stabilized amplifier for measurement of very low voltage and currents.Cathode Ray Oscilloscopes- Block Schematic, Principles and applications.Dual Trace and Dual Beam Oscilloscopes, Digital Storage Oscilloscopes.	**7**
3	**Signal Generator and Analysis** Function Generators- RF Signal Generators- Sweep Generators – Frequency Synthesizer-Wave Analyzer- Harmonic Distortion Analyzer – Spectrum Analyzer.	**7**
4	**Digital Instruments** Comparison of analog& digital techniques- digital voltmeter-mutlimeter–frequency counters- measurement of frequency and time interval – extension of frequency range- measurement errors.	7
5	**Miscellaneous Instruments:** Strip chart recorders, XY recorders,TrueRms meter	2
6	**Tranducers**	7

1. M.J.S Smith , Application Specific Integrated circuits ,Pearson.
2. P.J Anderson ,The designer's guide to VHDL, Morgan Kaufman , 2nd edition ,2002.
3. W.Wolf , Modern VLSI Design: Systems on silicon , Pearson
4. G.Hatchel and F.Somenzi , logic Synthesis and verification Algorithms,Kluwer,1998

References:

1. http://www-ee.eng.hawaii.edu/~msmith/ASIC/HTML/ASIC.htm#anchor935203
2. J.Bhasker ,A VHDL Primer , BS Publications/Pearson Education.

Digital Signal Processing Lab
Code: EC 691 Contact: 3P Credits: 2
Simulation Laboratory using standard Simulator:

1. Sampled sinusoidal signal, various sequences and different arithmetic operations.
2. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.
3. Z-transform of various sequences – verification of the properties of Z-transform.
4. Twiddle factors – verification of the properties.
5. DFTs / IDFTs using matrix multiplication and also using commands.
6. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.
7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods.
8. Butterworth filter design with different set of parameters.
9. FIR filter design using rectangular, Hamming and Blackman windows.

Hardware Laboratory using either 5416 or 6713 Processor and Xilinx FPGA:

1. Writing & execution of small programs related to arithmetic operations and convolution using Assembly Language of TMS320C 5416/6713 Processor, study of MAC instruction.
2. Writing of small programs in VHDL and downloading onto Xilinx FPGA.
3. Mapping of some DSP algorithms onto FPGA.

VLSI circuit & system lab

EC 692 **Contacts: 3** **Credits: 2**

Laboratory 1. Familiarity with Spice simulation tool (3 Hrs.)
Laboratory 2. Spice Simulation of Inverter , NAND , NOR Gates. (3 Hrs.)
Laboratory 3 Familiarity with EDA tools for VLSI design /FPGA based system design (6 Hrs.)
Laboratory 4. Layouts ,Transistors and tools (3 Hrs.)
Laboratory 5. Standars cell Design (3 Hrs.)
Laboratory 6. Design of CMOS XOR/XNOR Gates. (3 Hrs.)
Laboratory 7. Design of CMOS Full adder (3 Hrs.)
Laboratory 8. Design of CMOS Flip flops (R-S ,D , J-K) (3 Hr.s)
Laboratory 9. Design of 8 bit synchronous Counter (3 Hrs.)
Laboratory 10. Design of 8 bit bi-directional register with tri-stated input/output bus (3 Hrs.)
Laboratory 11. Design of a 12 bit CPU with few instructions and implementation and validation on FPGA (15 Hrs.)

ELECTRONIC MEASUREMENT AND INSTRUMENTATION lab.
Code: EC694B
Contact: 3P
Credits: 2

1. Study of Static characteristics of Measuring Instrument
2. Study of Dynamic Characteristics of a Measuring Instrument
3. Acquaintance with basic structure of DMM and measurement of different electrical parameter
4. Wave and spectrum analysis using Q meter
5. Realization of a V-to-I & I-to-V converter.
6. Statistical analysis of errors in measurement .
7. Study of VCO (Voltage controlled oscillator) & PLL (Phase Locked Loop).tatic Characteristics of a Measuring Instrument

Object Oriented Programming Laboratory
EC694A
L-0, T-0, P-3;
Cr 2

1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, arrays
3. Assignments on developing interfaces- multiple inheritance, extending interfaces
4. Assignments on creating and accessing packages
5. Assignments on multithreaded programming
6. Assignments on applet programming

EC693 :Electronic circuit design lab
Industry related practical design problems.

Wireless Communication

Code : EC 701 **Contacts : 3L +1T =4hrs** **Credits :4**

Module No	Topic	Hrs

1	Cellular Mobile Wireless Networks: Systems and Design Fundamentals: Brief introduction to mobile wireless communication and systems, Description of cellular system, Cellular Structure, Frequency Reuse, Cell clustering, Capacity enhancement techniques for cellular networks, cell splitting, antenna sectoring, Co-channel and Adjacent channel interferences, Channel assignment schemes – Fixed channel, Dynamic channel and Hybrid channel, mobility management – location management and handoff management, handoff process, different types of handoff. Characteristics of wireless channel and propagation path loss models: Different Multi-path propagation mechanisms, Multi-path effects on mobile communication, Fading, different types of fading, small and large scale fading, slow and fast fading, narrowband and wideband fading, Inter symbol interference, fast fading model, Doppler effect due to velocity of mobiles, Rayleigh envelop, free space propagation model, two ray ground reflection model, log distance path loss model, log normal shadowing model, macro and micro cell propagation models, types of base stations and mobile station antennas.	8L 8L
2	Modern Mobile Wireless Communication Systems Evolution strategies – First Generation (1G) to Fourth Generation (4G), Personal Area Networks :PAN, Low Tier Wireless System: Cordless Telephone, Second Generation (CT2), Digital European Cordless Telecommunications (DECT), Public wide-area Wireless Networks: 1 G to 3G cellular networks.	2L
3	Multiple Access Technologies in cellular communication: Time division multiple access (TDMA), narrowband and wideband TDMA, synchronous and asynchronous TDMA, Frequency division multiple access (FDMA), Code Division Multiple Access (CDMA), Direct-sequence CDMA, spread spectrum technique, spectral efficiency of different wireless access technologies: Spectral Efficiency in FDMA system, Spectral Efficiency in TDMA system, Spectral Efficiency for DS-CDMA system	4L
4.	Cellular Communication Networks and Systems: Second generation (2G) Network: Global system for mobile communication (GSM): Architecture and Protocols Air Interface, GSM spectrum, GSM Multiple Access Scheme, GSM Channel Organization, Traffic Channel multi-frame, Control (Signaling) Channel Multi-frame, Frames, Multi-frames, Super-frames and Hyper-frames, GSM Call Set up Procedure, Location Update Procedure, Routing of a call to a Mobile Subscriber	5L
5.	The concept of packet data services The 2.5 G General Packet Radio Services: GPRS Networks Architecture, GPRS Interfaces and Reference Points, GPRS Mobility Management Procedures, GPRS Attachment and Detachment Procedures, Session Management and PDP Context, Data Transfer through GPRS Network and Routing, The IP Internetworking Model	4L
6	Overview of CDMA systems: IS-95 Networks and 3G – The Universal Mobile Telecommunication System (UMTS): CDMA based IS-95 Systems, forward link and reverse link for IS-95, handoff process in CDMA based IS-95 network. UMTS Network Architecture –Release 99, UMTS Interfaces, UMTS Network Evolution UMTS Release 4 and 5, UMTS FDD and TDD, UMTS Channels, Logical Channels, UMTS Time Slots	3L

TEXT BOOKS:

1. Wireless Networks: Applications and Protocols, T. S. Rappaport, Pearson Education
2. Wireless Communication and Networks : 3G and Beyond, I. Saha Misra, TMH Education.
3. Wireless Communications : Principles and Practice, T.S.Rappaport, PHI Learning.
4. Wireless Communications,

A. Goldsmith, Cambridge University Press.

REFERENCE BOOKS:

1. Lee's Essentials of Wireless Communications, MH Prof. Med/Tech
2. Wireless Digital Communications: Modulations and Spread Spectrum Applications, K. Feher, Prentice Hall.
3. Wireless Communications and Networking, J.W.Mark and W. Zhuang, PHI.

Microwave Engineering & Radar

Code : EC 702 **Contacts : 3L +1T =4hrs** **Credits :4**

Module No	Topic	Hrs
1	Introduction: RF & Microwave Spectrum, Historical Background, Typical applications of RF & Microwaves	**1**
2	Microwave Waveguides : Rectangular and Circular Waveguides– Mode structures, Cut-off frequency, Propagation Characteristics, wall currents, Attenuation constant, waveguide excitations.	5
3	Waveguide Passive Components: Waveguide Resonators – Rectangular & Cylindrical; Resonant frequencies, Mode structures, Q- factor,Co-axial Resonators; Excitation & coupling of cavities, Design of resonators.	[5]
4	N-port networks – circuit representations, Z-matrix, Y-matrix, S-matrix, transmission matrix,; their relationships; attenuators, phase shifter, directional couplers, Bethe-hole coupler, Magic tee, hybrid ring, circulators, isolators, antennas: Horns- sectoral horns, Pyramidal horns, Parabolic reflector, Cassigran feed, Patch antennas, antenna arrays. Scattering matrix representations of passive components.	[5]
5	Planar structure :Strip lines, Micro-strip lines, coplanar structure, Slot lines, Suspended strip lines, Fin lines – Configurations, Field patterns, propagation characteristics, Design considerations. Comparison of characteristics of lines.	[5]
6	Microwave Tubes: Limitations of conventional tubes in microwaves; Multi-cavity Klystron, Reflex klystron; Magnetron, Travelling wave tube, Backward wave oscillator – working principles, characteristics.	[5]
7	Semiconductor Microwave Devices: Tunnel diode; Gunn diode–design considerations for their waveguide mount. Avalanche diode – IMPATT, TRAPATT, Microwave bipolar transistor, hetero-junction bipolar transistor, Microwave field-effect transistor–JFET, MOSFET, MESFET, Parametric amplifiers; ICs	[5]
8	Radar systems – Radar block diagram, radar equation, detection of signals in noise and signal-to-noise ratio, Probabilities of detection & False alarm, integration of radar pulses, radar cross section, distributed targets, Transmitted power, pulse-repetition frequency, antenna parameters & system losses, introduction to radar clutter. Pulsed radar, CW radars, MTI, Tracking radars, Altimeter- Principles of operation.	
9	Microwave Measurements: Microwave Bench, Slotted line, Tuneable Probe, VSWR Meter, Slide screw tuner, Variable shorted line – operating principles with diagrams. Measurements of VSWR – Low, Medium and High, Measurement of Power – Calorimetric method, Thermocouple, Bolometers, Frequency measurement, Impedance measurement by shift in minima. Network Analysers, TDR, and Spectrum analyser.	[5]

Text Books

1. SY Liao Microwave Devices & Circuits Pearson Education /PHI
2. PA Rizzi Microwave Engineering-Passive Circuits Pearson Education

3. MI Skolnik Introduction to Radar Systems Tata-McGraw Hill
4. David M Pozar Microwave Engineering John Willy & Sons Inc.
References Books
1 Robert E Collin Foundation of Microwave Engineering, 2ed edition, McGraw Hill, Inc.
2 3 4 5 GP Srivastava & VL Gupta Microwave Devices & Circuit Design PHI
3.S Das & A Das Microwave Engineering Tata-McGraw Hill
4.K C Gupta Microwaves New Age Publishers
5 ML Sisodia & GS Raghuvansi Microwave Circuits and Passive Devices New Ag Publishers

Fibre Optic Communication

Code- EC703A **Contacts : 3L +0T =3hrs** Credit points- 4

Module No	Topic	Hrs
1	**Introduction to optical fiber**: Ray diagram, different types of optical fibre, step index, graded index. Optical Fibre Communication: Principles and systems, Single-mode Fibre: Mode Cut-Off wavelength, Mode-field Diameter, Equivalent Step-Index (ESI) Profile, Measurement, Dispersion Measurements: Time-Domain method & Frequency Domain Method, Geometrical Measurements: diameter, deformation, eccentricity, elasticity, Mechanical Strength of Optical Fibre. (3)	6
2	**Optical Sources:** Light Emitting Diode; principle, structures, power and efficiency, coupling to fibres. Laser diodes; principle, double heterostructure, gain and index guiding, distributed lasers. Quantum Well Lasers; Modes and narrow linewidth lasers. Modulation; Bandwidth for modulation, Physics of semiconductor, LED, Laser Diodes, Solar cell, Lasers, Bias & stabilization, Driver circuits for analog & digital modulation, Modulation bandwidth, PIN, APD photodiodes, photo diode amplifiers, Signal to noise ratio in PIN and APD receivers. (6)	10
3	**Optical Detectors:** Device types, optical detection principles, efficiency, responsivity, bandwidth. Preamplifiers; noise sources, signal to noise ratio. (2)	5
4	**Optical Interconnecting Devices**: Optical isolators, polarizer, circulators, attenuators, amplifiers, oscillators, filters, add/drop multiplexers, optical modulators, (2)	2
5	**Other optical device used in fibre optics communication**: Wave division multiplexing and demultiplexing, optical switching, optical amplifier (Raman, EDFA) (2)	2
	Point-to-point link and Wavelength Division Multiplexing: Building blocks; Multiplexing; Intensity Modulation/Direct Detection system; Principle of Regeneration; WDM link, Optical amplifiers; EDFA, SOA, Raman amplifier, Fabry-Perot filters. Dispersion compensation and management, Link analysis andBit-Error-Rate calculation.	10

Text Books

1. Optical Networks – A practical perspective : Rajiv Ramaswami, K. N. Sivarajan, Galen H. Sasaki (Morgan-Kaufman)
2. Optical Fibre Communication : John M. Senior (Pearson)
3. Optical Fibre Communication : Gerd Kaiser (TMH)
4. Optical Communication Systems : John Gawar (PHI
5. Ghatak, Fiber Optics Communication, Tata McGraw Hill, New Delhi

FPGA & Reconfigurable Computing

EC703B **Contacts: 3L** **Credits: 4**

Module No	Topic	Hrs

1	**Introduction to Reconfigurable Computing (RC) 5L:** History, State-of-the-Art and Future Trends, Computing requirements as Power, Area and VLSI scaling, Mapping of Algorithm analysis and speed-up, RC architectures- Fine Grain and Coarse Grain, Hybrid and Embedded Architectures, Supercomputers.	**5**
2	**Reconfigurable Logic Devices 6L:** FPGA and its internal architecture, computing elements, LUT, BRAM, interconnects, I/O Blocks, programming of FPGA and interfacing case study, ALU design, designing with embedded processors, introduction to Power PC and ARM processors.	**6**
3	**Hardware Description Language for RC 6L:** Design cycle, algorithms, Hardware Description Language, VHDL, different design styles: data flow, structural and behavioral and practical logic circuit implementation example on FPGA, debugging, writing test bench, High level synthesis and Low level synthesis.	**6**
4	**RC Configuration 4L:** Application segmentation and Resource partitioning, spatial and temporal configuration, systolic architectures and algorithms, Bit serial, on the fly, multiplexing vs. run-time reconfiguration.	**4**
5	**RC Implementation 6L:** Virtual Hardware Components (VHC) design process, high level synthesis of VHC and optimization, VHC data-path and control unit design, simulation and verification of VHC, determination of reconfigurable scheme and associated loading mechanisms (temporal and spatial partitioning) for RC	**6**
6	**RC applications 5L:** RC for DSP, DSP application building blocks, RC for Image processing, Bioinformatics and Network Security	**5**

Text Books:

1. M. Gokhale and P. Graham; Reconfigurable Computing: Accelerating Computation with FPGAs, Springer,
2. C. Maxfield ; The design Warrior's Guide to FPGAs: Devices, Tools and Flows, Newnes, 2004
3. C. Bobda, Introduction to Reconfigurable Computing : Architectures, Algorithm and Applications, Springer,

Reference Books:

1. W. Wolf , FPGA Based Systems Design, PHI, 2004
2. P. Lysagt and W. Rosenstiel, New Algorithms, Architectures and Applications for Reconfigurable Computing, Springer,2005

Embedded Systems

EC704A **Contacts: 3L** **Credits: 3**

Module No	Topic	Hrs
1	Introduction to Embedded System : Embedded system Vs General computing systems, History of Embedded systems, Purpose of Embedded systems, Microprocessor and Microcontroller, Hardware architecture of the real time systems.	**5**
2	Devices and Communication Buses: I/o types, serial and parallel communication devices, wireless communication devices, timer and counting devices, watchdog timer, real time clock, serial bus communication protocols, parallel communication network using ISA, PCI, PCT-X, Intrnet embedded system network protocols, USB, Bluetooth.	**10**
3	Program Modelling Concepts ; Fundamental issues in Hardware software co-design, Unified Modelling Language(UML), Hardware Software trade-offs DFG model, state machine programming model, model for multiprocessor system.	**5**
4	Real Time Operating Systems : Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, qualities of good RTOS.	**8**
5	Examples of Embedded System : Mobile phones, RFID, WISENET, Robotics,	**6**

	Biomedical Applications, Brain machine interface etc. Popular microcontrollers used in embedded systems, sensors, actuators.	
6	Programming concepts and embedded programming in C, C^{++}, JAVA.	**4**

Ref:

1. Introduction to Embedded Systems : Shibu K. V. (TMH)
2. Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)
3. Embedded Systems : Rajkamal (TMH)
4. Embedded Systems : L. B. Das (Pearson)
5. Embedded System design : S. Heath (Elsevier)
6. Embedded microcontroller and processor design: G. Osborn (Pearson)

Modern Control Engineering

EC704B **Contacts: 3L** **Credits: 3**

Module No	Topic	Hrs
1	Fuzzy Control: Introduction to the concept of fuzzy logic: Why we need fuzzy logic, an introductory example – fuzzy vs. non-fuzzy, when not to use fuzzy logic.	2
2	Fuzzy sets and its basic operations: Introduction to classical set, fuzzy set, definition of linguistic values, linguistic hedges, set theoretic operations (union, intersection, complement – different axioms), composition of fuzzy relations – max-min composition, max-product composition.	4
3	Logical arguments and propositions: Proposition concept, fuzzy If-Then rules, Modus Ponens, Modus Tolens,hypothetical syllogism	2
4	Fuzzy controller: Block diagram of a fuzzy controller and description of its different blocks like fuzzification, rule base, inference mechanism, defuzzification, case study of fuzzy control system – an inverted pendulum on a cart, OR speed control of running train.	6
5	Nonlinear Control: Introduction to nonlinear system: Common physical nonlinearities – saturation, friction, backlash, dead zone, relay	2
6	Definitions: Singular points, nodal point, saddle point, focus point, vortex point, limit cycles. Stability of non linear systems using phase plane method – analytical and graphical methods	2
7	The describing function method: Derivation of describing function of some common non linearities like dead zone and saturation, relay with dead zone and hysteresis, stability analysis using describing function method	4
8	Liapunov's stability criterion: Different stability criteria of Liapunov	2
9	Digital Control: Introduction to digital control:	4
10	Z-transforms, sampling and hold, comparison of analog and digital control system, pulse transfer function . Stability of sampled data system: Jury's test	2
11	Digital controller and its realization: Series, parallel and cascade.	2

Books:

1 MODERN CONTROL ENGINEERING, 5/E (English) 5th Edition by Katsuhiko Ogata, PHI

Artificial Intelligence

EC705A **Contacts: 3L** **Credits:3**

Module	Topics	Hours
1	Introduction:Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem	**2**
2	Intelligent Agents:Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents	**2**
3	Problem solving:Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	**2**
4	Search techniques:Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.	**5**
5	Heuristic search strategies:Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.	**5**
6	Adversarial search:Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.	**3**
7	Knowledge & reasoning:Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	**3**
8	Using predicate logic:Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.	**2**
9	Representing knowledge using rules:Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge	**3**
10	Probabilistic reasoning:Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	**4**
11	Planning:Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.	**2**
12	Natural language processing:Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.	**2**
13	Learning:Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.	**2**
14	Expert systems:Representing and using domain knowledge, expert system shells, knowledge acquisition.	**2**
15	Programming language:Basic knowledge of programming language like Prolog & Lisp	**6**

Books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS
7. Artificial Intelligence, Russel, Pearson

Database Management System

EC705B **Contacts: 3L** **Credits:3**

Module	Topics	Hours
1	Introduction:Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.	**4**
2	Entity:Relationship Model:Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.	**6**
3	Relational Model:Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views,Modifications Of the database.	**5**
4	SQL and Integrity Constraint:Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.	**8**
5	Relational Database Design:Functional Dependency, Different anamolies in designing a Database., Normalization using funtional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued depedencies, 4NF, 5NF	**9**
6	Internals of RDBMS:Physical data structures, Query optimization : join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management : transaction model properties, state serializability, lock base protocols, two phase locking.	**7**
7	Internals of RDBMS:Internals of RDBMS	**7**
8	File Organization & Index structures:File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree .	**6**

Text Books:

1.. Henry F. Korth and Silberschatz Abraham, “Database System Concepts”, Mc.Graw Hill.
2, Elmasri Ramez and Novathe Shamkant, “Fundamentals of Database Systems”, Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System , McGraw-Hill
4. Gray Jim and Reuter Address, “Transaction Processing : Concepts and Techniques”, Moragan Kauffman Publishers.
5. Jain: Advanced Database Management System CyberTech
6. Date C. J., “Introduction to Database Management”, Vol. I, II, III, Addison Wesley.
7. Ullman JD., “Principles of Database Systems”, Galgottia Publication.

Reference:

8. James Martin, “Principles of Database Management Systems”, 1985, Prentice Hall of India, New Delhi
9. “Fundamentals of Database Systems”, Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition
10. “Database Management Systems”, Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

Fiber Optic Communication lab

Code:EC-793A Contacts:3P Credits:2

Experiment with Optical fibre :

To calculate attenuation constant, bending loss and numerical aperture of optical fibre.

Experiments using LED module : Study of DC characteristics.

I-V characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.

P-I characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.

Experiment with fibre Optic analog link :
Input-output characteristics using long optical fibre. Calculation of attenuation per unit length of optical fibre.

FPGA Lab

EC793B **Contacts: 3** **Credits: 2**

1. Implementation of basic logic gates with VHDL on FPGA using different design styles.
2. Implementation of Multiplexers, Priority Encoder, decoder, counters etc. with VHDL on FPGA using different design styles.
3. Design and implementation of 16-bit ALU with VHDL on FPGA and verification by writing a test bench.
4. a) Generation of Filter co-efficient of a LPF using Simulink FDA tool.
   b) Generation of VHDL codes for the LPF by coupling the co-efficient in "a" with Xilinx.
   c) Implementation of the LPF in FPGA using the code in "b".
   d) Testing of the LPF by using the hardware-in-the loop configuration.
5. Design and implementation of a real time user defined Traffic Light Controller using FSM method on an FPGA.
6. Interfacing of LCD display with FPGA and configuration for the scrolling display

Microwave lab

Code:EC-792 Contacts:3P Credits:2

Experiments

1. Determination of phase and group velocities in a waveguide carrying TE_{10} Wave from Dispersion diagram [ω−β Plot].
2. Measurement of unknown impedance using shift in minima technique using a waveguide test bench.
3. Study of the characteristics of a Reflex Klystron oscillator
4. Study of Gunn-oscillator Characteristics using X-band waveguide test bench.
5. Measurement of coupling factor, Directivity, Insertion loss and Isolation of a Directional coupler using X-band waveguide test bench set up.
6. Scattering matrix of a magic tee / E-plane tee / H-plane tee using waveguide test bench at X-band.
7. Study of filter (LPF, HPF,BPF) response.

EC-781 Industrial Training Evaluation 0-0-3-3-2:
Student has to deliver a seminar on Industrial Training conducted after 6th semester

EC-782: Project-I 0-0-3-3-2:
A preliminary / short project to be carried out after discussions with project supervisor.

EC-783: Group Discussion: 0-0-3-3-2: Student has to appear in Group Discussions as assigned by Department.

Nanotechnology

EC801A **Contacts: 4** **Credits: 4**

Module	Topics	Hours
1	**THE PHYSICAL BASIS OF QUANTUM MECHANICS 5L:** Limitation of classical physics – plank's quantum hypothesis – Einstein's photoelectric effect – wave nature of particle – The uncertainty principle – Schrödinger's time dependent and independent wave equations – particle in a box – Harmonic oscillator – rigid rotator.	**5**
2	**FORMALISM OF QUANTUM MECHANICS 6L:** Linear operator – Hermitian operator – Postulates of Quantum mechanics – Simultaneous measurability of observable – equations in motion – Linear harmonic oscillator – Operator method – particle moving in a spherically symmetric potential – hydrogen atom – Hydrogen orbital – Matrix representation of wave functions.	**6**
3	**CRYSTAL STRUCTURE 4L:** Atomic structure - Atomic bonding in solids- Crystalline state of solids - Unit cells and Space lattices – Crystal structures - Crystal planes and directions- Miller Indices - Diffraction of X-rays by crystal - Bragg's equation - Correction to Bragg's equation - Reciprocal lattice - Crystal Defects - point, line and surface defects.	**4**
4	**SEMICONDUCTORS AND THEIR PROPERTIES 6L:** Band model of semiconductors - carrier concentrations in intrinsic and extrinsic semiconductors - Fermi level - variation of conductivity and mobility with temperature - law of mass action. Hall effect - Hall coefficients for intrinsic and extrinsic semiconductors - determination of Hall constant - Hall effect devices.	**6**
5	**FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY 6L:** Scientific Revolutions – Types of Nanotechnology and Nanomachines – the Periodic table – Atomic Structure - Molecules and phases - Energy - Molecular and atomic size – Surfaces and dimensional space – top down and bottom up. Opportunity at the nano scale - length and time scale in structures – energy landscapes – Inter dynamic aspects of inter molecular forces – Evolution of band structure and Fermi surface. Quantum dots - Nano wires – Nano tubes - 2D and 3D films	**6**
6	**SEMICONDUCTOR NANO DEVICES 5L:** Single Electron devices- Nano scale MOSFET Resonant Tunneling Transistor – Single Electron Transistors. Optical Fibers for Nanodevices - DNA Based Nanodevices – Gas based Nanodevices - Schottky devices - Quantum Structures and Devices - Quantum layers, wells, dots and wires - Carbon Nanotube based logic gates, optical devices - Connection with quantum dots, quantum wires, and quantum wells.	**5**

Books:

1. Quantum Physics – A. Ghatak
2. Quantum Mechanics - Bransden and Joachen
3. Statistical Physics by K. Huang
4. Statistical Mechanics-Landau &Lifshitz
5. Quantum wells, Wires & Dots,: Theoretical & Computational Physics of Semiconductors Nanostuructures, Paul Harrison
6. Principles of Quantum Mechanics 2nd ed. - R. Shankar
7. Thermodynamics and Statistical Mechanics - A N Tikhonov, Peter T Landberg, Peter Theodore
8. Thermodynamics and Statistical Mechanics by John M. Seddon , J. D. Gale
9. Statistical Mechanics – Sonntag.

EC-801 B : - Upper Atmospheric Propagation

Contacts: 4-0-0; Credits: 4; Total – 33 Hours

Pre-requisites:	Students should have knowledge on Electromagnetic waves (propagation, reflection, refraction, attenuation, radiation)

Module	Topic	Hrs.
1.	**Introduction:** Frequency bands and propagation mechanisms. Physical structure of the upper atmosphere. Temperature structure of the atmosphere. Long wave radiation and Radiative Balance in upper atmosphere. Greenhouse effect in the upper atmosphere.	**4**
2.	**Troposphere:** Field strength of Tropospheric wave. Scattering and absorption of a wave by a single particle. Effects of rain, snow, and ice on microwaves and millimeter waves.	**4**
3.	**Stratosphere:** Stratospheric ozone layer. Destruction of ozone and ozone problem. Stratospheric Circulation.	**4**
4.	**Ionosphere:** The production of ionization. Chapman ionization profile. Ionization mechanisms. Solar cycle effects on the ionosphere. Currents in the ionosphere. Virtual heights, critical frequencies, refractive index of ionized region, reflection and refraction of radio waves in ionosphere, influence of earth's magnetic field, loss of energy in ionosphere, skip distance and maximum usable frequency (MUF), single hop and multiple hop transmissions, optimum frequency, abnormal atmospheric behavior, Ionospheric storms, radio fade out, Dellinger's effect, Effect of solar eclipse, scattering of radio waves, Luxemburg effect. Determination of TEC using GPS systems.	**12**
5.	**Magnetosphere:** Magnetic field of the Earth. Formation of the magnetosphere. Magnetic merging. Currents in the magnetosphere.	**3**
6.	**Aurora:** Formation, height, intensity. Storms and sub storms.	**3**
7.	**Introduction to Upper Atmospheric Models:** Introduction to current Upper Atmospheric Models. Solar and cosmic effects on climate and Short and long term changes of Upper Atmosphere	**3**

Text Books	1.	Electromagnetic waves & Radiating Systems	Jordan & Balman	Prentice Hall India
	2.	Antenna & Wave Propagation	K.D. Prasad.	
	3.	Upper Atmosphere	S. K. Mitra	Asiatic Society, Kolkata
	4.	Fundamentals of Atmospheric Physics	M.L. Salby	Academic Press
	5.	The Earth's Ionosphere	M. Kelley	Academic Press

Remote Sensing

Code:EC -801C Contacts:4 Credits:4

Module	Topic	Hrs.
1	Basic of remote sensing, Electromagnetic Radiation principles, Atmospheric window, Indian remote sensing satellite system, Active, Passive, ground based and space based remote sensing. (10)	10
2	Spatial, spectral, Radiometric and temporal resolution, satellite sensors, detectors and scanning technique, FOV and error sources, Image analysis and Interpretation weather RADAR, LIDAR, acoustic sounding systems, TRMM, AURA-MLS, Megha Tropiques Alitmeter , Scatterometer, Radiometer.	14

3	Remote Sensing of Atmosphere and Earth Resources: Spectral response of water, Sea surface temperature, wind speed, colour monitor, clouds and aerosal, water vapor, convective system, Trace gases.	10
4	GPS based remote sensing:Ground based and radio occultation techniques	2

Ref.: 1. Remote Sensing and GIS - B. Bhatta (oxford university press)
2. Remote sensing of the Environment – J.R. Jenson (Pearson)

Radar & Navigation

Code:EC -801D Contacts:4 Credits:4

Module No.	Topic	Hrs.
1	**Radar:** Radar Principles and Applications, radar equation, monostatic, biastatic radar, threshold detection, integration of radar pulses, system losses, effects of RCS fluctuation, internal and external noise . Radar Transmitter, Radar Receivers MTI and pulse Doppler radars, range and speed ambiguities,Doppler Filter Banks, Digital MTI Processing, MTD, Limitations to MTI performance.	10
2	Tracking Radars: Conical Scan and Monopulse, ADT. matched Filter receiver, detection criteria, automatic detection,detectors & integrators, CFAR. radar clutter and reduction.	6
3	Target recognition: SAR & ISAR.	2
4	**Navigation :** Guidance and navigation, categories of navigation. navigation equations, co-ordinate frame, dead reckoning computations, positioning, terrain matching navigation, course computation, navigation errors.	8
5	Inertial Navigation: Instruments, Platforms, Mechanization Equations, Error Analysis & Fundamental Limits.	4
6	Satellite Navigation: Ranging Equations, Range Rate Equations and Clock Errors	2
7	NAVSTAR GPS: Principles, coverage, configuration, Control & Signal Structure, DGPS,GPS Accuracy; GLONASS, GAGAN, combined GPS/GLONASS.	4

Ref. 1. M I Skolnik Introduction to Radar Systems Tata-McGraw
2. N.S.Nagaraja Elements of Electronic Navigation Systems - Tata McGraw-Hill, 2nd Edition,

Digital Image Processing

EC802A **Contacts: 4L** **Credits:4**

Module	Topics	Hours
1	Digital Image Processing systems:Introduction to structure of human eye, Image formation in the human eye, Brightness adaptation and discrimination, Image sensing and acquisition, storage, Processing, Communication, Display Image Sampling and quantization, Basic relationships between pixels.	4
2	Image Transforms:Introduction to Fourier transform, DFT and 2-D DFT, Properties of 2-D DFT, FFT, IFFT, Walsh transform, Hadamard transform, Discrete cosine transform, Slant transform, Optimum transform: Karhunen - Loeve (Hotelling) transform.	7
3	Image Enhancement in the spatial and frequency domain:Gray level transformations, Histogram processing, Arithmetic and logic operations, Spatial filtering: Introduction, Smoothing and sharpening fil ters. Frequency domain filters: Homomorphic filtering.	6
4	Image data compression:Fundamental s, Redundancies: Coding, Interpixel Psycho-visual, fidelity criteria, Image compression models,	6

	Error free compression, Lossy compression, Image compression standards: Binary image and Continuous tone Still Image compression standards, Video compression standards.	
5	Morphological Image Processing:Introduction, Dilation, Erosion, Opening, closing, Hit -or-miss transformation, Morphological algorithm operations on binary Images, Morphological algorithm operations on gray-scale Images.	6
6	Image Segmentation and description:Detection of discontinuities, Edge linking and Boundary detection, Thresholding Region based segmentation, Image Representation schemes, Boundary descriptors, and Regional descriptors.	7

Text Books:

1. R.C Gonzalez and R. Woods :-Digital Image Processing, (Indian reprint: Pearson publication, 2001)
2. Anil K. Jain :- Digital Image Processing (Prentice-Hall, India)

Reference Books:

1. W. K. Pratt :- Digital Image Processing, - 2nd Edition, (John Wiley & Sons).
2. B. Chanda & D. Dutta Majumder, Digital Image Processing and Analysis, (Prentice-Hall, India)

Internet Technology

EC802D Contact: 4L Credit: 4

Module No.	Topic	Hrs.
1	Introduction : The need for Internet, Internet protocols, TCP/IP protocol stack, Internet services, and standardization, Review of Network technologies.	4
2	Internetworking Architecture: Architectural model, Application level interconnection, Network level interconnection, Properties of the Internet, Internet Architecture, Interconnection through IP Gateways and routers, Internet and Intranet	6
3	Internet Address : Universal identifiers, Three primary classes of IP addresses, Classless IP address, Network and Broadcast addresses, Mapping Internet addresses to physical addresses (ARP), ARP protocol format, Transport Gateways and subnet addressing, Multicast addressing	6
4	Internet Protocol : Internet Architecture and Philosophy, The concept of unreliable delivery, Connectionless delivery system, The Internet Datagram, Routing direct and indirect delivery, Table driven IP routing, Protocol layering, Reliable stream transport, TCP performance, Bootstrap protocol (BOOTP).	4
5	Routing in Internet : The origin of Gateway routing tables, Original Internet Architecture and Cores, Core Gateways, Automatic route propagation, Vector distance routing, Gateway to Gateway Protocol (GGP), Autonomous system concept, Exterior Gateway Protocol (EGP), Interior Gateway Protocol (RIP, OSPF, HELLO), Border Gateway Protocol (BGP), Routing Information Protocol (RIP).	6
6	Wide Area Networking : Broadband at the Metropolitan area networking, Concepts of Packet Switching, High speed dedicated WAN services and switched WAN services, Frame relay, Virtual Private Network (VPN)	4
7	Internet Servers : DNS, DHCP Servers, FTP, TELNET, E-Mail , VOIP 4 8. Firewall & Networking : Concepts of Firewall, Configuration of firewall, Firewalls & SSL, SSL implementation, Bit implementation of SSL, Use of SSL.	4

Text Books
1. Computer Networks and Internets - Douglas E. Comer; PE.
2. TCP/IP protocol suite - Forouzan Behrouz A; TMH

Reference Books:
1. Networks for Computer Scientists and Engineers- Y Zheng & S Akhtar- Oxford
2. Communication Networks - Leon-Garcia-Widjaja; TMH.
3. Internetworking with TCP / IP - Douglas E .Comer; PE.
4. Computer Networking and the Internet - Halsell & Kulkarni- Pearson
5. Computer Networks – Andrew S. Tanenbaum; PHI.
6. Data and Computer Communication - William Stallings; PHI.
7. The Complete reference of Networking - Craig Zacker; TMH.

Advanced Engineering Mathematics

EC 802E Contact: 4L Credit: 4

Module No.	Topic	Hrs.
1	Complex variable, Cauchy Riemann eqns, Residue calculus technique, Pole at infinity, Contour integral, Jordon's lemma	6
2	Conformal mapping and Conformal transformation	6
3	Series evaluation using contour integration	3
4	Partial differential equation 6L A) Transform techniques B) Green's function techniques	3
5	Fourier series and Fourier transform	4
6	Sampling techniques	2
7	Special functions, Bessel and Hankel functions, Fourier Bessel series	6
8	Method of Moments, Evaluation of capacitance of a square plate.	6

Text Books:
1. Gustafson, advanced mathematics Engineering, Springer India
2. Advanced Engineering Mathematics by Erwin Kreyzig, Published 1962 John Willey and Sons, INC, NY
3. M. D. Greenberg, Advanced Engineering Mathematics, Pearson Education.
4. Jordon & Smith, Mathematical Techniques, OUP
5. Field Computation by Method of Moments by RF Harrington Published 1968 Robert Krieger Publishing Company, Malabar, Florida.
6. Engineering Mathematics , Vol. 1 & Vol.2, Sastry, PHI
7. Advanced Engineering Mathematics, Willey, TMH

Software Engineering

EC 802C Contact: 4L Credit: 4

Module No.	Topic	Hrs.
	Introduction: - Emergence of Software Engineering; Control Flow-Based Design, Data Structure-Oriented Design, Data Flow-Oriented Design, Object Oriented Design; Software Life Cycle Models:Classical Waterfall Model,Iterative Waterfall Model, Prototyping Model, Evolutionary Model, Spiral Model; Comparison of Different Life Cycle Models.	7

	Requirements Analysis and Specification: - Requirements Analysis, Software Requirements Specification: SRS Document, Characteristics of a Good SRS Document, Organization of the SRS Document; Techniques for Representing Complex Logic: Decision Trees and Decision Table.	4
	Software Design: - What is a Good Software Design, Cohesion and Coupling, Neat Hierarchy; Function-Oriented Design: Overview of Structured Analysis/Structured Design Methodology, Structured Analysis, Data Flow Diagrams, Shortcomings of the DFD Model; Structured Design, Flow Chart vs. Structure Chart, Transform Analysis, Transaction Analysis; Functional vs. Object-Oriented Approach.	7
	User Interface Design: - Characteristics of a Good User Interface Design; User Guidance, Graphical User Interface, Types of User Interface; Command Language-Based Interface; Menu-Based Interface; Direct Manipulation Interface; Windowing Systems.	3
	Coding, Documentation, Testing: - Coding: Standards and Guidelines, Code Walk-Through, Code Inspection; Software Documentation; Testing: Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Integration Testing, System Testing.	5
	Software Project Management: - Project Planning; Project Size Estimation Metrics: Line of Code, Function Point; Project Estimation Techniques: Empirical Estimation (Expert Judgment, Delphi Cost Estimation), Heuristic (COCOMO), Analytical Estimation (Halstead's Software Science); Staffing Level Estimation; Scheduling: Work Breakdown Structure, Activity Networks, Gantt Charts, PERT Charts; Organization and Team Structures; Risk Management; Software Configuration Management: Source Code Control System.	7
	Software Reliability and Quality Assurance: - Software Reliability; Software Quality; ISO 9000: What is ISO 9000 Certification, ISO 9000 for Software Industry, Why get ISO 9000 Certification, How to Get ISO 9000 Certification, Summary of ISO 9001 Requirements, Salient Features of ISO 9001 Requirements; SEI Capability Maturity Model.	4
	Computer Aided Software Engineering: - Benefits of CASE; CASE Support in Software Life Cycle; Characteristics of CASE Tools.	3

Books:

1.Software Engineering: A Practitioner's Approach by Roger S. Pressman; Fifth Edition, TMH.
2.Software Engineering by Ian Sommerville; Sixth Edition, Pearson Education.
3. Software Engineering Fundamentals,Behforooz,Oxford University Press
4. Software Engineering,Principles & Practices,R.Khurana,Vikas
5. Fundamentals of Software Engineering by Rajib Mall; Second Edition, Prentice-Hall India.
6. Software Engineering: Theory and Practice by Shari Lawrence Pfleeger; 2nd Edition, Pearson 7.
Fundamentals of Software Engineering by Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli; Second Edition, Prentice-Hall India

References:

1.Object-Oriented Analysis and Design with Applications by Grady Booch; 2nd Edition, Pearson Edu.
2. Object-Oriented Analysis and Design by Andrew Haigh; Edition 2001, Tata McGraw-Hill.
3.Software Engineering,Jawadekar,TMH

Mobile Computing

EC802B Contact: 3L + 1TCredit: 4

Model	Topic	Hrs.

No.		
1	Introduction: Wireless Communication Fundamentals: Wireless transmission, Frequencies for radio transmission, Signal Propagation, Modulations- Spread spectrum – MCA, SDMA, FDMA, TDMA, CDMA, Cellular wireless Networks.	5
2	Wireless access protocols: IEEE 802.11 standard, WLAN Family, WLAN transmission technology, WLAN system architecture, Collision Sense Multiple Access with Collision Detection(CSMA/CD) and CSMA Collision avoidance (CSMA/CA), 802.11 PHY and MAC layers, IEEE 802.11 Distributed Co-ordinate System (DCF) and Point Co-ordination Function (PCF), WLAN family, HyperLAN, Bluetooth, Brief overview of WiMAX for wireless broadband communication.	6
3	Basic mobility management in Wireless Networks: Handoff and location management, Basic Mobile IP operations, types, concepts, Four basic entities for MIPv4, Mobile IPv4 Registration, Tunneling, MIPv4 Reverse Tunneling, MIPv4 Triangular Routing.	4
4	Mobile Network Layer Considerations: Limitations of MIPv4, MIPv6 and HMIPv6, Dynamic Host Configuration protocol, Micromobility solutions to the host mobility problem, Routing in Mobile ad-hoc network, DSDV, DSR, AODV, Alternative metrics.	5
5	Transport Layer Considerations: Traditional TCP, Classical TCP improvements- WAP, WAP 2.0.	3
6	Mobile Operating Systems: PalmOS, Pocket PC and Windows CE, Embedded Linux and other Mobile Opearting Systems.	4
7	Application Layer Considerations: Adaptation, Disconnected operations, Mobile Agents, Business implications and mobile commerce. Emerging Technologies such as Wearable Computing- challenges and concerns.	5

Books:

1. Mobile Computing by Raj Kamal, Oxford Higher Education University Press, New Delhi.
2. 802.11 Wireless LAN Fundamentals by Pejman Roshan & Jonathan Leay, Pearson Education, ND.
3.GPRS Networks by Geoff Sanders, John Wiley and sons, England

EC- 883: Grand - Viva : 0-0-0-0-5: Each student has to appear for final viva.

EC- 882: Project-II: 0-0-9-9-6: A final / detailed project to be completed, a Thesis on that topic to be submitted and to be appeared in a seminar to defend the submitted final project.

EC- 881: Grand - Viva : 0-0-0-0-5: Each student has to appear for seminar as assigned.

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