COCHIN UNIVERSITY OF SCIENCE & TECHNOLOGY

Scheme for I to VIII
B.TECH ELECTRICAL & ELECTRONICS ENGINEERING
(2012 Admission onwards)

Scheme of Examinations (2012 admissions)

SEMESTER I&II (Common to all branches)

Code No.	Subject	L Hrs/wk	T Hrs/wk	P Hrs/wk	C	Int	Univ	Total
1101	Engineering Mathematics –I	2	1		4	50	100	150
1102	Engineering Physics	3			4	50	100	150
1103	Engineering Chemistry	3			4	50	100	150
1104	Engineering Mechanics	3	1		5	50	100	150
1105	Engineering Graphics	1	-	3	5	50	100	150
1106	Basic Civil and Mechanical Engineering	2			4	50	100	150
1107	Basic Electrical and Electronics Engineering	2			4	50	100	150
1108	Computer Programming	1			4	50	100	150
1109	Environmental Studies and Technical Communication	2*			3	50	100	150
11 L1	Electrical and Mechanical Workshop	-	-	3	4	100	-	100
11 L2	Computer Programming Laboratory	-	-	2	2	100	-	100
11 L3	Language Laboratory	-	-	1	1	100	-	100
TOTAL		**19**	**2**	**9**	**44**			

* 1 hour / week each for Environmental Studies and Technical Communication.

SEMESTER III

Course Code	*Subject*	*L Hrs /Wk*	*T Hrs/Wk*	*P Hrs /Wk*	*Credit*	*Internal*	*University*	*Total*
CE/CS/EB/EC/EE/EI/FT/IT/ME/SE 1301	Engineering Mathematics II	3	1	0	3	50	100	150
EE1302	Material Science	3	1	0	3	50	100	150
EE1303	Fluid Mechanics & Heat Engines	3	1	0	3	50	100	150
EE1304	Circuits, Signals & Systems I	3	1	0	3	50	100	150
EE1305	Electrical Measurements & Measuring Instruments	3	1	0	3	50	100	150
CS/EB EE1306	Electronic Devices and Circuits	3	1	0	3	50	100	150
EE13L1	Electronic Circuits Lab	0	0	3	2	100	-	100
EE13L2	Basic Electrical Engineering Lab	0	0	3	2	100	-	100
TOTAL		**18**	**6**	**6**	**22**			

SEMESTER IV

Course Code	*Subject*	*L Hrs /Wk*	*T Hrs/Wk*	*P Hrs /Wk*	*Credit*	*Internal*	*University*	*Total*
CE/CS/EB/EC/EE/EI/FT/IT/ME/SE 1401	Engineering Mathematics III	3	1	0	3	50	100	150
EE1402	Digital Electronics	3	1	0	3	50	100	150
EE1403	Electrical Machines I	3	1	0	3	50	100	150
EE1404	Circuits, Signals & Systems II	3	1	0	3	50	100	150
EE1405	Analog Communication	3	1	0	3	50	100	150
EE1406	Industrial & Power Electronics	3	1	0	3	50	100	150
EE14L1	Digital Electronics Lab	0	0	3	2	100	-	100
EE14L2	Electrical Measurements Lab	0	0	3	2	100	-	100
TOTAL		**18**	**6**	**6**	**22**			

SEMESTER V

Course Code	*Subject*	*L Hrs /Wk*	*T Hrs/Wk*	*P Hrs /Wk*	*Credit*	*Internal*	*University*	*Total*
CE/CS/EB/EC/EE/EI/FT/IT/ME/SE 1501	Engineering Mathematics IV	3	1	0	3	50	100	150
EE1502	Electrical Machines II	3	1	0	3	50	100	150
EE1503	Power Systems I	3	1	0	3	50	100	150
EE1504	Microprocessor Based Systems	3	1	0	3	50	100	150
EE1505	Linear Integrated Circuits	3	1	0	3	50	100	150
EE1506	Field Theory	3	1	0	3	50	100	150
EE15L1	Electrical Machines Lab I	0	0	3	2	100	-	100
EE15L2	Microprocessor & Microcontroller Lab	0	0	3	2	100	-	100
TOTAL		**18**	**6**	**6**	**22**			

SEMESTER VI

Course Code	*Subject*	*L Hrs /Wk*	*T Hrs/Wk*	*P Hrs /Wk*	*Credit*	*Internal*	*University*	*Total*
EE1601	Modern Communication Engineering	3	1	0	3	50	100	150
EE1602	Electrical Drawing	3	1	0	3	50	100	150
EE1603	Modern Digital Signal Processing	3	1	0	3	50	100	150
EE1604	Electrical Machines III	3	1	0	3	50	100	150
EE1605	Control System I	3	1	0	3	50	100	150
EE1606	Elective I	3	1	0	3	50	100	150
EE16L1	Power Electronics Lab	0	0	3	2	100	-	100
EE16L2	Mini Project	0	0	3	2	100	-	100
TOTAL		**18**	**6**	**6**	**22**			

ELECTIVES

1606 E1-Advanced Microprocessors
1606 E2-Optimization Techniques & Algorithm
1606 E3-Image Processing
1606 E4-Non Conventional & Renewable Energy Sources

SEMESTER VII

Course Code	*Subject*	*L Hrs /Wk*	*T Hrs/Wk*	*P Hrs /Wk*	*Credit*	*Internal*	*University*	*Total*
EE1701	Industrial Organization and Management	3	1	0	3	50	100	150
EE1702	Design Estimation & Costing	3	1	0	3	50	100	150
EE1703	Power Systems II	3	1	0	3	50	100	150
EE1704	Control System II	3	1	0	3	50	100	150
EE1705	Elective II	3	1	0	3	50	100	150
EE17L1	Electrical Machines Lab II	0	0	3	2	100	-	100
EE17L2	Advanced Electrical Engineering Lab	0	0	3	2	100	-	100
EE17L3	Project Design	0	0	2	1	50	-	50
EE17L4	Seminar	0	0	2	2	100	-	100
TOTAL		**15**	**5**	**10**	**22**			

ELECTIVES

EE1705 E1-Wireless Communications
EE1705 E2-High Voltage DC & Extra High Voltage AC
EE1705 E3-Soft Computing
EE1705 E4-Energy Auditing & Analysis

SEMESTER VIII

Course Code	*Subject*	*L Hrs /Wk*	*T Hrs/Wk*	*P Hrs /Wk*	*Credit*	*Internal*	*University*	*Total*
EE1801	Electronic Instrumentation	3	1	0	3	50	100	150
EE1802	Electrical Machine Design	3	1	0	3	50	100	150
EE1803	Power Systems III	3	1	0	3	50	100	150
EE1804	Elective III	3	1	0	3	50	100	150
EE18L1	Major Project	0	0	14	8	300	-	300
EE18L2	Viva-voce	0	0	0	2	-	100	100
TOTAL		**12**	**4**	**14**	**22**			

ELECTIVES
EE 1804 E1-Mechatronics
EE1804 E2-Biosensors and Transducers
EE1804 E3-Flexible AC Transmission Systems
EE1804 E4-Power Quality

1101 ENGINEERING MATHEMATICS I

Module I
Ordinary differential equations:

First order differential equations - exact differential equations, Bernoulli's equations--Methods of solution and Simple applications.

Linear differential equations of higher orders with constant co-efficients-Methods of solution of these equations. Cauchy's linear differential equations. Simultaneous linear differential equations- Simple applications of linear differential equations in engineering problems –Electrical Circuits, Mechanical Systems.

Module II
Infinite series : Integral test, comparison test, ratio test, Cauchy's root test, Raabe's test, seies of positive and negative terms, concept of absolute convergence, alternating series, Leibniz test(No proofs for any of the above tests)

Power series : Taylor and Maclaurin series of functions, Leibniz formula for the nth derivative of the product of two functions (No proof),use of Leibniz formula for the determination of co-efficients of the power series.

Module III
Partial differentiation: Partial differentiation-Concept of partial derivative - Chain rule- Total derivative- Euler's theorem for homogeneous functions, Differentials and their applications in errors and approximations, Jacobians - Maxima minima of functions of two variables(Proof of the result not required)-Simple applications.

Co-ordinate systems: Rectangular co-ordinates-Polar co-ordinates-In plane and in Space-Cylindrical polar co-ordinates-Spherical polar co-ordinates.

Module IV
Integral calculus:
Application of definite integrals: Area, Volume, Arc length, Surface area.
Multiple integrals : Evaluation of double integrals-Change of order of integration. Evaluation of triple integrals-Change of Variables in integrals.
Applications of multiple integrals. Plane Area, Surface area &Volumes of solids

References:

1.S.S.Sastry, Engineering Mathematics -Vol1, PHI publishers
2.Erwin Kreyzig, Advanced Engineering Mathematics, Wiley Eastern
3.T.Veerarajan, Engineering Mathematics, TMGH Publishers
4.B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers

Type of Questions for University Exam.
Q 1:Eight short answer questions of 5 marks with two questions from each of the four modules. (8x5 = 40 marks)
Q 2 to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B. (4x15 = 60 marks)

1102 ENGINEERING PHYSICS

Module 1

Laser-introduction--spontaneous and stimulated emission-principle of laser- properties of laser-Einstein coefficients and the analysis of lasing conditions- Basic components of a laser-Different types of lasers-construction, working and applications of Ruby laser-Neodymium YAG laser- He-Ne laser- semiconductor laser-Applications of laser in medicine, industry, science and communication.

Holography-basic principle-Comparison with ordinary photography-Recording and reconstruction of holograms-applications.

Fibre optics - Basic structure of an optical fibre - step-index fibre and graded index fibre- propagation of light in an optical fibre-acceptance angle and acceptance cone- Numerical aperture of a step-index fibre-Numerical aperture of a graded index fibre-modes of propagation-step index monomode fibre-Multimode stepindex fibre- Graded multimode fibre-Attenuation in optic fibres-fibre losses-material loss, scattering loss, absorption loss, leaky modes-dispersion in optical fibres- Applications.

Module II

Crystallography – Space lattice- Basis- Unit cell- Unit cell parameters- Crystal systems- Bravais lattices-Three cubic lattices-sc, bcc, and fcc- Number of atoms per unit cell- Co-ordination number- Atomic radius-Packing factor-Relation between density and crystal lattice constants- Lattice planes and Miller indices-Separation between lattice planes in sc- Bragg's law- Bragg's x-ray spectrometer- Crystal structure analysis.

Liquid crystals- Liquid crystals, display systems-merits and demerits- Metallic glasses- Types of metallic glasses (Metal-metalloid glasses, Metal-metal glasses) – Properties of metallic glasses (Structural, electrical,magnetic and chemical properties).

Shape memory alloys- Shape memory effect, pseudo elasticity

Module III

Introduction to nanoscale science and technology- nanostructures-nanoring, nanorod, nanoparticle, nanoshells- Properties of nanoparticles- optical, electrical, magnetic, mechanical properties and quantum confinement- Classification of nanomaterials- C60, metallic nanocomposites and polymer nanocomposites-Applications of nanotechnology.

Superconductivity-Introduction--transition temperature-Meissner effect-properties of super conductors.Types of superconductors-type 1 and type 2- AC Josephsons effect- DC Jospehsons effect- Flux quantisation-Squid-High temperature superconductors-Applications of super conductivity.

Special Theory of Relativity - Michelson-Morley experiment. Einstein's postulates. Lorentz transformation equations (no derivation). Simultaneity. Length contraction. Time dilation. Velocity addition. Relativistic mass. Mass energy relation. Mass less particle.

Module IV

Quantum mechanics-Introduction-origin of quantum theory-black body radiation and photo electric effect (brief ideas only)-matter waves- wave packet-uncertainty principle-(two forms)Time dependent Shrodinger equation for a free particle-Particle in force field and time dependent Schrodinger equation-Time independent schrodinger equation-Physical intrepretation of wave function-application -Particle in a Box (one dimensional) –Energy eigen values and wave functions **Ultrasonics**-piezo electric effect-Magnetostriction effect-production of ultrasonics-properties of ultrasonics- ultrasonic diffractometer and determination of velocity of ultrasonics in a liquid-Application of ultrasonics in non destructive testing - Accoustics of building-reverberation- Absorption Coefficient-Sabines formula for reverberation time(Derivation)-Accoustic intensity- loudness-decibel-phon-conditions for good acoustics(Qualitative study).

References:

1.S. Mani Naidu, A Text book of Engineering Physics, Pearson, 2010
2.M.C. Santosh Kumar, Engineering Physics, Nalpat Publishers.
3.B. Premlet, Advanced Engineering Physics, Phasor Books, Kollam.
4.A.S. Vasudeva, Modern Engineering Physics, S. Chand & Co.
5.Prabir K. Vasu and Hrishikesh Dhasmana, Engineering Physics, Ane books Pvt. Ltd., 2010.
6.S.O. Pillai & Sivakami, Applied Physics, New Age International (P) Ltd., Second Edition 2008.
7.G.S. Raghuvanshi, Engineering Physics, Prentice Hall of India.

Type of Questions for University Exam.

Q 1:Eight short answer questions of 5 marks with two questions from each of the four modules. (8x5 = 40 marks)

Q 2 to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B. (4x15 = 60 marks)

1103 ENGINEERING CHEMISTRY

Module I

Solid state chemistry: Fundamentals, Bonding in solids, Born-Haber cycle, Point defects, Methods to improve reactivity of solids, Free electron theory, Band theory, Fermi level in semiconductors, Molecular field theory of magnetic materials.

Spectroscopy: Molecular energy levels-Types of molecular spectra- Electronic spectra (Classification of electronic transitions- Beer Lamberts law, Vibrational spectra (mechanism of interaction and application), Rotational spectra (Determination of bond length and application). NMR spectra (Basic principle, chemical shift, spin-spin splitting)

Solid surface characterisation: Electron spectroscopy for chemical analysis, Chemical shift, BET isotherm, Thermodynamics of adsorption.

Module II

Electrochemistry: Fundamentals, Electrode potential, Nernst's equation, Types of electrodes, Salt bridge, E.M.F measurement. Concentration cells, Calculation of E.M.F of a concentration cell.

Acids and bases, Arrhenius concept, Bronsted-Lowry concept of acids and bases, Lewis concept, Buffer solutions, pH measurement, Polarisation, Overvoltage.

Power generation: Secondary cells, Fuel cells, Photovoltaic effect, Solar cells.

Corrosion and its control: Theories of corrosion - Galvanic series- Types of corrosion - Factors affecting corrosion and different methods of corrosion control.

Chemical Kinetics: reaction rate, rate constant, rate law, reaction order, first order, second order, pseudo-first order reactions, integrated rate laws, half-life of a reaction and its relation to rate constant. Molecularity, simple unimolecular and bimolecular reactions. Arrhenius equation.

Module III

Chemical Thermodynamics: Fundamentals, Molecular interpretation of internal energy, enthalpy and entropy, Heat of reaction, Kirchhof's equation, Trouton's rule, Entropy changes accompanying different processes, Nernst heat theorem, Third-law.

Free energy: Dependence on pressure and temperature, Gibbs-Helmholtz equation, Free energy changes and equilibrium constant, chemical potential, Fugacity, Thermodynamics of biochemical reactions.

Phase Rule: Terms involved in phase rule and examples, Application of phase rule to one component water system, Application of phase rule to two-component systems.

Module IV

Engineering materials:

Polymers- Classifications- Mechanism of polymerisation (Addition, free radical, cationic, anionic and coordination polymerisation)- Thermoplastics and thermosetting plastics-Compounding of plastics-Moulding techniques of plastics (Compression, Injection, Transfer and Extrusion moulding)-Preparation, properties and uses of PVC, PVA, Nylon, PET - Silicon polymers- Biodegradable plastics. Elastomers- structure of natural rubber- vulcanisation- synthetic rubbers (Buna-S, Butyl rubber and Neoprene).

Lubricants- Introduction-Mechanism of lubrication- solid and liquid lubricant- Properties of lubricants-Viscosity index- flash and fire point- cloud and pour point- aniline value.

Refractories: Classification – Properties of refractories.

Cement- Manufacture of Portland cement- Theory of setting and hardening of cement.

References:

1. Peter Atkins, Julio de Paula, Elements of Physical Chemistry, Oxford University Press, 2005.
2. John E. McMurry and Robert C. Fay, Chemistry, 5th Edition, Pearson, 2008.
3. O. G Palanna, Engineering Chemistry, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2009.
4. R.N. Goyal, Harmendra Goel, Textbook of Engineering Chemistry, 2nd Edition, Ane Books Pvt. Ltd., 2011.
5. R Gopalan, D Venkappayya, Sulochana Nagarajan, Textbook of Engineering Chemistry, 2nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2005.
6. Shashi Chawla, A Text Book of Engineering Chemistry, Dhanpat Rai & Co, New Delhi, 2003.
7. Kochubaby Manjooran, Modern Engineering Chemistry, Kannantheri Publication, Kochi.

Type of Questions for University Exam.

Q 1:Eight short answer questions of 5 marks with two questions from each of the four modules. (8x5 = 40 marks)

Q 2 to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B. (4x15 = 60 marks)

1104 ENGINEERING MECHANICS

A)STATICS

Module I

Concurrent forces in a plane: Principles of statics. Composition and resolution of forces. Equilibrium of concurrent forces in a plane. Method of projection. Method of moments. Friction.

Parallel forces in a plane: Two parallel forces. General case of parallel forces in a plane. Centre of parallel forces and centre of gravity, Pappus theorems, centroids of composite plane figures and curves. Distributed forces in a plane.

Module II

Properties of areas: . Moment of inertia of a plane figure with respect to an axis in its plane. Polar moment of inertia. Product of inertia. Principal axes. Mass moment of inertia of material bodies.

General case of forces in a plane: Composition of forces in a plane. Equilibrium of forces in a plane. Plane trusses - Method of joints. Method of sections. Plane frames : Method of members. **Principle of virtual work:** Equilibrium of ideal systems, stable and unstable equilibrium.

B)DYNAMICS

Module III

Rectilinear translation: Kinematics of rectilinear motion. Differential equation of rectilinear motion. Motion of a particle acted upon by a constant force, by a force as a function of time and by a force proportional to displacement. Simple harmonic motion. D'Alembert's principle. Momentum and impulse. Work and energy, ideal systems, conservation of energy. Impact.

Module IV

Curvilinear translation: Kinematics of curvilinear translation. Differential equations of motion. Motion of a projectile. D'Alembert's principle in curvilinear motion. Moment of momentum. Work and energy in curvilinear motion.

Rotation of a rigid body: Kinematics of rotation. Equation of motion of a rigid body rotating about a fixed axis. Rotation under the action of a constant moment. Compound pendulum. General case of moment proportional to the angle of rotation. D'Alemberts principle of rotation. Resultant inertia force in rotation. Principle of angular momentum in rotation. Energy equation for rotating bodies.

References:

1. Timoshenko and Young, Engineering Mechanics, McGraw Hill Book Company.
2. Beer F. P. and Johnston E. R, Mechanics for Engineers (Vol. 1- Statics and Vol.2 -Dynamics), Tata McGraw Hill.
3. Merriam H. L. & Kraige L. G, Engineering Mechanics (Vol. 1- Statics and Vol.2 -Dynamics), John Wiley and Sons.
4. Biju N, Engineering mechanics, Educational Publications.

Type of Questions for University Exam.

Q 1:Eight short answer questions of 5 marks with two questions from each of the four modules. (8x5 = 40 marks)

Q 2 to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B. (4x15 = 60 marks)

1105 ENGINEERING GRAPHICS

Module I

Introduction to engineering graphics. Drawing instruments and their use. familiarisation with current Indian Standard Code of Practice for general engineering drawing.

Scales- plain scale ,vernier scale, diagonal scale.

Conic sections- Construction of ellipse, parabola, hyperbola - construction of cycloid, involute, archimedian spiral and logarithmic spiral- drawing tangents and normals to these curves.

Module II

Introduction to orthographic projections- plane of projection- principles of first angle and third angle projections, projection of points in different quadrants.

Orthographic projection of straight lines parallel to one plane and inclined to the other plane- straight lines inclined to both the planes- true length and inclination of lines with reference planes- traces of lines.

Projection of plane laminae of geometrical shapes in oblique positions.

Module III

Projection of polyhedra and solids of revolution- frustum, projection of solids with axis parallel to one plane and parallel or perpendicular to other plane- projection of solids with axis inclined to both the planes- projection of solids on auxiliary planes.

Section of solids by planes inclined to horizontal or vertical planes- true shape of sections.

Module IV

Development of surface of cubes, prisms, cylinders, pyramids and cones

Intersection of surfaces- methods of determining lines of intersection - intersection of prism in prism and cylinder in cylinder.

Module V

Introduction to isometric projection- isometric scales, isometric views- isometric projections of prisms, pyramids, cylinders, cones and spheres.

Introduction to perspective projections : visual ray method and vanishing point method- perspective of circles- perspective views of prisms and pyramids.

References:

1. K.C. John. Engineering Graphics, PHI Learning
2. P.I. Varghese and K.C. John, Engineering Graphics, JET Publishers
3. N.D.Bhat , Elementary Engineering Drawing, Charotar publishing house
4. P.S.Gill , Geometric Drawing, B.D Kataria &Sons, Ludhiana
5. P I Varghese , Engineering Graphics, VIP Publishers.

University Examination Question Paper pattern

Two questions of 20 marks each from all the five modules. Answer one question from each module. (5x20 = 100 marks)

1106 BASIC CIVIL AND MECHANICAL ENGINEERING

PART- A: BASIC CIVIL ENGINEERING

Module I

Engineering Materials: Cement - varieties and grade of cement and its uses. Cement mortar- Steel- types of steel for reinforcement bars, steel structural sections. Brick- varieties and strength, tests on bricks.

Aggregates- types & requirements. Concrete- grades of concrete as per IS code, water cement ratio, workability, mixing, batching, placing, compaction and curing.

Construction: Foundation- types of foundations- isolated footing, combined footing, raft, pile & well foundations- Foundation for Machinery

Module II

Super structure: Brick masonry, English bond and Flemish bond, Stone masonry-Ashlar masonry- Rubble masonry. Roofing- Steel trusses, roofing for industrial buildings

Surveying: Principles, instruments, ranging and chaining of survey lines, errors in chaining, field work, field book, selection of survey stations, reconnaissance.

Leveling: Leveling instruments, different types, temporary adjustments, mean sea level, reduced level of point, booking of field notes, reduction of levels by height of collimation method.

References:

1. S.C. Rangawala, Engineering Materials, Charotar Publishing House, Anand.
2. Roy M. Thomas, Fundamentals of Civil Engineering, Educational Publishers,Ernakulam
3 Surendra Singh, Building Materials, Vikas Publishing Company, New delhi.
4 S.C. Rangawala, Building Construction, Charotar Publishing House, Anand.
5. P. Kanetkar, Surveying and Levelling, Volumes 1 and 2, United Book Corporation, Poona.

PART A - Type of Questions for University Exam. (Maximum Marks: 50) (To be answered in separate answer book)
Q 1 :Four short answer questions of 4 marks each with two questions from each modules. (4x5 = 20 marks)
Q 2 to Q.5 : Two questions A & B of 15 marks from each moduls with option to answer either A or B. (2 x 15 = 30 marks)

PART – B: BASIC MECHANICAL EGINEERING

Module I

Thermodynamics: Thermodynamics systems – open, closed and isolated systems, equilibrium state of a system, property and state, process, cycle, Zeroth law of thermodynamics- concept of temperature, temperature scales. First law – internal energy, enthalpy, work and heat, Different processes, isobaric, isochoric, isothermal and adiabatic processes Second law – Kelvin-plank and Claussius statements, Carnot Cycle.

Internal Combustion Engines: Air standard cycles – Otto and Diesel cycles, working of two stroke and four stroke Petrol and Diesel engines, Carburatted and MPFI engines, fuel pump, fuel injector, ignition system, cooling system, lubricating system.

Module II

Refrigeration and Air conditioning: Vapour compression and vapour absorption refrigeration systems, summer, winter and comfort air conditioning.

Manufacturing processes – Casting (sand and die casting processes), Forging (open &closed die forging), Rolling, Extrusion, Welding (resistance, arc and gas), brazing and soldering

Elementary ideas of **simple reaction and impulse turbines**, compounding of turbines.

Transmission of power: Belt drives (open and closed), Chain drives.

References:

1. P.K. Nag, Engineering Thermodynamics, Tata McGraw Hill
2. J.P. Holman, Thermodynamics, Mc Graw Hill
3. Rogowsky, Elements of Internal combustion Engines, Tata McGraw Hill
4. Gill, Smith & Ziurys, Fundamentals of Internal Combustion Engines, Oxford & IBH
5. Stoecker, Refrigeration and Air Conditioning, Tata McGraw Hill
6. Raghavan : Material Science and Engineering, Prentice Hall of India

PART B - Type of Questions for University Exam. (Maximum Marks: 50) (To be answered in separate answer book)
Q 1 :Four short answer questions of 4 marks each with two questions from each modules. (4x5 = 20 marks)
Q 2 to Q.5 : Two questions A & B of 15 marks from each moduls with option to answer either A or B. (2 x 15 = 30 marks)

1107 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

PART- A: ELECTRICAL ENGINEERING

Module I

Resistance : Circular wires – Wire Tables – Temperature Effects – Types of Resistors – Colour Coding and Standard Resistor Values – Conductance – Ohmmeters – Metric Units –The Memristor. **Ohm's Law, Power and Energy** : Ohm's Law – Plotting Ohm's Law – Power – Energy – Efficiency – Circuits Breakers, GFCI's and Fuses – Applications .

Series dc Circuits: Series Resistors – Series Circuits – Power Distribution and Series circuit – Voltage Sources in a Series – Kirchoff's Voltage Law – Voltage Division in a Series Circuit – Interchanging Series Elements – Notation – Voltage Regulation and the Internal Resistance of Voltage Sources. **Parallel dc Circuits:** Parallel Resistors – Parallel Circuits – Power Distribution in a Parallel Circuit – Kirchhoff's Current Law – Current Divider Rule – Voltage Sources in Parallel – Open and Short Circuits.

Capacitors: The Electric Field – Capacitance – Capacitors, **Inductors:** Magnetic Field – Inductance.

Module II

AC Fundamentals: Sinusoidal Alternating Waveforms - Sinusoidal ac Voltage Characteristics and Definitions – Frequency Spectrum – The Sinusoidal Waveform – General format for the sinusoidal Voltage of current – Phase Relations – Average Value – Effective (rms) Values – ac Meters and Instruments. Elementary Concepts of Energy Meter Watt Meter, Volt Meter and Ammeter.

The Basic Elements and Phasors: Response of Basic R,L and C Elements to a Sinusoidal Voltage or Current – Frequency Response of the Basic Elements – Average Power and Power Factor – Complex Numbers – Rectangular Form – Polar Form – Conversion between Forms.

Series and Parallel ac Circuits: Impedance and the Phasor Diagram- Series Configuration – Voltage Divider Rule – Frequency Response for Series ac Circuits –Admittance and Susceptance – Parallel ac Networks – Current Divider Rule – Frequency response of Parallel Elements.

Introduction to 3 phase Systems: StarΔ Connection

Elementary Concepts of Generation, Transmission, and Distribution: Various Levels of Power Transmission – Conventional Sources of Electrical Energy, Hydro, Thermal, Nuclear and Diesel Power Station - Introduction to Primary and Secondary distribution - Basic Concepts of Transformers - Principle of Operation – Applications to Power Systems.

PART- B: ELECTRONICS ENGINEERING

Module III

The Diode - Biasing the Diode, Voltage - Current Characteristic of a Diode, Diode Models, **Diode Applications** - Half Wave and Full Wave Rectifiers, Power supply Filters and Regulators, **Special Purpose Diodes** - Zener Diodes-Applications, Varactor Diodes, Optical Diodes-Other Types of Diodes. **Bipolar Junction Transistors (BJTs)** - Transistor Structure - Basic Transistor Operation, Transistor characteristics and parameters, Transistor as an Amplifier, Transistor as a Switch.

Module IV

Sensors-Temperature, light, force and sound sensors; **Actuators** – Heat, Light, force and sound actuators. **Electronic measurements** - measurements of voltages and currents, voltmeter, ammeter, multimeter, CRO (Block level treatment only)

Introduction to Electronic Communication systems: Modulation and Demodulation, Analog communication system, Electromagnetic frequency spectrum, Bandwidth and information capacity, Principles of Amplitude and angle modulation, Bandwidth requirements of angle modulated waves.

Optical communication: Fundamental concepts, Block diagram of an optical fibre communications system. **Cellular Telephone**: Fundamental concepts, Frequency reuse, Block diagram of a simplified cellular telephone system, Roaming and handoffs

Satellite communication: Block diagram of Satellite system link models – Uplink, Transponder Downlink.

Reference:

1. Boylestad, *Introductory Circuit analysis*, Pearson Education, 12/e, 2012.
2. Thomas L. Floyd, Electronic Devices, Pearson Education Inc. 7th edition.
3. Neil Storey, Electronics A systems approach, Pearson Education Inc. 2011 Wayne Tomasi, *Electronic Communication Systems: Fundamentals through Advanced*, Pearson Education Inc. 5th edition.

Type of Questions for University Exam.

Q 1:Eight short answer questions of 5 marks with two questions from each of the four modules. (8x5 = 40 marks)

Q 2 to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B. (4x15 = 60 marks)

1108 COMPUTER PROGRAMMING

Module I

Basics of Computer and Information Technology:

Digital Computer System (CPU, Memory, I/O devices)- Working of a digital computer- Hardware and Software : Definition - Categories of Software, Application of Computers – Role of Information Technology – Internet Services

Problem Solving Methodology:

Program - Programming Process (Problem statement, Analysis, Design a solution, Implement/Coding the solution, Test the solution, Iteration through the phases to refine/correct the program)- Design tools (Algorithm, Flow-chart, Pseudo-code)- Develop algorithms for simple problems.

Module II

Programming Languages:

Types and generation of programming languages- Compiler – Interpreter-Linker –Loader –Execution of Program

Basics of C:

Character set-Identifier- Keywords- Constants –Data Types- Variables and declaration –Operators and Expressions – Operator precedence and associativity – Expression Evaluation (Simple Examples) - Input and output functions – Simple computational problems involving the above constructs.

Module III

Control Statements:

Selection, Conditional operator, Iteration (for, while, do-while), Branching (switch, break, continue, goto), Nesting of control statements- Problems using control statements.

Arrays and Strings:

1D and 2D arrays –Searching (Linear and Binary) - Sorting (Bubble, Selection) – Matrix manipulation programs – Strings and basic operations on strings – Strings functions - Programs on string manipulation

Functions:

Definition – Calling – Declaration – Parameter Passing (by value and by reference) – Recursion – Library functions –Programs based on functions

Module IV

User defined data types:

Structure – Union - Enumerated data type - Programs involving structure and union.

Pointers:

Declaration, Initialization – Pointers and arrays – Pointers and structures – Pointers and functions – Command line arguments – Dynamic memory allocation – Operations on pointers – Programs involving the above concepts

Files:

File concept – File pointer – File handling operations (open, close, read, write etc) on sequential and random access files. Programs on file manipulations using fgetc(), fgets), fseek.

References:

1. Pradip Dey and Manas Ghosh, Computer Fundamentals and Programming in C, Oxford.
2. Samarjit Ghosh, All of C, PHI Learning
3. Byron Gottfried , Programming with C , 2nd edition, TMH publication.
4. B.W. Kernighan and D.M. Ritchie, The C Programming Language, Pearson Education.
5. R G Dromey , How to solve it by Computer, Prentice Hall
6. D.E. Knuth, The Art of Computer Programming – Volume 1,2 &3, Addison Wesley.
7. Yashwant P. Kanetkar, Let Us Use C, 8th Edition (Paperback).
8. Sukhendu Dey , Complete Knowledge in C, Narosa
9. Varghese Paul, Computer Fundamentals , EPD.

Type of Questions for University Exam.

Q 1:Eight short answer questions of 5 marks with two questions from each of the four modules. (8x5 = 40 marks)

Q 2 to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B. (4x15 = 60 marks)

1109 ENVIRONMENTAL STUDIES AND TECHNICAL COMMUNICATION

PART – A: ENVIRONMENTAL STUDIES (1 hour / week)

Module I

Natural resources - issues related to the use and over exploitation of forest resources, water resources, mineral resources, food resources, energy resources and land resources- role of an individual in conservation of natural resources - equitable use of resources for sustainable life styles.

Concept of an ecosystem - structure and function - energy flow in the ecosystem - ecological succession - food chains, food webs and ecological pyramids - structure and functions of a forest ecosystem and an aquatic eco system.

Definition of biodiversity - genetic, species and ecosystem diversity - biogeographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Threats to biodiversity, Conservation of biodiversity.

Module II

Environmental Pollution - Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, marine pollution, thermal pollution and nuclear hazards - Causes, effects and control measures of urban and industrial solid wastes -Role of an individual in prevention of pollution - An overview of the various environmental legislations in India - Issues involved in enforcement of environmental legislation. Disaster Management: Floods, earth quake, cyclone and landslides. Role of public awareness in disaster management.

The concept of sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, water shed management - Resettlement and rehabilitation of people; its problems and concerns - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies - Population growth and problems of population explosion – Environment and human health – Human rights – Value education – Role of Information Technology in environment and human health - Environmental ethics: issues and possible solutions.

References:

1.Rajagopalan. R, Environmental Studies: From Crisis to Cure, Oxford University Press, 2005

2.Erach Bharucha, Textbook of Environmental Studies and Ethics, Universities Press (India), Hyderabad, 2005.

3.Jayashree A. Parikh, V.M. Balsaraf, P.B. Dwivedi, Environmental Studies, Ane Books Pvt. Ltd., 2010.

4.Anindita Basak, Environmental Studies, Pearson, 2009.

5.Gouri Suresh, Environmental Studies and Ethics, I.K. International Publishing House Pvt. Ltd., New Delhi, 2007.

6.S.P. Misra, Essential Environmental Studies, 3rd Edition, Ane Books Pvt. Ltd., 2011.

7.Benny Joseph, Environmental Science & Engineering, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.

8.Meenambal T , Uma R M and K Murali, Principles of Environmental Science and Engineering, S. Chand & Company Ltd, 2005

PART – B: TECHNICAL COMMUNICATION (1 hour / week)

This is a practice oriented, need based, and functional – communicative course. It is intended to develop the student's skill of communication in listening, speaking, reading and writing. The student is advised to cultivate the habit of reading newspapers, magazines and books in a free, extensive manner to consolidate the skill already achieved. A more inter-active process of teaching/learning is called for in order to achieve effective communication.

Questions at the class tests and semester end examination will be largely problem solving and application oriented in nature.

Module I

Communicative Grammar: Time, tense and aspect; Verbs of state and event; Use of preposition; Expressing emotions and attitudes: Hope, anticipation of pleasure, disappointment, approval, disapproval, surprise.

The sounds of English: (it is not a course in phonetics. Technical terms will not be used except when absolutely necessary.)

Length of vowels-long and short vowels

/ | /, / 3 : /, /a :/, / : /, /U : / | / / 2 /, /,/ Λ /, / O /, / U / - Consonants : / f, v, o, o, s, z, 3/ - Stress pattern -

Intonation: failing and rising.

Oral Communication: starting and ending a conversation; telling and asking people to do things; expressing opinions and ideas, decisions and intentions, offers and invitations, feelings, right and wrong, numbers and money.

Purpose and audience; dealing with customers and clients; face-to-face discussions; interviews; group discussions; meetings and attending meetings; checking understanding; raising questions; giving and receiving feedback; using body language; leading and directing discussions; concluding discussions; using graphics in oral presentations

Reading Comprehension and reference skills: skimming and scanning; factual and inferential comprehension; prediction; guessing meaning of words from context; word reference; comprehending graphics in technical writing. Reading strategies; reading speed; reading between the lines for hidden meaning; interpreting graphics; using a dictionary; using an index; using a contents list to find information; choosing the right reference source.

Module II

Written Communication: note making and note taking; summarizing; notes and memos; developing notes into text; organization of ideas: cohesion and coherence; Preparing notes – writing business letters and E-mail messages. Organizing a meeting, preparing an agenda, chairing a meeting, drafting motions and resolutions, writing minutes. Paragraph writing: Paragraph writing – Topic sentence, cohesion and coherence- sentence liners (so, but, however etc), ordering information in space and time; short essays: description and argument; comparison and contrast; illustration; using graphics in writing: tables and charts; diagrams and flow-charts; maps, plans and graphs. Preparation of a business report-writing a business proposal - format, length,structure.

Spelling rules and tips; writing a rough draft; editing and proof reading; writing the final draft; styling text; filling in complex forms; standard letters; Writing a curriculum vitae (both chronological & functional) along with an application for a job; Public relation – Concept and relevance – PR in a business organization-handing the media; writing a report; writing leaflets and brochures; writing references; essay writing: expository writing; description of processes and products; classification; the instructional process; arguments and presentation of arguments; narrating events chronologically.

References :

1.John Seely, Oxford Guide to Writing and Speaking, Oxford University Press.
2.C. Muralikrishna and Sunita Mishra, Communication Skills for Engineers, 2nd Edition, Pearson, 2011.
3.Meenakshi Raman and Sangeetha Sharma, Technical Communication: Principles and Practice, Oxford University Press, 2004.
4.Krishna Mohan and Meenakshi Raman, Effective English Communication,Tata Mc-GraHill,2000.
5.William Sanborn Pfeiffer, T.V.S. Padmaja, Technical Communication – A Practical Approach, Pearson, 2007.
6.R.C. Bhatia, Business Communication, 2nd Edition, Ane Books Pvt. Ltd., 2008.
7.Krishna Mohan and Meera Banerji, Developing Communication Skills, Mac Millan India Ltd, 2000.

University Examination Pattern

The question paper will have two parts. Part A and Part B will have a weightage of 50 marks each and they will have to be answered in separate answer books.

Question Paper Pattern for Part A (Environmental Studies)

Q I. – 6 short type questions of 3 marks each, with three questions from each module (6 x3 = 18)
QII. – 2 questions A and B of 16 marks from Module I with choice to answer one. Both A and B should have a minimum of two sub – sections.
QIII - 2 questions A and B of 16 marks from Module II with choice to answer one. Both A and B should have a minimum of two sub – sections.

Question Paper Pattern for Part B (Technical Communication)

Q I – 10 short answer questions of 2 marks each, with five questions from each module. The questions shall be problem solving and application oriented in nature. (10x2 = 20 marks)
QII. – 2 questions A and B of 15 marks from Module I with choice to answer one. Both A and B should have a minimum of two sub – sections. The questions shall be problem solving and application oriented in nature.
QIII - 2 questions A and B of 15 marks from Module II with choice to answer one. Both A and B should have a minimum of two sub – sections. The questions shall be problem solving and application oriented in nature.

11 L1 ELECTRICAL AND MECHANICAL WORKSHOP

ELECTRICAL WORKSHOP

1. One lamp controlled by one switch 2. Series and parallel connections of lamps.
3. Stair case wiring.
4. Hospital Wiring.
5. Godown wiring.
6. Fluorescent lamp.
7. Connection of plug socket.
8. Different kinds of joints.
9. Transformer winding.
10. Soldering practice.
11. Familiarisation of CRO.

MECHANICAL WORK SHOP

Preliminary exercises for beginners in all the following shops. Specific models may be designed by the teachers.

1) Fitting Shop.
2) Sheet Metal Shop
3) Foundry Shop
4) Welding Shop
5) Carpentry Shop

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

11 L2 COMPUTER PROGRAMMING LABORATORY

Application packages

Word
1. To create an advertisement in Word.
2. To illustrate the concept of mail merging in word.

Spread Sheet
3. To create a spread sheet to analyse the marks of the students of a class and also to create appropriate charts.

Power Point
4. To create the presentation for the department using Power Point.

C Programming Basics

Operators & Expressions
5. To write a simple menu driven calculator program using switch statement

IO Formatting
6. To write a program to print Pascal's triangle.

Decision Making
7. To write a program for electricity bill preparation.

Looping
8. To write a program to print the *sine* and *cosine* series.

Arrays
9. To write a program to perform Matrix multiplication.
10. To write a program to prepare and print the sales report.

String
11. To write a program to perform string manipulation manipulations function like *string concatenations, comparison, find the length and string copy* without using library functions.
12. To write a program to arrange names in alphabetical order.

Functions
13. To write a C program to calculate the mean, variance and standard deviation using functions.
14. To write a C program to perform sequential and binary search using functions.

Recursion
15. To write a program to print the Fibonacci series and to calculate the factorial of the given number using functions.

Structures
16. To print the mark sheet of n students using structures.

Pointers
17. To write a program using pointers to access the elements of an array and count the number of occurrences of the given number in the array.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

11 L3 LANGUAGE LABORATORY

The **Language Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

Objectives:

1. To expose the students to a variety of self-instructional, learner-friendly modes of language learning.
2. To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams.
3. To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
4. To train them to use language effectively to face interviews, group discussions, public speaking.
5. To initiate them into greater use of the computer in resume preparation, report writing, format-making etc.

SYLLABUS :

The following course content is prescribed for the **English Language Laboratory** sessions:

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Situational Dialogues / Role Play.
4. Oral Presentations- Prepared and Extempore.
5. 'Just A Minute' Sessions (JAM).
6. Describing Objects / Situations / People.
7. Information Transfer
8. Debate
9. Telephoning Skills.
10. Giving Directions.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

CE/CS/EB/EC/EE/EI/FT/IT/ME/SE 1301 ENGINEERING MATHEMATICS II

Module I

Matrices and Vector spaces: Rank of matrix, Echelon and normal form, Solutions of linear systems of algebraic equations, Eigen values and Eigen vectors, Cayley- Hamilton theorem (no proof).

Vector Spaces- Subspaces, -Linear Independence of vectors-Linear span-Dimension and Basis. Linear transformations.

Module II

Fourier series and Fourier integrals: Fourier series of Periodic functions-Euler formulae for Fourier coefficients-functions having period 2π, arybitrary period- even and odd functions-half range expansions, Fourier integral, Fourier cosine and sine transformations, linearity property, transform of derivatives, convolution theorem (no proof)

Module III

Laplace transforms: Linearity property, transforms of elementary functions, Laplace transforms of derivatives and integrals, differentiation and integration of transforms, convolution theorem (no proof), use of Laplace transforms in the solution of initial value problems, unit step function, impulse function - transform of step functions, transforms of periodic functions.

Module IV

Vector calculus: Scalar and Vector point functions-Gradient and directional derivative of a scalar point functions. - Divergence and Curl of a vector point functions- their physical meanings. Evaluation of line integral, surface integral and volume integrals, Gauss's divergence theorem, Stoke's theorem (No Proof of these theorem), conservative force fields, scalar potential.

References:

1. R.K.Jain, S.R.K.Iyengar, *Advanced Engineering Mathematics*, Narosa Publishers.
2. C.R.Wilie & L.C.Barrett, *Advanced Engineering Mathematics*, McGraw Hill Publishers
3. *Larry C Andrews, Ronald C Philips, Mathematical Techniques For Engineers & Scientists, Phi Publishers*
4. *M.C.Potter, J.L.Goldberg, Advanced Engineering Mathematics, Oxford University Press*
5. *B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1302 MATERIAL SCIENCE

Module I

Conducting materials: Review of metallic conduction on the basis of free electron theory- Fermi-Dirac distribution – variation of conductivity with temperature and composition, Materials for electric resistances- general electric properties: brushes of electrical machines, lamp filaments, fuses and solder.

Semiconductors: Compound semiconductors – basic ideas of amorphous and organic semiconductor – preparation of semiconductor materials – zone-refining technique – fabrication of p-n-p junction.

Magnetic materials: Classification of magnetic materials – origin of permanent magnetic dipoles – ferromagnetism - hysterisis curve – hard and soft magnetic materials – magnetic material used in electrical machines, instruments and relays.

Module II

Dielectrics: dielectric polarization under static fields – electronic, ionic and dipolar polarizations – behavior of dielectrics in alternating fields – mechanism of breakdown in gases, liquids and solids - factors influencing dielectric strength – capacitor materials Insulating materials – complex dielectric constant – dipolar relaxation dielectric loss insulator materials used – inorganic materials (mica, glass, porcelain, asbestos) – organic materials (paper, rubber, cotton silk, fibre, wood, plastics, bakelite)- resins and varnishes – liquid insulators (transformer oil) – gaseous insulators (air, SF6, and hydrogen) – ageing of insulators.

Module III

Materials for special applications: materials for solar cells/fuels cells/battery- materials for coatings for enhanced solar thermal energy collection – solar selective coatings- cold mirror coatings- heat mirror coatings – antireflection coatings, Sintered alloys for breaker/switch contacts – arcing tips.

Module IV

Modern techniques for Material Studies: optical microscopy – electron microscopy – photoelectron spectroscopy – atomic absorption spectroscopy – magnetic resonance – nuclear magnetic resonance – electron spin resonance – ferromagnetic resonance.

References:

1. Indulkar C.S. & Thirivengadam S- *An Introduction to Electrical Engineering Materials*, S Chand Co, 1998.
2. *Yu Koristky - Electrical Engineering Materials, MIR, 1970.*
3. *Arumugam M - Materials Science, Anuradha Publishers, 1990.*
4. *Meinal A.B & Meinal M.P- Applied Solar Energy – An Introduction, Addition Wesley Publications.*
5. *Kapoor P.L- Electrical Engineering Materials, Khanna Publications.*
6. *Hutchison T.S & Baird D.C - The Physics of Engineering Solids, John Wiley Publications.*
7. *A.J Dekker - Electrical Engineering Materials, Prentice Hall of India.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1303 FLUID MECHANICS & HEAT ENGINES

Module I

Fluids and their properties: Fluids, shear stress in a moving fluid, viscosity, Newtonian and non-Newtonian fluids, viscosity in liquids and gases. Fluid statics: pressure, variation of pressure in a static fluid, absolute and gauge pressure, measurement of gauge pressure.

Kinematics of fluid flow: Eulerian and Langragain approaches, classification of fluid flow as steady and unsteady flow, uniform and non uniform flow, laminar and turbulent flow, Path line, stream line, streak line and stream tube, one, two, and three dimensional flow, velocity and accelerations in steady and unsteady flow. **Basic Hydrodynamics:** Ideal fluids, equations of continuity in the differential form, rotational and irrotational flow, circulation and vorticity, Stream function, Velocity potential, one dimensional flow along a stream line, Bernoulli's equation and its limitations, measurement of velocity, Pitot tube and Pitot-static tube, venturi meter, orifice meter, flow nozzles, notches and weirs.

Module II

Steady flow of incompressible fluids in pipes: Laminar and turbulent flows, critical Reynolds number, hydraulic radius, general equation for friction, laminar flow in circular pipes, Darcy- Weisbach equation, friction factor, equivalent pipes, minor losses in pipes, Development of boundary layer. **Dimensional Analysis & Similitude:** Rayleigh's method, Buckingharm's Pi theorem, nondimensional parameters in fluid mechanics and machinery – principles of similitude – geometric, kinematic and dynamics similarities – model studies. Physical meaning of important dimensional groups of fluid mechanics and their practical use.

Module III

Dynamic action of fluid: Momentum equation applied to a control volume, impact of jets, flow of an incompressible fluid over fixed and moving vanes, work done and efficiency.

Hydraulic turbines: velocity triangles, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine, their constructional features and performance characteristics – non dimensional parameters for comparative study of turbine performance, theory of draft tubes, speed regulation of turbines, selection of type and speed of turbines.

Module IV

Pumping machinery: general features of positive displacement and rotodynamic pumps, cetrifugal pumps, classification, principle of working, velocity diagrams, losses in pumps, circulatory flow, multistage pumps, propeller pumps, priming, cavitation and its significance.

Reciprocating pumps: Acceleration head, effect of friction, use of air vessels, efficiencies, pump characteristics.

References:

1. *Douglas, Gasiorek, and Swaffield: Fluid mechanics – Pitman*
2. *Daugherty & Franzini: Fluid mechanics with Engg.Applications Mc Graw Hill*
3. *Dr. Jagdish Lal: Hydraulic mechanics, Metropolitan book Co. Delhi-6*
4. *N.S Govinda Rao: Fluid flow mechanics - Tata Mc Graw Hill.*
5. *F.M White: Fluid Mechanics.*
6. *Vallentine: Applied hydrodynamics – Butter worths – London.*
7. *Massery : Fluid Mechanics – ELBS*
8. *K.L Kumar: Engineering fluid mechanics – Eurasia publishing house, New Delhi.*
9. *Herbert Addison: A Treatise on applied hydraulics.*
10. *A.J Stepanof : Centrifugal and axial flow pumps, Wiley, Newyork.*
11. *D.G Shepherd : Principles of turbo machinery – Mac Millan publishing Co. Inc.*
12. *Som & Biswas : Introduction to fluid Mechanics & Machinery (TMH)*
13. *Agarwal: Fluid mechanics & Machinery, TMH.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1304 CIRCUITS, SIGNALS & SYSTEMS I

Module I

Review of network theorem – steady state AC analysis-mesh and node analysis, mesh and node analysis by inspection, superposition theorem, reciprocity theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem.

Module II

Network topology – definition of graph,tree, incidence matrix, tie-set matrix, cut-set matrix, application of graph theoretic methods to formulation of network equation, current variable and voltage variable methods.

Coupled circuit – self and mutual inductance analysis of coupled coils, dot rule, conductively coupled equivalent circuits, coupling coefficient, linear transformer, ideal transformer.

Module III

Polyphase systems – balanced and unbalanced loads – unbalanced three wire and four wire star connected load, displacement neutral method, power measurement using wattmeter.

Circuit transients – direct current transients - RL, RC, RLC transients, alternating current transients – application of Laplace transform for transients analysis.

Module IV

Fourier method of waveform analysis – frequency spectrum of periodic signals, trigonometric Fourier series, exponential Fourier series.

Fourier transform and inverse Fourier transform – properties of Fourier transforms, continuous amplitude and phase spectra.

References:

1. Joseph. A.Edminister, *"Theory & problems of electric circuit",* Schaum's outline series, Tata McGraw Hill.
2. A Sudhakar,Shyammohan S Pally, *"Circuits and Networks Analysis and synthesis"*, Tata McGraw Hill.
3. *C.P.Kuriakose ,"Circuit Theory Continuous and Discrete-Time Systems, Elements of Network Synthesis",PHI.*
4. *D. Roy Choudhury, "Networks and Systems", New Age International.*
5. *G.K. Mithal, "Network Analysis", Khanna Publications*.

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1305 ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

Module I

General Principles of Measurements, Standards: Absolute and Working Standards, Calibration of Meters, Qualities of Measurements, Characteristics, Errors in Measurement and its Analysis, Direct Deflecting Instruments. Moving Coil, Moving Iron, Dynamo Meter, Induction, Thermal, Electrostatic and Rectifier Type, Shunts and Multipliers, Various Types of Galvanometers.

Module II

Measurement of Current, Voltage and Resistance, Measurement of Insulation Resistance, Earth Resistance, Earth Tester; Measurement of Power and Energy, Dynamometer Type Wattmeter, Error and Compensation, Ampere Hour Meter, Single and Three Phase Energy Meters (Induction Type), Calibration, Trivector Meter, Frequency Meters, Power Factor Meters, Current Transformers and Potential Transformers.

Module III

Null Deflection Method – Measurement of Resistance; Current, Voltage and Power – Direct Current Potentiometer-Wheatstone Bridge-Kevin Double Bridge-Carry Foster Slide Wire Bridge-Bridge Current Limitations-Localization of Cable Fault by Murray and Varley Loop Tests-A.C Potentiometers-Various A.C Bridges and Measurement of Inductance & Capacitance; Magnetic Measurements: Classification-Measurement of Flux and Permeability-Hibbert's Magnetic Standard –Flux Meter, Hall Effect Gauss meter, Ballistic Galvanometer, Calibration-Vibration Galvanometer-B.H. Curve and Permeability and Measurement on bar and ring specimens-Hysteresis Measurement-Core Loss Measurement with Lloyd Fishes square

Module IV

Illumination: Laws of Illumination- Polar Curves- Photometry- Luminous Efficiency- Measurement of Illumination of Different Light Sources- Illumination of Surfaces- Levels of Illumination; Digital Measurements and Meters; Oscilloscope- Basic Principle of Signal Display- Triggered Sweep CRO- Trigger Pulse Circuit- Delay Line in Triggered Sweep- Sync- Selector for continuous Sweep CRO- Dual Beam CRO- Dual Trace Oscilloscope-Applications.

References:

1. *A.K Sawhney - A course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Sons.*
2. *Golding E.W - Electrical Measurements & Measuring Instruments, Wheeler Pub.*
3. *Cooper W.D - Modern Electronics Instrumentation, Prentice Hall of India.*
4. *Stout M.B - Basic Electrical Measurements, Prentice Hall.*
5. *Oliver & Cage - Electronic Measurements & Instrumentation, McGraw Hill.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

CS/EB/EE1306 ELECTRONIC DEVICES AND CIRCUITS

Module I

DC power supplies - power transformers - rectification - half wave, full wave, bridge - expression for ripple factor, efficiency, comparison, diode ratings. filters - capacitor - inductor LC filters- use of bleeder resistor - voltage multipliers - dual power supplies - zener and avalanche diodes - simple and series voltage regulator. *Special semiconductor devices:* Principles and operation of photodiodes, PIN diodes, phototransistors, LED, UJT. MOSFET- Enhancement and depletion type NMOS, PMOS AND CMOS - basic principles & characteristics.

Module II

Small Signal amplifiers: Bipolar junction transistor – configurations, characteristics - current amplification factors - relations between alpha & beta – comparison. *BJT amplifiers*: Biasing techniques of BJT- stabilization of operating point - h-parameters - CE RC coupled amplifier - concept of load lines- frequency response of RC coupled amplifier - frequency analysis of R C coupled amplifier - lower cut-off frequency - upper cut-off frequency - 3 db bandwidth.
FET Amplifiers: Principle of operation, characteristics, Common source amplifier- design, frequency response- applications

Module III

Power amplifier - classification - class A, B, AB and C power amplifiers-tuned amplifier- pushpull and complementary symmetry power amplifier –Harmonic distortion– Heat sinks.
Feed-back amplifiers: concept of Negative and positive feedback – Bark Hausen criteria -low frequency sinusoidal oscillators
High frequency oscillators – types- LC, Crystal oscillators –circuit diagram-description-applications

Module IV

*Pulse Circuits***:-**Different types Pulse circuits - pulse characteristics - Pulse shaping using RC circuits - Differentiating and integrating circuits –applications. Clipping and clamping circuits using diodes - *Transistor as a switch*– simple sweep circuits-bootstrap sweep.
Multivibrators-astable, monostable and bistable ciruits using BJTs-applications

References:

1. Boylestead & Neshelsky: ,"Electronic Devices & Circuit Theory", PHI2003
2. Millman & Halkias, "Electronic Devices & Circuits", TMH, New Delhi.1996
3. Taub & Schilling, Pulse, Digital and Switching ciruits, TMH, New Delhi
4. *Bapat Y N, "Electronic Devices & Circuits", Tata McGraw Hill, New Delhi.1995*
5. *Allan Mottorshed, " Electronic Devices & Circuits", PHI, New Delhi.*
6. *Schilling & Belove "Electronic Circuits, Discrete & Integrated", TMH, New Delhi 1989*
7. *Theodore F.Bogart: "Electronic Devices & Circuits" Universal Book Stall, New Delhi 1992*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE13L1 ELECTRONIC CIRCUITS LAB

1. Study of Multimeter, Signal generators, CRO etc. and measurement of electrical quantities
2. Testing of Passive and Active components - Resistors, Capacitors, inductors, Transformers, diodes, Transistors, etc.
3. Characteristics of Active devices
4. Rectifying circuits

i) HW rectifier
ii) FW rectifier
iii) FW Bridge rectifier
iv) Filter circuits - Capacitor filter, inductor filter and Pi section filter
(Measurement of ripple factor, maximum ratings of the devices)

5. Differentiating circuit and integrating circuit.
6. Clipping & Clamping circuits.
7. Amplifying circuits Simple common emitter amplifier configuration - gain and bandwidth.
8. Oscillators –
9. Multivibrators – A stable only.
10. Circuits using OP- Amps

Note: 50% Mark is earmarked for continuous evaluation and 50% mark for end semester examination, to be assessed by two examiners. A candidate shall secure a minimum of 50% marks for two components to be eligible for pass in that subject.

EE13L2 BASIC ELECTRICAL ENGINEERING LAB

1. Determination of the voltage-current characteristics of linear resistance and an incandescent lamp
2. Measurement of linear resistance using voltmeter and ammeter.
3. Potential divider connection of rheostat and dependence of output voltage upon the value of the load resistance.
4. Study of PMMC and MI voltmeters and ammeters, dynamometer type wattmeter, clip on ammeter, standard symbols on the dials of the meters
5. Verification of Kirchoff's laws using rheostats.
6. Verification of superposition theorem in a resistive circuit with two given d.c. sources.
7. Verification of Thevenin's theorem in d.c. circuits.
8. Verification of generalized Reciprocity theorem in a d.c. circuit.
9. RLC series parallel circuit – Measurement of current in various branches and verification by calculation – drawing Phasor diagram.
10. Study of voltage – current relationship of series circuit with given RLC elements and condition for series resonance.
11. Determination of fusing time versus current characteristics for two specimens – Fusing factor – study of various types of fuses.
12. Single-phase power measurement using a wattmeter – determination of thermal efficiency of a kettle.
13. Measurement of power in three-phase circuits.
    a) Single wattmeter method.
    b) Two wattmeter method.

Student shall present his/her fair record, notebook duly certified by the Head of the Department, to the examiners at the time of University practical examination.

Note: 50% Mark is earmarked for continuous evaluation and 50% mark for end semester examination, to be assessed by two examiners. A candidate shall secure a minimum of 50% marks for two components to be eligible for pass in that subject.

CE/CS/EB/EC/EE/EI/FT/IT/ME/SE 1401ENGINEERING MATHEMATICS III

Module I

Complex Analytic functions and conformal mapping: curves and regions in the complex plane, complex functions, limit, derivative, analytic function, Cauchy - Riemann equations, Elementary complex functions such as powers, exponential function, logarithmic, trigonometric and hyperbolic functions.

Conformal mapping: Linear fractional transformations, mapping by elementary functions like Z^2, e^z, sin z, cos z, sin hz, and Cos hz, Z+1/Z.

Module II

Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, Taylor's series, Laurent's series, residue theorem, evaluation of real integrals using integration around unit circle, around the semi circle, integrating contours having poles, on the real axis.

Module III

Partial differential equations: Formation of partial differential equations. Solutions of equations of the form F(p, q) = 0, F(x, p, q)=0, F(y, p, q)=0, F(z, p, q)=0, F1(x, p) = F2(y, q), Lagrange's form Pp + Qq = R. Linear homogeneous partial differential equations with constant coefficients.

Module IV

Vibrating string : one dimensional wave equation, D' Alembert's solution, solution by the method of separation of variables, One dimensional heat equation, solution of the equation by the method of separation of variables. Solutions of Laplace's equation over a rectangular region and a circular region by the method of separation of variables.

References:

1.R.K.Jain, S.R.K.Iyengar, *Advanced Engineering Mathematics*, Narosa Publishers, 2nd ed.
2.C.R.Wilie & L.C.Barrett ,*Advanced Engineering Mathematics*, Mc Graw Hill,6th ed.
3.Ervin Kreyszig, *Advanced Engineering Mathematics*, Wiley Eastern,9th ed.
4.Churchill R.V, *Complex Variables & Applications*, Mc Graw Hill Publishers,5th ed.
5.M.C.Potter, J. L. Goldberg, *Advanced Engineering Mathematics*, Oxford University Press,3rd ed.

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1402 DIGITAL ELECTRONICS

Module I

Number System and binary codes: Binary, Octal and Hexadecimal number systems – binary arithmetic, binary codes, excess-3 code, Gray code error detection and correction – Boolean algebra – minimisation of Boolean functions using Karnaugh map and Quine-Mclusky methods – formation of switching functions from word statements, realisation using NAND, NOR & XOR gates – combinational circuits – multiplexer – demultiplexer, decoder, encoder.

.

Module II

Arithmetic circuits: Half adder, full adder, subtractor, serial and parallel addition – carry look ahead adder – binary multiplication – multivibrators – monostable and astable multivibrators using discrete gates.

Module III

Sequential circuits: flip-flops – RS, JK, T & D flip-flops, shift registers – counters – design -asynchronous and synchronous counters, up-down counters, Modulo counter, ring counter, Johnson counter – sequence generators – analysis of sequential circuits – state table and diagrams

Memories – ROM, RAM, EPROM, EEPROM Programmable logic array, devices – basic ideas – PLD architecture – PAL and PLA – programmable examples with software tools.

Module IV

Logic families: RTL, DTL, TTL, ECL, and CMOS – tristate logic – specification and transfer characteristics of basic TTL interfaces, - standard logic levels – current and voltage parameters – fan in and fan out – propagation delay, integrated circuits modules, noise consideration – interfacing of CMOS to TTL and interfacing of TTL to CMOS.

References:

1. Taub & Schilling - *Digital Integrated Electronics*
2. *Samuel C Lee - Digital Circuits and Logic Design*
3. *A P Malvino - Digital Computer Electronics*
4. *Morris & Miller - Design with TTL Integrated Circuits*

Type for questions for University Exams

Question (1) - Eight short answer question of five marks with two questions from each of four modules

Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1403 ELECTRICAL MACHINES I

Module I

DC generators: Principle of DC generators, constructional details, field, armature and commutator or magnetic circuits, field flux distribution. Armature windings – pole pitch, coil span, winding pitch and commutator pitch. Simplex lap and wave windings, parallel paths, equalizer ring connections, dummy coils – methods of setting brushes in d.c machines. Methods of excitation – separately excited, shunt, series and compound machines. Induced e.m.f – e.m.f. equations. Armature m.m.f. – Magnitude and direction, armature reaction – air gap flux distribution under load conditions, effect of saturation, demagnetizing and cross-magnetizing armature m.m.f. – variation with brush position – compensating winding connections.

Module II

Commutator: Time of commutation, e.m.f. In the coil undergoing commutation, reactance e.m.f. – effect of brush shift, interpoles – polarity and winding connections. Type of d.c. generators – characteristics – open circuit characteristics, condition for self-excitation, critical resistance, critical speed. Load characteristics, effect of compounding. Parallel operation – parallel operation of shunt series and compound generations, equalizer connections.

Module III

DC Motors: Principles of operation, back e.m.f, production of torque, torque equation, developed and shaft torque, performance characteristics of shunt, series and compound motors, applications of various types of DC motors. Starting – need of the starter, face plate starters – three point and four point starters, calculation of resistance elements for shunt meter starter, Speed control – field control, armature control – Ward Leonard speed control. Testing of d.c. machines – losses and efficiency, separation of losses – Swinburne's test, Hopkinson's test, Fields Test, retardation test.

Module IV

Transformers: Single-phase transformer - constructional details – core, winding, insulation and brushing. Principles of operation, turns ratio, emf equation. Operation on load - magnetizing and core loss components – phasor diagram – equivalent circuit. Regulation – losses and efficiency.

Testing of transformers: DC test, SC test, Sumpner's back to back test, separation of losses, three phase connections – star and delta connections using single phase transformers. Three phase transformers – oscillating, neutral, tertiary winding, Scott connection –open delta connection – six phase connections. Parallel operation, load sharing, distribution transformers – all day efficiency.

References:

1) *Clayton A.E. & Hancock N.N.- Performance and Design of DC machines, ELBS/CBS Publishers, Delhi, 1990*
2) *Theraja B.L.- A text book of Electrical Technology Vol II, S. Chand & Co., New Delhi, 1992*
3) *Bhimbra P.S.- Electrical Machinery, Khanna Publishers, New Delhi, 1992*
4) *M.G. Say- Performance and Design of AC machines, ELBS & Pitman, Third Edition, 1980.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1404 CIRCUITS, SIGNALS & SYSTEMS II

Module I

Continuous time signals and systems – Basic signals – Impulse, step, ramp, exponential and sinusoidal signals, Basic operations on signals. Continuous time systems – Properties – Linearity, stability, causality, memory, inevitability, time invariance. Analysis of LTI system – Impulse response – Convolution, differential equation representation.

Module II

Two port networks - characterization in terms of impedance, admittance, hybrid and transmission parameters – inter relationship among parameter sets – reciprocal and symmetrical two port networks – inter connection of two port network – I and II equivalent of a two port network – image impedance – characteristic impedance and propagation constant of a symmetrical two port network.

Module III

Passive filters- Filter fundementals, Classification of Filters- Low pass, High pass, Band Pass & Band reject Filters, image parameters, characteristic impedance, design of filter networks - T and π sections of constant K low pass filter, constant K high pass filter, m-derived low pass filter, m-derived high pass filter, composite filters.
Network synthesis – Positive real functions, frequency response of reactive one-ports, synthesis of L-C and R-C using Foster and Cauer forms.

Module IV

Discrete time signals and systems – Sampling theorem, Nyquist rate-aliasing, impulse, step ,exponential and sinusoidal signals. Discrete time systems: Properties- Linearity, stability, causality, memory, invertibility, time invariants. Representation of systems- Impulse response – Difference equation representation. Z Transform: Properties, analysis of LTI system using Z transform, inverse Z transform, system function.

References:

1. Openheim & Wilsky, *Signals & systems* , PHI/Pearson Education
2. David.K.Cheng - "*Analysis of Linear System"s*, Addison Wesley, 1977
3. *C.P.Kuriakose ,"Circuit Theory Continuous and Discrete-Time Systems, Elements of Network Synthesis",PHI.*
4. *D. Roy Choudhury, "Networks and Systems", New Age International.*
5. *G.K. Mithal, "Network Analysis", Khanna Publications.*
6. *A Sudhakar,Shyammohan S Pally, "Circuits and Networks Analysis and synthesis", Tata McGraw Hill.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1405 ANALOG COMMUNICATION

Module I

Introduction–communication process, source of information, communication channels; Modulation – need, band width requirements – electromagnetic spectrum. Amplitude modulation – principles – visual concepts, modulation factor and percentage of modulation, mathematical relationship, component phasors, frequency spectrum, band selection. Amplitude modulators – ISB modulators – VSB modulation. AM transmitters – low level, high level – SSB systems – comparisons, mathematical analysis, SSB generation –SSB transmitters – filter method, phase shift method, third method. AM receivers – TRF receivers, Super heterodyne receiver, Double Super heterodyne receiver – SSB receiver – BFO, envelope detection, multi-channel Pilot carrier.

Module II

Angle Modulation – mathematical analysis, principles, waveforms, frequency deviation, frequency analysis, bandwidth requirement, phasor representation–pre-emphasis, de-emphasis. FM modulators – direct, indirect, Phase modulators – direct. FM transmitters – direct FM, indirect FM; FM receivers-block diagram– demodulators – Tuned circuit frequency discriminators, slope detector, balanced slope detector, Foster-Seeley discriminators, ratio detectors – FM noise suppression; FM stereo broadcasting-stereo transmitter, stereo receiver (block level treatment only).

Module III

Noise – external, internal – noise calculations, multiple noise sources, equivalent noise band width – Noise figure – Effective noise temperature, noise figure in terms of available gain – Noise in AM, angle modulation, pulse modulation – Performance of Communication systems – noise representation- Comparison of coded and uncoded systems - Characteristics of receivers – sensitivity, selectivity, double spotting, SNR – AGC circuitry – Performance of communication receivers – Comparison study of AM, FM and PM.

Module IV

Telephony –Simple telephone communication, classification of switching systems, Basics of a switching system; Switches & Multiplexers, DTMF & Pulse signaling, Electronic switching – stored program control, centralized and distributed SPC, enhanced services, Time division, space division & combination switching, Signaling techniques; Traffic Engineering – Network traffic, load and parameters, grade of service, blocking probability, traffic congestion.

References:

1. George Kennedy, *Electronic communication systems*, McGraw Hill ,4th ed.
2. Thiagarajan-Viswanathan, *Telecommunication Switching Systems and Networks*, PHI Ltd, 2001
3. *Simon Haykin, Communication Systems, John Wiley & Sons, 2004.*
4. *Robert J Schoenbeck, Electronic Communications Modulation & Transmission, PHI Ltd, 2nd Ed.*
5. *Wayne Tomasi, Electronic Communications Systems (Fundamentals through Advanced), Pearson Education 5th Ed.*
6. *B. P. Lathi, Communication Systems, B.S Publication, 2001*
7. *Taub & Schilling, Principles of Communication Systems, Tata McGraw Hill, 1991*
8. *Roddy & Coolen, Electronic Communications, Pearson Education/ Prentice-Hall India Ltd, 4th Ed.*
9. *D. N. Krishnakumar, Telecommunication & Switching, Sanguine Publishers, 2006*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1406 INDUSTRIAL & POWER ELECTRONICS

Module I

Power transistors - Design of high power amplifier – switching transistors - Parallel operation of transistor - Power MOSFET - Operating principles - Structure and characteristics. Thyristors – Classification & Constructional Details. SCR - Working principle - turn on, turn off and V - I characteristics - gate characteristics, and rating: Series and parallel operation of SCR - TRIAC - characteristics, modes of operation, Trigger circuits - magnetic & solid state , half- wave and full-wave operation .

Module II

Single phase controlled rectifiers - half-wave, full-wave, half-controlled and fully controlled - typical waveforms with R, RL, RL with diode and RL with voltage source - voltage and current equation for half-wave controlled rectifier. Three phase half-wave and full-wave controlled rectifier with R load, waveforms. DC motor speed control - various schemes – multi quardrant operation - simple circuits for speed control of series, PM and separately excited motors.

Module III

Commutation schemes - (different classes) waveforms - single-phase invertors - series, parallel and bridge -PWM invertor - square wave and sin wave output. Chopper circuits using SCR transistor (detailed analysis not required) - Jones Chopper. A.C Motor speed control - various schemes - electronic control of speed of induction motors and synchronous motors.

Module IV

Static switches: dc & ac switches-1φ and 3φ switches-design of static switches-Solid state relays.
Switching regulators - Basic concepts, analysis and design of Buck, Boost, Buck-Boost and derived converters . UPS - Characteristics - Configuration – Application. Batteries: Characteristics and selection-charging circuits.
Thyristor protection - over current, over voltage, di/dt, dv/dt, gate protection.
Industrial applications: Timer circuits - Flasher circuits-Electronic ballast, dielectric heating, induction heating.

References:

1. Muhammed H. Rashid, *Power Electronics – Circuits, Devices and Applications*, PHI Ltd, 3rd ed.
2. .*Power Electronics*, IMPACT Learning Material Series, Indian Society for Technical Education.
3. J. Michael Jacob, *Power Electronics: Principles & Applications*, Thomson Learning, New Delhi, 2006
4. B. K. Bose, *Modern Power Electronics And AC Drives*, Pearson Education/ Prentice-Hall India Ltd, 2003
5. Biswanath Paul, *Industrial Electronics and Control*, Prentice Hall of India, New Delhi, 2002
6. D W Hart, *Introduction to Power Electronics*, Pearson Education,1997
7. P C Sen, *Power Electronics*, Tata Mc Graw Hill, 2007
8. Singh & Khanchandani , *Power Electronics*, Tata Mc Graw Hill, 2nd ed.
9. Asghar M syed , *Power Electronics*, Prentice Hall of India, 2003
10. Hays , *The art of Electronics*, Cambridge University Press,1989

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE14L1 DIGITAL ELECTRONICS LAB

1. Half adder and full adder using NAND gates.
2.Code converters - Binary to Gray and gray to Binary using mode control
3. Binary addition and subtraction (a) 1's complement (b) 2's complement (using 7483)
4. BCD adder using 7483.
5. Study of MUX, DeMUX &Decoder Circuits and ICs
6. Set up R-S & JK flip flops using NAND Gates
7. Asynchronous UP / DOWN counter using JK Flip flops
8. Design and realization of sequence generators.
9. Study of shift registers and Implementation of Johnson and Ring counter using it.
10. Study of IC counters 7490, 7492, 7493 and 74192 or the CMOS equivalent.
11. Astable and monostable multi- vibrators using TTL gates.
12. Transfer characteristics and specifications of TTL gates

Note: 50% Mark is earmarked for continuous evaluation and 50% mark for end semester examination, to be assessed by two examiners. A candidate shall secure a minimum of 50% marks for two components to be eligible for pass in that subject.

EE14L2 ELECTRICAL MEASUREMENTS LAB

1. Measurement of resistance using Wheatston's bridge
2. Measurement of resistance using Kelvin's double bridge
3. Measurement of self and mutual inductance of coupled coils
4. Measurement of KVAR in 3-phase circuits by single and two wattmeter method.
5. Calibration of ammeter using slide wire potentiometer
6. Calibration of Voltmeter using slide wire potentiometer
7. Measurement of internal resistance of battery using vernier potentiometer
8. Measurement of resistance of earth electrode using earth megger.
9. Calibration of wattmeter using vernier potentiometer
10. Determination of B-H curve
11. Determination of Hysterisis loop-tracing the loop using CRO
12. Calibration of single phase energy meter by direct and phantom loading
13. Calibration of single-phase energy meter at 0.5 & 0.866 p.f. without using phase shifting transformer.
14. Calibration of 3-phase energy meter.
15. Adjustments in energy meter using rotating sub- standard.

Student shall present his/her fair record, notebook duly certified by the Head of the Department, to the examiners at the time of University Practical examination.

Note: 50% Mark is earmarked for continuous evaluation and 50% mark for end semester examination, to be assessed by two examiners. A candidate shall secure a minimum of 50% marks for two components to be eligible for pass in that subject.

CE/CS/EB/EC/EE/EI/FT/IT/ME/SE 1501 ENGINEERING MATHEMATICS - IV

Module I

Probability distributions: random variables (discrete & continuous), probability density, mathematical expectation, mean and variance of a probability distribution, binomial distribution, Poisson approximation to the binomial distribution, uniform distribution , normal distribution.

Curve fitting: method of least squares, correlation and regression, lines of regression.

Module II

Sampling distributions: population and samples, the sampling distribution of the mean unknown),σ known), the sampling distribution of the mean (σ(the sampling distribution of the variance, point estimation, interval estimation, tests of hypotheses, null hypotheses and significance tests, hypothesis concerning one mean, type I and type II errors, hypotheses concerning two means. The estimation of variances: Hypotheses concerning one variance - Hypotheses concerning two variances.

Module III

Finite difference Operators:∇, Δ, E, δ, μ , $x^{(n)}$

Newton's Forward and Backward differences interpolation polynomials, central differences, Stirlings central differences interpolation polynomial. Lagrange interpolation polynomial, divided differences, Newton's divided differences interpolation polynomial

Numerical differentiation: Formulae for derivatives in the case of equally spaced points.

Numerical integration: Trapezoidal and Simpson's rules, compounded rules, errors of interpolation and integration formulae. Gauss quadrature formulae (No derivation for 2 point and 3 point formulae)

Module IV

Numerical solution of ordinary differential equations: Taylor series method, Euler's method, modified Euler's method, Runge-Kutta formulae 4th order formula,

Numerical solution of boundary value problems: Methods of finite differences, finite differences methods for solving Laplace's equation in a rectangular region, finite differences methods for solving the wave equation and heat equation.

References:

1. Irvrin Miller & Freind, *Probability and Statistics for Engineers*, Prentice-Hall India Ltd, 6th ed.
2. S. S. Sastry, *Numerical Methods*, Prentice-Hall India Ltd, 4th ed.
3. *P. Kandaswamy K.Thilagavathy, K.Gunavathy , Numerical Methods, S. Chand & Co., 2005*
4. *A. Papoulis, Probability, Random Variables And Stochastic Processes, McGraw Hill, 4th ed.*

Type for questions for University Exams

Question (1) - Eight short answer question of five marks with two questions from each of four modules

Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1502 ELECTRICAL MACHINES II

Module I

Alternators- constructional features of high speed cylindrical rotor and low speed salient pole machines, synchronous speed AC windings - different types (detailed drawing not required) emf equation- distribution factor- coil span factor- field mmf and gap flux density distribution – harmonics in induced emf - remedial measures - mmf of AC windings- space harmonics- revolving magnetic field.

Module II

Theory of cylindrical rotor machines- armature reaction- synchronous impedance- voltage regulation-determination of regulation by mmf, emf and Potier methods- Principles of operation of automatic voltage regulators - determination of Xd, Xq by slip test.

Parallel operation of alternators - performance of two machines in parallel-synchronising power - effect of speed regulation on load sharing -methods of synchronizing- synchroscope- methods of automatic synchronizing- synchronous machines on infinite bus bars.

Module III

Synchronous motor-torque and power relationship-phasor diagram starting of synchronous motors-losses and efficiency calculations-V curves-synchronous condenser-load angle

Module IV

Power angle diagrams -power flow equation for cylindrical and salient pole machines-reluctance power-maximum power transfer-stability limit-control of active and reactive power in synchronous machines on infinite bus bars.

Symmetrical short circuits (only qualitative analysis) - steady state, transient and subtransient reactance - time constants- Hunting in synchronous machines- natural frequency of oscillations - damper windings.

References:

1. Nagrath I.J. and Kothari D.P.: Theory of AC machines, Tata McGraw Hill
2. Bimbra P.S. : Electrical Machinery, Khanna Publications
3. *Say M.G ELBS & Pitman : Performance and design of AC Machines,*
4. *Langsdorf A.S : Theory of AC machines, Tata McGraw Hill*
5. *Gupta B.R & Vandana Singhal : Fundamentals of Electrical Machines, New Age International ,1990*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1503 POWER SYSTEMS I

Module I

Conventional sources of electrical energy- thermal, hydroelectric, diesel and nuclear power plants-introduction to renewable energy sources- power plant economics –operating coasts- load factor- demand factor- diversity factor- plant factor. Types of tariffs, power factor improvement.

Module II

Overhead transmission systems- arrangement of conductors- sag and tension- transmission line supports and their location, economic span- choice of transmission voltage- line insulators- string efficiency- impulse ratio- arcing horns and rings- failure of insulation- corona- under ground cables- different types- capacitance of single core and three core cables- grading of cables.

Module III

Distribution systems- classification and arrangement of distribution systems- distribution substation layout and arrangement- economic loading of distribution transformers- design of feeders. Kelvin's Law- considerations in primary and secondary distribution system design- current distribution and voltage drop in single-phase and three-phase four-wire distribution systems- voltage drop calculation and design of distributors in ring system- improvement of existing distribution systems- LT capacitor installation- size and connection- Rising mains- Equipment earthling- Electric energy management. Power quality.

Module IV

Performance of transmission lines- calculation of transmission line inductance and capacitance- GMD and GMR- bundled conductors- transposition- ABCD constants- effect of capacitance- nominal T and π methods of calculations- power flow through a transmission line. Methods of voltage control.

Reference:

1. *Soni, Gupta, Bhatnagar- A course in Electric Power, Dhanapat Rai & Sons New Delhi, 1996.*
2. *A.T Star, - Generation, Transmission & Utilization of Electric Power, Sir. Issac Pitman and Sons, 1961.*
3. *Turan, Goren - Electric Power Transmission System Engineering, John Wiley,1988.*
4. *S.L Uppal - Electric Power, Khanna Publishers, 1992.*
5. *A.S Pabla - Electric Power Distribution System, Tata McGraw Hill, 1992.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1504 MICROPROCESSOR BASED SYSTEMS

Module I
Basics of 8085 Microprocessor
Architecture- pin description-Features-Interrupt system-Stack and subroutine
Memory Interfacing-Decoding techniques-Mapping techniques
I/O mapped I/O-Memory mapped I/O-Serial Communication and DMA features

Module II
Programming with 8085
Basic instruction set-Addressing modes-Timing diagram-Assembly language programs-Looping counting indexing operations-Delay routines

Module III
Peripherals
8255-Programmable Peripheral Interface
8253-Programmable Interval Timer
8279-Programmable Keyboard & Display Controller
8251-Programmable Communications Interface

Module IV
Microcontrollers
Basics of 8051-Architecture and pinouts-Internal Memory organization-Counters Timers-Serial data input and output-Power saving modes-Programming with 8051-Interfacing of keyboard ADC, DAC etc

Reference:

1. Gaonker R.S. - Microprocessor Architecture, Programming and applications
2. Ghosh and Sridhar, *0000 to 8085 Microprocessors for Engineers and Scientists*, Prentice-Hall India, 2nd edition
3. Kenneth Ayala, The 8051 Microcontroller ,West Publishing Company.
4. Mazidi ,The 8051 Microcontrollers & Embedded Systems, Pearson Education
5. *A.Nagoor Kani, Microprocessors,architecture and programming,RBA Publications*
6. *Microprocessors and Interfacing, Douglas V Hall, Tata Mc Gram Hill*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1505 LINEAR INTEGRATED CIRCUITS

Module I

Integrated Circuits- Introduction to operational amplifiers – basic differiential amplifier – dual input balanced output and unbalanced output – Internal block schematic of op amp - Biasing used in IC – Constant current source - current mirror Circuits – Op – amp parameters – ideal op amp – transfer curve – equivalent circuit –internal circuit analysis of a typical op – amp- frequency response frequency compensation. Slew rate and its effect, typical data sheet 741.

Module II

Input bias current – off set – drift – compensating networks CMRR,SVRR, finite gain bandwidth and its effect in opamp circuits performance Open loop configurations Op amp in closed loop configuration : Different feed back configutrations – voltage follower – V/I converters, I/V converters and its applications – Differential amplifiers with one op amp and 3 op amps. Instrumentation amplifier IC and its application.

Module III

Op amp applications – Summer – Sub tractor –Log amplifier –Antilog amplifier _ Integrator and differentiator Comparatoprs : zero crossing – using voltage references – regenerative (Schmitt trigger) comparators : window detector application – OP as comparators – Astable and monostable multivibrators – Triangular and tooth wave generators – RC phase shift and Wien bridge oscillators – Sample and hold circuit – peak detector circuit. Precision rectifiers. Voltage regulators – 723 (block diagram, typical low voltage regulator circuit). 78XX, 79XX, 371.

Module IV

Specialized ICs and applications: 555 timers – Functional block diagram – A stable multi vibrator , mono stable , multi vibrator and its applications – Voltage to Frequency converter – Automobile tachometer : 566 VCO chip 565 PLL: - PLL applications . ADC and DAC – performance specification – weighted, R – 2R ; successive approximation , flash, integrating ,Filters: Transfer functions – LPF,HPF,BPF,BRF Approximation methods Butter worth – Chebyshev – Active Filters – I order filters, Quality factor Design – Universal Active Filters – All Pass filters. Switched Capacitive Filters.

References:

1. Op amps and Linear Integrated circuits : RF Coughlin – Pearson Education /PHI
2. Design with operational Amplifiers Analog Ics: Sargio Franko – 2nd Edition McGraw Hill
3. Linear Integrated Circuits : d roy Chaudary , Shail B Jain
4. Integrated circuits : K.R Botkar
5. Analog Integrated Circuits : Gray John wiely 2 nd edition
6.

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1506 FIELD THEORY

Module I

Overview of vector analysis – Co-ordinate systems – rectangular, cylindrical, spherical - transformations. Divergence theorem, Stokes theorem, Div, Grad, Curl.

Static Electric field: Coulomb's law, superposition, electric flux, electric field, electric scalar potential, dipole, method of images – Gauss law for electric flux, boundary conditions – capacitance of isolated sphere, concentric sphere, co-axial cylinder/cable two wire transmission line- energy stored in electric field / capacitor, energy density. Laplace equation, Poisson's equation, Uniqueness theorem.

Module II

Static magnetic field of steady electric currents – magnetic flux, Biot -Savart law, Ampere's law, Gauss law for magnetic flux –boundary conditions, magnetic vector potential, inductance of a coaxial cable, two wire transmission line, solenoid, toroid. Electromagnetic induction – Faraday's law, self & mutual inductance. Continuity equation – displacement current – Maxwell's equations integral & differential form.

Module III

Uniform plane waves –general solution –TEM waves – relation between electric and magnetic fields, phase and group velocity – plane waves in lossy medium, skin depth, propagation constants and intrinsic impedance – Harmonically varying field, Poyntings theorem-interpretation, application. Wave polarization – linear, elliptic and circular polarization, wave guides – rectangular - modes of propagation- cylindrical wave guides.

Module IV

Reflection of plane waves at boundaries – normal and oblique incidence – refraction – transmission – Snell's law – critical angle – Brewster angle – total internal reflection.

Transmission lines: - Uniform transmission line – VI solution- characteristic impedance – VSWR – impedance matching – quarter wave and half wave length transformer – stub matching – single and double – Smith chart – impedance matching using Smith Chart.

References:

1. Sadiku MNO - *Elements of Electromagnetics*, Addison Wesley 2002.
2. Premlet B - *Electromagnetic theory with applications*, Phasor Books 2002.
3. W. H. Hayt - *Engineering Electromagnetics*, Mc Graw Hill2001.
4. Nannapaneni Narayana Rao - *Elements of Engineering Electromagnetics* – Prentice –Hall, 1998
5. Cheng D.K - *Electromagnetic Fields & Wave*, Addison Wesley 2002.

Type for questions for University Exams

Question (1) - Eight short answer question of five marks with two questions from each of four modules

Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE15L1 ELECTRICAL MACHINES LAB I

DC Machines

Plotting of the open circuit characteristics of the given d.c. shunt generator at rated speed. Pre-determination of o.c.c. at other speeds and critical resistances of various speeds. Finding the voltage built-up with a given field circuit resistance and the critical speed for a given field circuit resistance.

Load test on the given DC shunt generator and plotting external characteristics – Deduce the internal characteristics and armature reaction curve.

Brake test on DC shunt and series motor and plot the following characteristics:

- Output Vs Efficiency
- Output Vs Line current
- Output Vs Speed
- Speed Vs Torque
- Line current Vs Torque

Study of 3 point and 4 point starters for DC shunt motor

Swinburne's test on DC shunt machine and pre-determination of armature current and percentage efficiency when the machine operates as a motor and as a generator delivering ¼, ½, ¾, full and 5/4th rated output.

Hopkinson's Test on a pair of DC Machines and pre-determining of the efficiency of the machine working as motor and as a generator under various conditions of load on the generator.

Separation of losses in a d.c. machine by conducting a retardation test and determination of the moment of inertia of the rotating system.

Separation of losses in d.c. shunt machine by conducting no load test at different excitations and plotting the variations of these losses at various speeds.

Transformers

Polarity test on single phase transformers.

Connect three single phase transformers to form a 3 phase transformer with YY and DYI connection. Perform the load test, under balanced upf conditions – Plot the efficiency Vs output and % regulation Vs output characteristics.

O.C and S.C test on the single phase transformer and pre-determination of the following:

- Efficiency at various loads and power factors.
- Regulation at various loads and lagging and leading power factors.
- Equivalent circuits referred to H.V and L.V sides.

Calculation of performance using equivalent circuit and given load connection to the equivalent circuit.

Upf load at which efficiency is maximum.

Separation of losses of single phase transformer into hysteresis and eddy current loss components at normal voltage and frequency.

Sumpner's test on a pair of identical single phase transformers and pre-determination of the efficiency and regulations at various loads and power factor.

Scott connection of the single phase transformers and the performance under various load conditions at Upf and plotting the efficiency curves with main transformer secondary alone loaded.

Teaser transformer secondary alone loaded.

Balanced loading.

Unbalanced loading.

Student shall present his/her fair record, notebook duly certified by the Head of the Department, to the examiners at the time of University practical examination.

Note: 50% Mark is earmarked for continuous evaluation and 50% mark for end semester examination, to be assessed by two examiners. A candidate shall secure a minimum of 50% marks for two components to be eligible for pass in that subject.

EE15L2 MICROPROCESSOR & MICROCONTROLLER LAB

Part A (Compulsory)

Study of a typical microprocessor trainer kit and its operation
Simple programming examples using 8085 instruction set. To understand the use of various instructions and addressing modes – monitor routines.

Interfacing and programming of 8255 (eg: traffic light control , Burglar alarm, stop watch)
Interfacing and programming of 8253/8254
Interfacing and programming of 8279.

Part B

A/D and D/A converter interface
Stepper motor interface.
Display interface.

Programming of different types of EPROM 2716, 2732, etc…(at least two topics from Part B has to be covered.)

Note: 50% Mark is earmarked for continuous evaluation and 50% mark for end semester examination, to be assessed by two examiners. A candidate shall secure a minimum of 50% marks for two components to be eligible for pass in that subject.

EE1601 MODERN COMMUNICATION ENGINEERING

Module 1

Microwave Communication : Basic principles of microwave links- Microwave Relay Systems – Choice of frequency – line of sight and over the horizon systems – modulation methods – block schematics of terminal transmitters and receivers – microwave repeaters – microwave repeaters – microwave repeaters – microwave antennas – propagation mechanisms – propagation characteristics – path loss models – shadowing models – small scale fading and multipath fading – basic principles of design of microwave link

Module II

Satellite Communication – Orbit of communication satellite – Satellite Constellation – Orbital parameters – Orbital perturbations – Geostationary orbits – Low Earth and Medium Orbits – Look Angles – Frequency selection RF Links – Propagation characteristics – Modulation methods- coding – multiple access – space craft – antennas – transponders – intersatellite link – link power budget – earth station interference – Satellite systems – Geostationary systems – Distress and Safety systems – Navigation systems – direct sound broadcast systems – Direct Television broadcast systems

Module III

Wireless communication systems: Cellular concepts – Cell Splitting and Frequency Reuse - Propagation Mechanisms – Modulation techniques for wireless communication – Analog, Digital and Spread Spectrum modulation – Equalisation, Diversity and Channel coding Diversity Techniques – Multiple access techniques for Wireless Commuications – FDMA,TDMA and CDMA – Wireless systems and standards – AMPS – Global System for Mobile(GSM) – CDMA – General Packet Radio Service – DECT System .

Fiber optic communication: light wave communication systems- Fiber optic cable - optical transmitter and receiver.

Module 1V

Radiation and Propagation of Waves: - (analysis not required) - Electro magnetic Radiation- Waves in free space-polarization - reception- effects of Environment- Propagation of waves:- Ground waves- Sky-wave propagation - space waves- antennas- Basic consideration - wire radiator in space - common terms and definitions- Effects of ground on Antennas- Directional High frequency Antennas - UHF Micro wave antennas - Wide band and special purpose antennas.

References:

1) Electronic Communications: Dennis Roddy and John Coolen, Prentice Hall, India.
2) Electronic Communication Systems: Kennedy & Davis - Fourth Edition-TMH
3) Communication Electronics: Frenzel, McGraw Hill, International Editions.
   For Modules IV & V
4) Communication Electronics : Frenzel MGH

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B

EE1602 ELECTRICAL DRAWING

Module I
D.C Armature windings- Simplex lap and wave windings.
Sectional front and side elevation of the armature with commutator.
Sectional front and side elevation of the yoke and pole assembly with field winding.
Sectional front and side elevation of an assembled dc machine.

Module II
Transformers
Sectional plan and elevation of core type and shell type single-phase transformer.
Sectional plan and elevation of a three-phase transformer.
Induction Motors
Sectional front and side elevation of slip ring and squirrel cage induction motor.
Alternators
Sectional front and side elevation of salient pole and turbo alternators.

Module III
Three-phase AC windings
Single layer windings- Mush windings and concentric windings.
Double layer lap windings- Full pitched, short pitched and fractional slot windings.
Double layer lap windings.

Module IV
Single line layout of substations.
Single line layout of generating stations.
Single circuit and double circuit transmission towers.

References:

1. *Narang K.L-A text book of Electrical Engineering Drawing ,Trch India Publication.*
2. *S.K Battacharya-Electrical Engineering Drawing.*
3. *A.K Sawhney-Electrical Machine Design, Dhanapath Rai, New Delhi.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1603 MODERN DIGITAL SIGNAL PROCESSING

Module I

Review of discrete time signal & systems-Frequency domain representation of discrete time signals- Discrete Fourier series(DFS)- properties Discrete Time Fourier Transform (DTFT) properties, Discrete Fourier Transform(DFT) properties& Fast Fourier Transform(FFT) Decimation in Time & Decimation in Frequency algorithms.

Module II

FIR Digital filters_Transfer function_generalised difference equation representation-filter design using Fourier series - window functions - frequency sampling technique_Realizations - direct - cascade –– linear phase realisation - Finite word length effects in FIR filter design- Applications of FIR filters.

Module III

IIR Digital Filters - Transfer function. Difference equation representation. Analog filter approximations - Butterworth and Chebychev approximations _Transformation techniques- - impulse invariant transformation - Bilinear transformation_ Recursive Realizations_ Direct form I , Direct form II –Cascade Realization-Parallel realization – Comparison of IIR & FIR filters in terms of computational complexity, memory requirement, hardware complexity, stability - Finite word length effects in IIR filter design-effects due to truncation and rounding-limit cycles- Applications of IIR filters

Module IV

General DSP architecture- features _ on chip subsystems- memory organization-Addressing modes- Instruction types - TMS320C54X fixed point processor- TMS320C4X floating point processor-Applications of DSP

References :

1. *Cristi, Modern Digital Signal Processing, Ed. 1.*
2. *Ashok Ambardar, Analog and Digital Signal Processing, Edition 2.*
3. *Avatar Singh, Digital Signal Processing Implementations, Edition 1*
4. *John G Proakis & Dimitris G Manolakis : "Digital Signal Processing", PHI, New Delhi*
5. *Oppenheim & Ronald W Schafer : "Digital Signal Processing", Prentice Hall India*
6. *Sanjit K. Mithra, : " Digital Signal Processing", Tata Mc- Graw Hill*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1604 ELECTRICAL MACHINES III

Module I

Three phase induction motor - constructional details - slip ring and squirrel cage types- Theory of the induction machine with constant mutual flux - slip phasor diagram - mechanical power and developed torque - Torque slip curves - variation and starting torque with rotor resistance- pull out torque - losses and efficiency - approximate and exact equivalent circuits - circle diagram - No load and blocked rotor tests - performance calculations from the equivalent circuit.

Module II

Starting - starting squirrel cage motors- direct on-line starting auto transformer and star - delta starter - starting current and torque - starting of slip ring motors - design of rotor rheostat.

Effects of harmonics - Harmonic induction and harmonic synchronous torques - cogging, crawling and noise production - methods of elimination - special rotor construction - Deep bar, composite bar and Boucherot rotor constructions - equivalent circuits and torque curves of double cage motors.

Module III

Methods of speed control - pole changing methods - rotor rheostatic control - change of supply frequency - use of SCR for speed control - principle of speed regulation and improvement of power factor by rotor injected emf.

Induction generator Theory - phasor diagram - circle diagram - equivalent circuit - applications.

Synchronous induction motor- construction - rotor winding connections - circle diagram - pulling into step.

Module IV

Single phase induction motor - revolving field theory equivalent circuit - torque slip curve- starting methods - split phase, capacitor start, capacitor run motors shaded pole motor - repulsion start and repulsion induction motor.

Commutator motors - General, principles and theory - commutator as a frequency converter - emf induced in a commutator winding - single phase series motor - theory - phasor and circle diagram - compensating and interpole windings - universal motor - principle of repulsion motor - torque production - phasor diagram - compensated type of motors repulsion start induction motor - applications.

Poly phase commutator motors - Three phase series and shunt type - schrage motor - characteristics and applications .

References:

1. *Performance & Design of AC Machines: Say MG*
2. *Theory of AC Machinery : Langsdorff AC*
3. *AC Commutator Motors : Openshaw Taylor*
4. *Alternating Current Machines : Puchstein & Lloyd*
5. *Electrical Machines Part I & II : Kostenko & Pietrovsky*

Type for questions for University Exams

Question (1) - Eight short answer question of five marks with two questions from each of four modules

Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE 1605 CONTROL SYSTEMS I

Module I
Systems Concepts and Modeling: Classification of systems, static dynamic, linear, non-linear, time varying, time invariant, distributed, lumped etc. Superposition principle, Modeling of electrical systems, dynamic equations using Kirchhoff's laws. Transfer functions - armature controlled and field controlled DC motor- block diagrams and signal flow graphs.

Module II
Modeling of non-electrical systems: Translational and rotational systems, force voltage and force-current analogy, thermal and hydraulic systems. Dynamic equations and transfer functions-comparison of different systems.
Control system components: Synchros, DC and AC servomotor, Stepper motor, Tacho generator.

Module III
Time domain analysis for linear systems: Response to standard inputs, impulse response-step ramp and acceleration inputs-time domain performance measures of second order system-under damped and over damped systems, effect of pole locations in s-plane, effects of additional pole and additional zero, static error constants and system type number.

Module IV Frequency domain analysis, sinusoidal frequency response. Polar plots and logarithmic plots – Bode plots – Nyquist plots – absolute stability and relative stability from Bode and Nyquist plots. Routh's Hurwitz criterion.

References:

1. K Ogata. - "*Modern Control Engineering*", Low Price Edition.
2. M.Gopal,"C*ontrol Systems Principles and Design*", Tata Mc Graw Hill.
3. *A.Nagoor kani "Control Systems", RBA Publication*
4. *S Palani "Control Systems Engineering", Tata Mc Graw Hill.*
5. *Joseph J. Distefano, III.Allen R. Stubberud, Ivan J. Wililams, "Feedback and Control Systems", Schaum's outline series, Tata McGraw Hill.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE 1606 E1 - ADVANCED MICROPROCESSORS

Module I

Intel 8086 Architecture_ Memory address space and data organization_ Segment registers and memory segmentation_ I/O address space- Addressing modes Comparison of 8086 and 8088. Basic 8086/8088 configuration, Minimum mode-Maximum mode

Module II

8086 assembly language programming _Addressing modes _instruction set _datatransfer, arithmetic bit manipulation & string instructions_simple sequential & looping programs -Interfacing of 8255, – DMA controller (8257) – programmable interrupt controller (8259) .

Module III

Introduction to 80386 – memory management unit – descriptors, selectors, description tables and TSS – real and protected mode – memory paging – special features of the Pentium processor – branch prediction logic – super scalar architecture.

Module IV

PIC controllers: Introduction to microchip PIC family of microcontrollers and development tools. CPU architecture and instruction set, Harvard Architecture and Pipelining. Program memory considerations, Register file structure and addressing modes, CPU Registers, Instruction set.

References:

1. Microprocessors and interfacing Douglas V Hall, Tata Mcgraw Hill
2. Gaonkar Ramesh, Fundamentals of Microcontrollers and applications in embedded systems, Penram International publishing
3. *Design with PIC Microcontrollers John B Peatman, Pearson Education Asia LPE*
4. *THe 8086/8088 Family John Uffenbeck, Pearson Media, LPE*

5. *Brey B.B. - The Intel Microprocessors – Architecture, Programming & Interfacing, Prentice Hall.*
6. *Liu Y.C & Gibsen G.A - Microcomputer System - The 8086/8088 family. Prentice Hall of India.*
7. *Ray A.K, & Bhurchandi K.W - Advanced Microprocessors and Peripherals, Tata McGraw Hill.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1606 E2 - OPTIMIZATION TECHNIQUES & ALGORITHM

Module I

Linear programming: Formulation-Graphical and simplex methods-Big-M method-Two phase method-Dual simplex method-Primal Dual problems.

Module II

Unconstrained one dimensional optimization techniques: Necessary and sufficient conditions -Unrestricted search methods-Fibonacci and golden section method-Quadratic Interpolation methods, cubic interpolation and direct root methods.

Module III

Unconstrained n dimensional optimization techniques**:** Direct search methods -Random search -pattern search and Rosen brooch's hill claiming method- Descent methods-Steepest descent, conjugate gradient, quasi -Newton method.

Module IV

Constrained optimization Techniques**:** Necessary and sufficient conditions -Equality and inequality constraints-Kuhn-Tucker conditions-Gradient projection method-cutting plane method- penalty function method.

Dynamic programming- principle of optimality- recursive equation approach-application to shortest route, cargo-loading, allocation and production schedule problems.

References :

1. *Rao,S.S.,'Optimization : Theory and Application' Wiley Eastern Press, 2nd edition 1984*
2. *Taha,H.A., Operations Research -An Introduction,Prentice Hall of India,2003*
3. *Fox, R.L., 'Optimization methods for Engineering Design', Addition Welsey, 1971*
4. *A. Ravindran , K. M. Ragsdell , G. V. Reklaitis, Engineering Optimization Methods And , Wiley, 2008*
5. *Godfrey C. Onwubolu , B. V. Babu , New optimization techniques in engineering , Springer, 2004*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE 1606 E3 IMAGE PROCESSING

Module I

Digital image fundamentals: representation - elements of visual perception - simple image formation model - Image sampling and quantization - basic relationships between pixels – imaging geometry.

Review of matrix theory results: Row and column ordering - Toeplitz, Circulant and Block matrices. Review of Image transforms: 2D-DFT, FFT, Walsh, Hadamard, Haar, DCT and Wavelet transforms.

Module II

Image enhancement: Spatial domain methods: point processing - intensity transformations, histogram processing, image subtraction, image averaging; Spatial filtering- smoothing filters, sharpening filters. Frequency domain methods: low pass filtering, high pass filtering, homomorphic filtering. Generation of spatial masks from frequency domain specifications.

Image segmentation: Detection of discontinuities - point, line and edge and combined detection , Edge linking and boundary description - local and global processing using Hough transform – Thresholding - Region oriented segmentation - basic formulation, region growing by pixel aggregation, region splitting and merging - Use of motion in segmentation. Fundamentals of Representation and Description.

Module III

Image restoration: Degradation model - Diagonalization of circulant and Block circulant matrices - Algebraic approaches - Inverse filtering - Wiener filter - Constrained Least squares restoration - Interactive restoration - Geometric transformations.

Fundamentals of Colour image processing: colour models - RGB, CMY, YIQ, HIS - Pseudo color image processing - intensity slicing, gray level to color transformation.

Module IV

Image compression: fundamentals- redundancy: coding, inter pixel, psycho visual, fidelity criteria, Models, Elements of information theory, Error free compression- variable length, bit plane, lossless predictive, Lossy compression- lossy predictive, transform coding. Fundamentals of JPEG, MPEG & Fractal image compression techniques.

References:

1. Gonzalez and Woods, *Digital Image Processing*, Pearson Education/ Prentice-Hall India Ltd., 2nd ed.
2. *Anil K. Jain, Fundamentals of Digital Image Processing, Pearson Education/ PHI Ltd, 2003.*
3. *Mark Nelson, Jean-Loup Gailly, The Data compression Book, BPB Publications, 2nd ed.*
4. *Pratt William K., Digital Image Processing, John Wiley & sons, 2nd ed.*
5. *Chanda & Majumdar, Digital Image Processing and Analysis, Prentice-Hall India Ltd, 2003.*
6. *M. Sonka, V. Hlavac, R. Boyle, Image Processing, Analysis and Machine Vision, Thomson Learning, 2006*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE 1606 E4 NON CONVENTIONAL & RENEWABLE ENERGY SOURCES

Module I

Renewable and non-renewable sources of energy – brief review of conventional sources of energy – energy production and world energy consumption – green house effect and global warming. Solar energy option. Thermal conversion – design fabrication and performance of flat plate collectors – description of solar thermal devices (stills water heater, furnaces cookers and refrigerators) – Solar thermal power generation systems – thermal storage.

Module II

Photovoltaic conversion – conceptual description of photo voltaic effect – electrical characteristic of silicon PV cells and modules – solar cell material and prospects – Instruments for measurement of solar radiation – Empirical equations for predicting availability of solar radiation.

Module III

Wind energy – wind turbines – Horizontal axis and vertical axis with turbines – Power and energy from wind turbines – wind characteristics. Energy from oceans: wave energy – Physical principles – wave characteristics and wave power – wave energy technology. – fixed devices – floating devices

Module IV

Biomes – classification – biomass – conversion process – application – ocean thermal energy conversion systems – Tidal & wave power application – fuel cells – types – losses in fuel cell - application – MHD generators – application of MHD generation - micro and mini hybrid power.

References:

1. *Renewable energy sources – John W, Twidell & Antony D. Wier – ELBS Publication*
2. *Renewable Energy - Power for sustainable Future – Edited by Godfrey Boyle – Oxford University Press in association with the Open University, 1996.*
3. *Applied solar Energy - Meinel A B and Meinel MP, Addison Wesley Publications.*
4. *Renewable and Novel energy sources – SL Sah, MI Publications, New Delhi, 1995.*
5. *Direct Energy Conversion – George Sutton – McGraw hill Publications.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE16L1 POWER ELECTRONICS LAB

Part A - Power Electronics
Study of Power devices – power BJT, SCR, power MOSFET, IGBT etc.
Characteristics of SCR and Triac
Characteristics of power MOSFET
Triggering circuits for SCRs – R, RC and UJT triggering
Single phase fully controlled SCR bridge circuit – R load, RL load – effect of free wheeling diode.
Triggering circuits for SCR chopper
Triac triggering
Speed control DC motor using SCR
Study of V/F control of induction motor.
AC controller using Triac
Study of UPS/SMPS

Part B - Op-Amps
Study of Op-Amps
Op-Amp inverter – scale changer – summer – integrator – differentiator – comparator and instrumentation amplifier

Design and setup of low pass – high pass and band pass filters using Op- Amps
Voltage Regulation using 723
PLL measurement of lock range and capture range
Circuits using Op-Amps for wave form generation
Astable, monostable multivibrators
Wein Bridge Oscillator
Triangular and square wave form generation
Precision rectifiers
Schmitt trigger using Op-Amps

According to the facility available in the laboratory any 15 experiments can be conducted.

Note: 50% Mark is earmarked for continuous evaluation and 50% mark for end semester examination, to be assessed by two examiners. A candidate shall secure a minimum of 50% marks for two components to be eligible for pass in that subject.

EE16L2 MINI PROJECT

Each batch comprising of 3 to5 students shall design, develop and realize an electronic product. Basic elements of product design must be considered. Fully software/simulation projects are not allowed. Each student shall submit a project report at the end of the semester. The project report should contain the design and engineering documentation including the Bill of Materials and test results. Product has to be demonstrated for its full design specifications. Innovative design concepts, reliability considerations and aesthetics / ergonomic aspects taken care of in the project shall be given due weight.

Guidelines for evaluation:

i) Attendance and Regularity	10
ii) Work knowledge and Involvement	30
iii) End-Semester presentation & Oral examination	20
iv) Level of completion and demonstration of functionality/specifications	25
v) Project Report	15
Total	100 marks

***Note**: External projects and R&D projects need not be encouraged at this level. Points (i) & (ii) to be evaluated by the project guide & co-ordinator and the rest by the final evaluation team comprising of 3 teachers including the project guide.*

EE1701 INDUSTRIAL ORGANIZATION AND MANAGEMENT

Module I

Organisation: Introduction, definition of organization, system approach applied to organization, necessity of organization, elements of organization, process of organization, principles of organization, formal and informal organization, organization structure, types of organization structure .

Forms of business organization: Concept of ownership organization, types of ownership. Individual ownership, partnership, joint stock Company, private and public limited company, co-operative organizations, state ownership, public corporation

Module *II*

Basic concept of management: Introduction, definitions of management, characteristics of management, levels of management, management skills

Management theory: Scientific management, contribution of Gilbreth. Gantt, Neo-classical theory, modern management theories

Functions of management: Planning, forecasting, organizing, staffing, directing, motivating, controlling, co-coordinating, communicating, decision making.

Module *III*

Personnel management: Introduction, definition, objectives, characteristics, functions, principles and organization of personnel management

Markets and marketing: Introduction, the market, marketing information, market segmentation, consumer and indusial markets, pricing, sales, physical distribution, consumer behaviour and advertisement.

Financial management: the basics , financial accounts, inflation, profitability, budgets and controls, cost accounting, valuation of stock, allocation of overheads, standard costing ,marginal costing

Module IV

Productivity and production: Measurement of productivity, productivity index productivity improvement procedure

Materials management and purchasing: Objectives, functions, importance of materials management. Stores and storekeeping

Inventory control: Classification, functions, inventory models, inventory costs, EOQ, Materials requirement planning

References:

1. Fraidoon Mazda, Engineering Management-, Addison -Wesley
2. Koontz and O'Donnell, Essentials of Management, Mc Graw Hill
3. Kotlar P, Marketing Management, Prentice Hall India
4. Chandra P , Finance Management
5. Monks J.G Operations Management

Type for questions for University Exams

Question (1) - Eight short answer question of five marks with two questions from each of four modules

Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1702 DESIGN ESTIMATION & COSTING

Module I

Role of national electrical code in the design of electrical installation – electrical symbols and diagrams – design considerations of electrical installations – electric supply systems – protection and protective devices for electric installation against overload – short circuit and earth fault – electric services in building – service connections – service mains – reception and distribution of main supply – sub- circuits – neutral and earth wire – earth bus – guideline for installation of fittings – design, selection, layout, drawing and location of distribution boards and panel boards – control and switch gears – criteria for selection of HT and LT underground cables.

Module II

Design of illumination schemes – various types of light sources – different types of lighting arrangement – energy efficiency in lamps and illumination – design considerations of good lighting schemes – design of lighting schemes for various purposes – lighting calculations – design of flood lighting and street lighting – electrical aspects and considerations for lifts, escalator services and standby generators – design and safety aspects of electrical installations for residential buildings, hospitals, hotels, recreational and assembly buildings and cinema theatre.

Module III

Electrical installations of high rise buildings – design – schematic diagram – layout – estimation and testing of rising main – main supply board and distribution boards for high rise buildings – lighting protection – electrical system design – estimation and costing of commercial buildings – design considerations of electrical installations in Industries – design, estimating and costing of electrical installations for small industries.

Module IV

Selection of EHV and HV power and distribution transformers and switchgears – case studies – design – layout – schematic diagram –estimation and costing – (a) 16MVA – 110/11KV outdoor substation having one or two incoming and 8 or less outgoing – (b) 11KV/415V outdoor substations upto 630KVA – (c) 11KV/415V indoor substation upto 630KVA – (d) bus bar trunking above 630KVA – design of earthing system – plate and pipe earthing

References:

1. Raina & Battacharya, Electrical System Design, Estimation & costing, Wiley Eastern
2. Gupta J.B, Electrical Installating, Estimating & Costing, Kataria & Sons
3. ISI, National Electric Code, Bureau of Indian Standard Publications
4. Cinema Regulation (Rules) & Act
5. IEEE Standards, IEEE
6. Relevant Indian Standard Specifiactions, IS Publication.

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1703 POWER SYSTEMS II

Module I

Representation of power system – one line diagrams – impedance and reactance diagrams – per unit and percent quantities – primitive and interconnected networks and their performance equations – y-bus and z- bus matrices and their formulation – effect of off nominal transformer on y-bus – load flow studies – problem formulation – classification of buses – gauss-seidal method – Newton Raphson method and fast decoupled load flow method – line loss computation – voltage dependency consideration in load modeling.

Module II

Economic load dispatch – system constraints – economic dispatch of thermal plants neglecting line losses – optimum load dispatch including transmission line losses – exact transmission loss formula – automatic load dispatching – optimal load flow solution – speed governing mechanism – speed governing of turbo generator – load sharing and governor characteristics – transfer function model – load frequency – control of single and multi area systems – static analysis – automatic voltage regulation – IEEE type I excitation system transfer function model.

Module III

Short circuit studies – faults on power systems – three phase to ground faults – SLGF – DLGF – LLF faults – sequence impedance and sequence network – symmetrical component methods of analysis of symmetrical and unsymmetrical faults at the terminals of an unloaded generator – fault analysis using z-bus phase shift in star – delta transformer banks – faults through impedance – short circuit capacity of a bus and circuit breaker rating.

Module IV

Power system stability studies – steady stage dynamic and transient stability – electrical stiffness – swing equation – inertia constant – equal area criterion applied to the case of a sudden change in mechanical power input – multi machine stability analysis using forward euler method – basic assumptions and algorithms – factors affecting stability – voltage stability problem – causes and mitigation methods – introduction to HVDC and flexible ac transmission (FACTS) systems.

References:

1. Stevenson W.D Jr *Elements of Power System Analysis* (Tata McGraw Hill).
2. I.J Nagrath & D.P Kothari *Modern Power System Analysis*, (Tata McGraw Hill).
3. S.L.Uppal -*Electrical Power* (Khanna Publication).
4. S.S Rao - *Switch gear & Protection* (Khanna Publication)
5. Soni, Guptha, Bhatnagar - *A course in Electric Power* (Dhanapat Rai & Sons).

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE 1704 CONTROL SYSTEMS II

Module I

State space models for linear systems: Concepts, state space, linear systems in state space, state diagram, state models from transfer functions, phase variable and canonical forms, state transition matrix, solution of state equations, controllability and observability.

Linear discrete time systems: pulse transfer function, state space representation of discrete time systems, stability using Jury's test.

Module II

Basic control actions and Root locus technique: Modes of control- Proportional(P) , Integral(I), Derivative(D) and combinations of P, I and D. and its effects on system performance. PID controller tuning in process control.

Basic theory and properties of root locus, rules for construction of root locus, complete root locus diagram , effects of addition of poles and zeros.

Module III

Design of control systems: Cascade and feedback compensations, design principles, compensating networks- lead, lag, lag lead, design by gain adjustment, cascade compensation using Bode plots and root locus.

Module IV

Nonlinear systems analysis. Non-linear systems behavior, nonlinearities in control systems, describing function of common nonlinearities, stability analysis by describing function, Phase plane and phase trajectories, Lyapunov stability.

References:

1.K Ogata. - "Modern Control Engineering", Law Price Edition.
2.M.Gopal,"*Control Systems Principlas and Design*", Tata Mc Graw Hill.
3. A.Nagoor kani "*Advanced Control Theory*", RBA Publication
4.S Palani "*Control Systems Engineering*", Tata Mc Graw Hill.

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1705 E1-WIRELESS COMMUNICATION

Module I
Evolution of mobile radio communication fundamentals. Large scale path loss: propagation models, reflection, diffraction, scattering, practical link budget design using path loss model. Small scale fading & multipath propagation and measurements, impulse
response model and parameters of multipath channels, types of fading, theory of multi-
path shape factor for fading wireless channels.

Module II
Spread spectrum modulation techniques: Pseudo-noise sequence, direct sequence spread spectrum (DS-SS), frequency hopped spread spectrum(FHSS), performance of DS-SS, performance of FH-SS, modulation performance in fading and multipath channels, fundamentals of equalisation, equaliser in communication receiver, survey of equalisation techniques, linear equaliser, linear equaliser, non-linear equalisation, diversity,
techniques RAKE, receiver.

Module III
Characteristics of speech signals, quantisation techniques, vocoders, linear predictive coders, time division multiple access, space division multiple access, and frequency
division multiple access.

Module IV
Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems. Introduction to wireless networks, 2G, 3G wireless systems, wireless standards.

Reference:

1. T.S. Rappaport, “Wireless Communication-Principles and practice”, Pearson
2. Willium C. Y. Lee, “Mobile communication Design and fundamentals”
3. D. R. Kamilo Fehar, “Wireless digital communication”
4. Haykin S & Moher M., “Modern wireless communication”, Pearson, 2005.
5. R. Pandya, “ Mobile and personal communication system”, PHI.

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1705 E2 - HIGH VOLTAGE DC & EXTRA HIGH VOLTAGE AC

Module I

Introduction **:**Need of EHV transmission, standard transmission voltage, comparison of EHV ac & dc transmission systems and their applications & limitations, surface voltage gradients in conductor, distribution of voltage gradients on sub-conductors, mechanical considerations of transmission lines, modern trends in EHV AC and DC transmission Extra High Voltage Testing: Characteristics and generation of impulse voltage, generation of high Ac and
DC voltages, measurement of high voltage by spheregaps and potential dividers.

Module II

EHV AC Transmission: Corona loss formulas, corona current, audible noise – generation and
characteristics corona pulses their generation and properties, radio interference (RI) effects, over voltage due to switching, ferroresonance, reduction of switching surges on EHV system, principle of half wave transmission.

Module III

EHV DC Transmission: Types of dc links, converter station, choice of converter configuration and pulse number, effect of source inductance on operation of converters.
Principle of dc link control, converter controls characteristics, firing angle control, current and excitation angle control, power control, starting and stopping of dc link.

Module IV

Converter faults, protection against over currents and over voltages, smoothing reactors, generation of harmonics, ac and dc filters, Multi Terminal DC systems (MTDC): Types, control, protection and applications.

References :

1. R. D. Begamudre*, "Extra High Voltage AC Transmission Engineering" Wiley Eastern.*
2. *K. R. Padiyar, "HVDC Power Transmission Systems: Technology and System Reactions" New Age International.*
3. *J. Arrillaga," High Voltage Direct current Transmission" IFFE Power Engineering Series 6, Peter Peregrinus Ltd,London.*
4. *M. S. Naidu & V. Kamaraju, "High Voltage Engineering" Tata Mc Graw Hill.*
5. *M. H. Rashid , " Power Electronics : Circuits, Devices and Applications" Prentice Hall of India.*
6. *S. Rao, "EHV AC and HVDC Transmission Engineering and Practice" Khanna Publisher.*
7. *"EPRI, Transmission Line Reference Book, 345 KV and above" Electric Power Research Institute. Palo Alto,California, 1982.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1705 E3-SOFT COMPUTING

Module I

Introduction to Neural Network**:** Concept, biological neural network, evolution of artificial neural network, McCulloch-Pitts neuron models, Learning (Supervise & Unsupervise) and activation function, Models of ANN-Feed forward network and feed back network, Learning Rules- Hebbian, Delta, Perceptron Learning and Windrow-Hoff, winner take all.

Module II

Supervised Learning**:** Perceptron learning,- Single layer/multilayer, linear Separability, Adaline, Madaline, Back propagation network, RBFN. Application of Neural network in forecasting, data compression and image compression.

Unsupervised learning**:** Kohonen SOM (Theory, Architecture, Flow Chart, Training Algorithm) Counter Propagation (Theory , Full Counter Propagation NET and Forward only counter propagation net), ART (Theory, ART1, ART2). Application of Neural networks in pattern and face recognition, intrusion detection, robotic vision.

Module III

Fuzzy Set: Basic Definition and Terminology, Set-theoretic Operations, Member Function, Formulation and Parameterization, Fuzzy rules and fuzzy Reasoning, Extension Principal and Fuzzy Relations, Fuzzy if-then Rules, Fuzzy Inference Systems. Hybrid system including neuro fuzzy hybrid, neuro genetic hybrid and fuzzy genetic hybrid, fuzzy logic controlled GA. Application of Fuzzy logic in solving engineering problems.

Module IV

Genetic Algorithm: Introduction to GA, Simple Genetic Algorithm, terminology and operators of GA (individual, gene, fitness, population, data structure, encoding, selection, crossover, mutation, convergence criteria). Reasons for working of GA and Schema theorem, GA optimization problems including JSPP (Job shop scheduling problem), TSP (Travelling salesman problem), Network design routing, timetabling problem. GA implementation using MATLAB.

References:-

1. *S.N. Shivnandam, "Principle of soft computing", Wiley.*
2. *S. Rajshekaran and G.A.V. Pai, "Neural Network , Fuzzy logic And Genetic Algorithm", PHI.*
3. *Jack M. Zurada, "Introduction to Artificial Neural Network System" JAico Publication.*
4. *Simon Haykins, "Neural Network- A Comprehensive Foudation"*
5. *Timothy J.Ross, "Fuzzy logic with Engineering Applications", McGraw-Hills 1.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1705 E4 - ENERGY AUDITING & ANALYSIS

Module I

System approach and End use approach to efficient use of Electricity: Electricity tariff types; Energy auditing: Types and objectives-audit instruments- ECO assessment and Economic methods-specific energy analysis-Minimum energy paths-consumption models-Case study.

Module II

Electric motor: Energy efficient controls and starting efficiency-Motor Efficiency and Load Analysis- Energy efficient /high efficient Motors-Case study; Load Matching and selection of motors.

Variable speed drives: Pumps and Fans-Efficient Control strategies- Optimal selection and sizing -Optimal operation and Storage; Case study

Module III

Transformer Loading/Efficiency analysis, Feeder/cable loss evaluation, case study.

Reactive Power management**:** Capacitor Sizing-Degree of Compensation-Capacitor losses-Location-Placement-Maintenance, case study.

Peak Demand controls- Methodologies-Types of Industrial loads-Optimal Load scheduling-case study.

Lighting- Energy efficient light sources-Energy conservation in Lighting Schemes- Electronic ballast-Power quality issues-Luminaries, case study.

Module IV

Cogeneration: Types and Schemes-Optimal operation of cogeneration plants-case study;
Electric loads of Air conditioning & Refrigeration-Energy conservation measures- Cool storage. Types-Optimal operation-case study; Electric water heating-Gysers-Solar Water Heaters- Power Consumption in Compressors, Energy conservation measures; Electrolytic Process; Computer Controls- software-EMS .

References:

1. *Handbook on Energy Audit and Environment Management, Y P Abbi and Shashank Jain, TERI, 2006*
2. *Handbook of Energy Audits Albert Thumann , William J. Younger , Terry Niehus , 2009*
3. *Howard E. Jordan, .Energy-Efficient Electric Motors and Their Applications., Plenum Pub Corp; 2nd edition (1994)*
4. *Albert Thumann , .Handbook of Energy Audits., Fairmont Pr; 5th edition (1998)*
5. *Albert Thumann, P.W, -.Plant Engineers and Managers Guide to Energy Conservation. - Seventh Edition-TWI Press Inc, Terre Haute, 2007*
6. *IEEE Recommended Practices for Energy Management in Industrial and Commercial Facilities*
7. *Energy Efficiency Manual: for everyone who uses energy, pays for utilities, designs and builds, is interested in energy conservation and the environment, Donald R. Wulfinghoff, Energy Institute Press (March 2000)*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE17L1 ELECTRICAL MACHINES LAB II

Synchronous Machines
Regulation of alternator by direct loading
Regulation of alternator by emf and mmf methods.
Regulation of alternator by potier and ASA methods
Slip test and regulation of salient pole alternator using two - reaction theory
Synchronizing of alternator to mains by dark lamp & bright lamp method and control of reactive power.

Induction machines
Variation of starting torque with rotor resistance in slip ring induction motor.
Direct load test on induction motor.
Pre determination of Characteristic and equivalent circuit of induction motor from no load and blocked rotor test.
Synchronous induction motor V- curves, pre determination of field current.
Pre determination of characteristic of pole changing motor
Test on Induction generator. Determination of rotor hysterisis.

Special experiments
V/f control of induction motor.
Characteristic of single-phase induction motor.
Complete torque slip characteristic of induction motor.
Characteristic of double cage induction motor.
Slip power recovery schemes:
Cascade operation of induction motor. Determination of slip and load shared by each motor and overall efficiency of the test.
Methods using converter/inverter operations
From the above list, maximum number of experiments may be conducted subject to facility available.

Note: 50% Mark is earmarked for continuous evaluation and 50% mark for end semester examination, to be assessed by two examiners. A candidate shall secure a minimum of 50% marks for two components to be eligible for pass in that subject.

EE17L2 ADVANCED ELECTRICAL ENGG. LAB

1) MATLAB – I – experiments using MATLAB toolbox.
2) Determination of transfer function of DC motor (a) armature control (b) field control.
3) Study and experiments on (a) DC servo motor (b) AC servomotor.
4) Experiments on synchros (a) characteristics (b) data transmission (c) error detection (d) differential synchro.
5) Determination of transfer function of the amplidyne and load characteristics.
6) Design and experimental determination of frequency response determination of lag, lead and lag-lead networks.
7) Magnetic amplifier – characteristics and control circuits.
8) Static and dynamic performance evaluation of transducer (a) resistance thermometer (b) vibration pick up (c) pH meter.
9) Study and performance evaluation of transducers (a) strain gauge (b) inductive pick up (c) capacitive pick up (d) LVDT.
10) Study and experiments on pneumatic control system.
11) Microprocessor based generation of non-linear functions using proper interfacing and display devices.
12) PSPICE simulation of single-phase and three-phase diode bridge rectifiers.
13) PSPICE simulation of three-phase thyristor bridge rectifier.
14) Power flow analysis of the system with the given single line diagram, using the given power flow analysis package.
15) Fault analysis of the system with given single line diagram, using the given fault analysis package. Obtain the sub-transient fault currents for DLFG, DLFG, LLF faults at leach bus.
16) Determination of relay characteristics.

Note: 50% Mark is earmarked for continuous evaluation and 50% mark for end semester examination, to be assessed by two examiners. A candidate shall secure a minimum of 50% marks for two components to be eligible for pass in that subject.

EE17L3 PROJECT DESIGN

Each batch comprising of 3 to 5 students shall identify a project related to the curriculum of study. At the end of the semester, each student shall submit a project synopsis comprising of the following.

- Application and feasibility of the project
- Complete and detailed design specifications.
- Block level design documentation
- Detailed design documentation including circuit diagrams and algorithms / circuits
- Bill of materials in standard format and cost model, if applicable
- Project implementation action plan using standard presentation tools

Guidelines for evaluation:

i) Attendance and Regularity	10
ii) Quality and adequacy of design documentation	10
iii) Concepts and completeness of design	10
iv) Theoretical knowledge and individual involvement	10
v) Quality and contents of project synopsis	10
Total	50 Marks

Note: *Points (i)-(iii) to be evaluated by the respective project guides and project coordinator based on continuous evaluation. (iv)-(v) to be evaluated by the final evaluation team comprising of 3 internal examiners including the project guide.*

EE17L4 SEMINAR

Students shall individually prepare and submit a seminar report on a topic of current relevance related to the field of Electronics & Communication Engineering. The reference shall include standard journals, conference proceedings, reputed magazines and textbooks, technical reports and URLs. The references shall be incorporated in the report following IEEE standards reflecting the state-of-the-art in the topic selected. Each student shall present a seminar for about 30 minutes duration on the selected topic. The report and presentation shall be evaluated by a team of internal experts comprising of 3 teachers based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the seminar report.

EE1801 ELECTRONIC INSTRUMENTATION

Module I

Transducers – definitions – classifications – resistance transducers- strains gauge – types –construction – temperature effect - circuitry, semi conductor strain gauge – load cell.
Resistance thermo meter – types – circuits – errors. Thermistor – advantage of thermistor.

Inductive transducers – LVDT – applications – LVDT load cell – LVDT pressure transducer – resolver – capacitive transducer – principle of operation – applications – capacitor microphone.
Piezoelectric transducer – materials – equivalent circuit – d, g, h, coefficients – thermocouple – principle – applications – magnetostrictive transducers – materials, applications, Hall effect transducer – application – elastic transducers (brief study) – Bourdon tubes – diaphragms – Bellows – Fibre Optics transducers – digital transducers – shaft encoder.

Module II

Signal conditioning – instrumentation amplifiers – differential amplifiers – filters – law and high pass, band pass and band rejection filters –transducer bridges – null type and deflection bridges – AC bridges using push pull transducers – general telemetry systems – sampling process – principles of time division and frequency division multiplexing, different types of modulation techniques as applied to telemetry (general idea)

Module III

Instrumentations systems – basic measuring systems – analog and digital data acquisition systems – generalized input-output configuration of measuring systems – dynamic characteristics.
Digital instruments – operating principles of DVM using successive approximation – V/F conversion and integrating principles – counter digital method for frequency, phase, time and period measurements – digital RLC meters – Q-meter – vector impedance meter – electronic multimeter.

Module IV

Display methods and devices – different types of display – display system building blocks – recorders – galvanometric recorders-pen driving systems – servo recorders – magnetic recorders – digital recorders – accuracy and precision – classification errors- combined errors etc.

References:

1. A.K Sawhney - *A course in electrical and electronic measurements and Instrumentation*, Dhanapath Rai & Co. 2001 eddition.
2. Ernest O.Doeblin - *Measurements systems application & design*, McGraw Hill International edition 1984.
3. Albert D. Helfric & William D. Cooper - *Modern Electronic Instrumentation & Measurements Techniques* (Prentice Hall)
4. Dr. S. Renganathan- *Transducers Engineering* (Allied Publishers Ltd. Delhi
5. K.B Kalaasen - *Electronic measurement and instrumentation*, Cambridge University press 1996.

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1802 ELECTRICAL MACHINE DESIGN

Module I

D C Machines:- Output equation – main dimensions choice of specific electro magnetic loadings – choice of speed and number of poles. Design of armature conductors, slots and windings – design of airgap,field system, commutator,interpoles,compensating winding and brushes – Carter's co-efficient – real and apparent flux density. Design examples.

Module II

Transformers; - Single phase and Three phase transformers – output equation - main dimensions – specific electric and magnetic loadings – design of core, LV winding, HV winding – cooling of transformers – design of cooling tank and tubes. Temperature rise time curve – short time and continuous rating.

Module III

Alternators:- Salient pole and turbo alternators – output equation – main dimensions – choice of specific electric and magnetic loadings – choice of speed and number of poles – design of armature conductors, slots and winding – design of air-gap, field system and damper winding – prediction of open circuit characteristics and regulation of the alternator based on design data – design examples.

Module IV

Induction machines:- Output equation – main dimensions – choice of specific electric and magnetic loadings – design of stator and rotor windings, stator and rotor slots and air-gap of slip ring and squirrel cage motors – calculation of rotor bar and end ring currents in cage rotor – calculation of equivalent circuit parameters and prediction of magnetising current based on design data – design examples.

References:

1. *Clayton & Hancock - Performance and Design of DC Machines, ELBS.*
2. *Sawhney - Electrical Machine Design, Dhanapath Rai.*
3. *Say M.G - Performance and Design of AC Machines, Pitman, ELBS.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1803 POWER SYSTEMS III

Module I

Circuit breakers – principles of operation – different types and their operations – ABCB – oil CB – SFC – vacuum CB- circuit breaker ratings – cause of over voltages – surges and traveling waves – voltage waves on loss less line – reflection and attenuation – protection against lightning – earth wires – lightning diverters – surge absorbers- arcing ground – neutral earthing – basic concepts of insulation levels and their selection – BIL – coordination of insulation.

Module II

Protective relays – protective zones – requirement of protective relaying – different types of relays and their applications – generalized theory of relays – protection scheme for generator – transformers, lines and bus bars - static relays amplitude and phase comparators – block diagrams of static relays – protection scheme for generators – transformers, lines and bus bars – microprocessor based protective relaying.

Module III

Electric traction: systems of traction – speed time curve – mechanics of traction – power supply – systems of current collection – electric heating – advantage of electric heating – resistance and induction are furnaces – construction and field of application of dielectric heating.

Module IV

Energy conservation in electric motors – lighting and electric heating systems – electrical energy auditing – instrumentation and general methodology – power quality problems – definitions – harmonics – sources – effects – total harmonic distortion (THD) – mitigation methods – Electricity tariff – rate structure elements – types of tariffs – declining block rates – demand energy rates – seasonal rates – time of day rates – interruptible rates – curtailable rates.

References:

1. *Rao S.S - Switch Gear protections, Khanna.*
2. *Thomas & Browne Jr - Circuit Interruption – Theory and Techniques.*
3. *Soni, Gupta & Bhatnagar - A Course in Electrical Power, Dhanapat Rai.*
4. *Van.C Warrington A.R - Protective Relays Vol.1 & 2, Chappman & Hall.*
5. *Mason C.R - Art and Science of Protective Relaying, Wiley Eastern.*
6. *Ravindranath, Chander.M - Power System Protection and Switchgear, WileyEastern.*
7. *Haydt G.T - Electric Power Quality, Stars in circle publications.*
8. *Kazibwe W.E & Sendula M.H.- Electric Power Quality.*
9. *IEEE Recommended Practice for Energy Management in Industries and Commercial Facilities, IEEE Press USA*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE 1804 E1-MECHATRONICS

Module I

Introduction to Mechatronics - Elements of Mechatronic Systems. Mechatronics in manufacturing - Mechatronics in products - Scope of Mechatronics.

Mathematical modeling of Engineering Systems: System Building blocks for Mechanical, Electrical, Fluid and Thermal systems.

General Engineering System Modeling: Rotational - Translational, Electromechanical, Hydraulic_ Mechanical systems - System Transfer Function - Dynamic response of systems for standard test signals (Detailed mathematical analysis not required).

Module II

Actuation Systems: Pneumatic & Hydraulic Systems: Process Control Valves, Directional and Pressure Control valves, Linear and Rotary actuators.

Mechanical Actuation Systems: Translational and Rotational motions, Kinematic Chains, Cams, Gear Trains, Ratchet and Pawl, Belt and Chain drives, Bearings.

Electrical Actuation Systems: Mechanical and Solid State Relays, Solenoids, DC & AC motors, Servo & Stepper motors- feedback devices - encoders - pulse digitizers - resolvers - inductosyn – tachometers.

Module III

Fundamentals of numerical control - advantages of NC systems - classification of NC systems - point to point and contouring systems - NC and CNC - incremental and absolute systems - open loop and closed loop systems - features of NC machine tools - fundamentals of machining - design consideration of NC machine tools - methods of improving machine accuracy and productivity

Industrial robotics - basic concepts - robot anatomy - robotics and automation - specification of robots - resolution - repeatability and accuracy of manipulator - classification of robots.

Module IV

MEMS: Internal Structure, advantages, manufactur
ing, applications - Fibre Optic Devices in Mechatronics

Mechatronic System Controllers: ON/OFF, P, I, D, PI and PID Controllers, Digital controllers, Intelligent Controllers in Mechatronics.

Programmable Logic Controllers: Structure, I/O processing, Programming, applications – Selection Criteria.

References:

1. *Bolton. N, Mechatronics- Electronic Control systems in Mechanical and Electrical Engineering, Pearson Education,4/e, 2008*
2. *M.D. Singh, J.G. Joshi, Mechatronics, Prentice Hall India, New Delhi, 2006*
3. *Dradly. D.A, Dawson.D, Burd N.C and Loader A.J, Mechatronics – Electronics in Products & Processes, Chapmen & Hail, 1993.*
4. *HMT Limited ,Mechatronics, Tata McGraw Hill,1998.*
5. *James Harter, Electromechanics- Principles concept and Devices, Prentice Hall, 1995.*
6. *Michel P. Groover, Industrial Robots-Technology, Programming and Applications, McGraw Hill,1986*
7. *Yoram Koren & Ben Yuri, Numerical Control of Machine Tools, Khanna Publishers,1984*
8. *A.Smaili,F.Mrad,Mechatronics-Integrated Technologis for Intelligent Machines,Oxford,2009*
9. *Appukuttan .K.K,Introduction To Mechatronics,Oxford University,Press,1/e, 2007*
10. *David G Alciatore,Micheal ,Introduction to Mechatronics and Measurement Systems,TMH,3/e,2007*
11. *Nitaigour P Premchand,Mechatronics-Principles,Concepts and Applications,TMH,11/e,2011*

Type for questions for University Exams

Question (1) - Eight short answer question of five marks with two questions from each of four modules

Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1804 E2- BIOSENSORS & TRANSDUCERS

Module I

Transducers and sensors : Transducers – sensors – active and passive. Study of biological sensors in human body and their basic mechanism of action – organization of nervous system – neuronal mechanism and circuit processing – study of various corpuscles like pacinian – Chemoreceptors,hot and cold receptors, barro receptors, sensors for smell, sound, vision, osmolality and taste.

Module II

Chemical Transducers: Transducers for the measurement of ions and dissolved gases.Reference electrodes – Hydrogen electrodes – silver- silver chloride electrodes – Calomel electrodes. Measurement of pH – Glass pH electrodes. Measurement of pCO2 – catheter tip electrodes for the measurement of pO2 and pCO2. Blood gas analysers and autoanalysers.

Module III

Bio sensors – Ion exchange membrane electrodes – oxygen electrodes- CO2 electrodes enzyme electrode-construction – ISFET for glucose, urea etc. Electrolytic sensors – optical sensor – fiber optic sensors.

Module IV

Transducers : Temperature transducer – thermoresistive transducers, thermoelectric, p-n junction, chemical thermometry. Displacement transducers – potentiometric – resistive strain gauges-inductive displacement – capactive displacement transducer. Pressuire transducer – indirect method – measurement of blood pressure using sphygmanometer – instrument based on korotkof sound , strain gauge and LVDT transducers, capactive and piezo electric type, catheter tip transducer – measurement of intracranial pressure – catheter tip – implantable type. Transducers for velocity and torque measurements .

References:

1. Geddes & Becker : Principles of Applied Biomedical Instrumentation, John Wiley, 1989.
2. R S C Cobbold,Transsducers for biomedical instruments John Wiley & Sons,1974.
3. *Brown & Gann :Engineering Principles in physiology Vol I Academic Press ,1973*
4. *A V S De Reuck:, Touch heat & pain , J & A Churchchill Ltd . London,1967..*
5. *Iberall & Guyton, Regulation & Control in Physological System, Insttruments Society USA*
6. *Harry Thomas , Handbook of Biomedical Instrumentation,Reston Virginia 2000*
7. *R S Khandpur, Handbook of Biomedical Instrumentation ,Tata McGraw Hill, 2004*
8. *D L Wise, Applied Bio Sensors , Butterworth Publishers , London 1989*
9. *Keith Brindely, Sensors & Transducers, Heinemann Newness, Great Britian, 1988.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1804 E3-FLEXIBLE AC TRANSMISSION SYSTEMS

Module I

FACTS concepts and general system considerations: Power flow in AC systems - Definition of FACTS - Power flow control -Constraints of maximum transmission line loading - Benefits of FACTS Transmission line compensation- Uncompensated line -shunt compensation - Series compensation -Phase angle control.

Module II

Static shunt compensators: SVC and STATCOM - Operation and control of TSC, TCR and STATCOM - Compensator control - Comparison between SVC and STATCOM.
Static series compensation: TSSC, SSSC -Static voltage and phase angle regulators - TCVR and TCPAR- Operation and Control -Applications.

Module III

Unified Power Flow Controller: Circuit Arrangement, Operation and control of UPFC- Basic Principle of P and Q control- independent real and reactive power flow control- Applications - Introduction to interline power flow controller.

Module IV

Special purpose FACTS controllers - Thyristor controlled voltage limiter - Thyristor controlled voltage regulator - Thyristor controlled braking resistor - Thyristor controlled current limiter-
Custom Power - Compensation Devices - STS - SSC - SVR -Backup energy supply devices

References :

1. *N.G. Hingorani, L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001.*
2. *R. Sreeram Kumar (Ed) "Lecture Notes on Flexible AC Transmission Systems (FACTS)". Institution of Engineers (India), Calicut Local Centre, 2003.*
3. *K.S.Sureshkumar, S.Ashok , "FACTS Controllers & Applications", E-book edition, Nalanda Digital Library, NIT Calicut,2003*
4. *T.J.E. Miller. "Reactive Power Control in Electric Systems", JohnWiley & Sons, 1984.*

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE1804 E4 -POWER QUALITY

Module I

Introduction-power quality-voltage quality-overview of power quality phenomena-classification of power quality issues-power quality measures and standards-THD-TIF-DIN-C-message weights-flicker factor-transient phenomena-occurrence of power quality problems

Module II

Harmonics-individual and total harmonic distortion-RMS value of a harmonic waveform-triplex harmonics-important harmonic introducing devices-SMPS-Three phase power converters-arcing devices-saturable devices-harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.

Module III

Power factor improvement- Passive Compensation . Passive Filtering . Harmonic Resonance . Impedance Scan Analysis- Active Power Factor Corrected Single Phase Front End, Control Methods for Single Phase APFC, Three Phase APFC and Control Techniques, PFC Based on Bilateral Single Phase and Three Phase Converter. static var compensators-SVC and STATCOM

Module IV

Active Harmonic Filtering-Shunt Injection Filter for single phase, three-phase three-wire and three-phase four-wire systems. d-q domain control of three phase shunt active filters uninterruptible power supplies-constant voltage transformers- series active power filtering techniques for harmonic cancellation and isolation . Dynamic Voltage Restorers for sag , swell and flicker problems.

References *:*

1. G.T. Heydt, Electric power quality, McGraw-Hill Professional, 2007

2. Math H. Bollen, Understanding Power Quality Problems, IEEE Press, 2000

3. J. Arrillaga, .Power System Quality Assessment., John wiley, 2000

4. J. Arrillaga, B.C. Smith, N.R. Watson & A. R.Wood „.Power system Harmonic Analysis., Wiley, 1997

5. IEEE and IEE Papers from Journals and Conference Records

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE18L1 MAJOR PROJECT

Each batch of students shall develop the project designed during the VII semester. The implementation phase shall proceed as follows:

- For hardware projects, practical verification of the design, PCB design, fabrication, design analysis and testing shall be done.
- For software projects, a proper front end (GUI) if applicable, shall be designed. A detailed algorithm level implementation, test data selection, validation, analysis of outputs and necessary trial run shall be done.
- Integration of hardware and software, if applicable, shall be carried out.
- A detailed project report in the prescribed format shall be submitted at the end of the semester. All test results and relevant design and engineering documentation shall be included in the report.
- The work shall be reviewed and evaluated periodically

A committee consisting of the Project Coordinator (appointed by the Head of the Department / Division), project guide and at least one senior faculty member will carry out the assessment based on at least one interim review and a final review just before the submission of the project report.

The final evaluation of the project shall include the following.

- Presentation of the work
- Oral examination
- Demonstration of the project against design specifications
- Quality and content of the project report

Guidelines for evaluation:

i.	Regularity and progress of work	60
ii.	Work knowledge and Involvement	60
iii.	End semester presentation and oral examination	60
iv.	Level of completion and demonstration of functionality/specifications	60
v.	Project Report – Presentation style and content	60
Total		300 marks

Note: *Points (i) and (ii) to be evaluated by the respective project guide and the project coordinator based on continuous evaluation. (iii)-(v) to be evaluated by the final evaluation team.*

EE18L2VIVA-VOCE

Each student is required to appear for a viva-voce examination at the end of the complete course work. The students shall produce the seminar report and project reports duly attested by the institutional authorities, before the examiners. The examination panel shall comprise of Head of the Department / Division or his/her nominee and one senior faculty of the Department/Division and an external expert .The examiners except the Head of the Department / Division or his/her nominee shall be, both appointed by the University. The examiners shall evaluate the students in terms of their conceptual grasp of the course of study and practical/analysis skills in the field.