EE : ELECTRICAL AND ELECTRONICS ENGINEERING

COMBINED FIRST AND SECOND SEMESTER

Code	**Subject**	**Hours/Week**			**Internal Marks**	**University Examination**	
		L	**T**	**P/D**		**Hrs**	**Marks**
EN04- 101	Engineering Mathematics I	3	-	-	50	3	100
EN04- 102	Engineering Mathematics II	3	-	-	50	3	100
EN04- 103A	Engineering Physics(A)	2	-	-	50	3	100
EN04- 103A(P)	**Physics Lab(A)**	-	-	1	25	-	-
EN04- 104A	Engineering Chemistry(A)	2	-	-	50	3	100
EN04- 104A(P)	**Chemistry Lab(A)**	-	-	1	25	-	-
EN04- 105	Humanities	2	-	-	50	3	100
EN04- 106A	Engineering Graphics(A)	1	-	3	50	3	100
EN04- 107A	Engineering Mechanics(A)	2	1	-	50	3	100
EE04- 108	Mechanical Engineering –I	2	-	-	50	3	100
EE04- 109	Basic Electrical Engineering	2	-	-	50	3	100
EE04- 110(P)	**Civil and Mechanical Workshop**	-	-	3	50	-	-
EE04- 111(P)	**Electrical and Electronics workshop**	-	-	2	50	-	-
TOTAL		**19**	**1**	**10**	**600**	**-**	**900**

Third Semester

Code	Subject	Hours/ Week			Sessional Marks	University Exam	
		L	T	P/D		Hrs	Marks
EE04 301	Computer Programming	2		2	50	3	100
EE04 302	Engineering Mathematics III	3	1		50	3	100
EE04 303	Mechanics of Solids	3	1		50	3	100
EE04 304	Mechanical Engineering II	3	1		50	3	100
EE04 305	Electronics I	3	1		50	3	100
EE04 306	Electric Circuit Theory	3	1		50	3	100
EE04 307 (P)	Electronics Lab I			3	50	3	100
EE04 308(P)	Basic Electrical Engineering Lab			3	50	3	100
	Total	**17**	**5**	**8**	**400**		**800**

Fourth Semester

Code	Subject	Hours/ Week			Sessional Marks	University Exam	
		L	T	P/D		Hrs	Marks
EE04 401	Engineering Mathematics IV	3	1		50	3	100
EE04 402	Environmental Studies	3	1		50	3	100
EE04 403	Electrical Measurements & Measuring Instruments	3	1		50	3	100
EE04 404	Electronics II	3	1		50	3	100
EE04 405	Electrical Machines I	3	1		50	3	100
EE04 406	Linear system Analysis	3	1		50	3	100
EE04 407(P)	Mechanical Engineering Lab			3	50	3	100
EE04	Electrical Measurements lab			3	50	3	100

408(P)							
	Total	**18**	**6**	**6**	**400**		**800**

Fifth Semester

Code	Subject	Hours/ Week			Sessional Marks	University Exam	
		L	T	P/D		Hrs	Marks
EE04 501	Analog and Digital Communications	3	1		50	3	100
EE04 502	Electro Magnetic Field Theory	3	1		50	3	100
EE04 503	Pulse and Digital Electronics	3	1		50	3	100
EE04 504	Power System I	3	1		50	3	100
EE04 505	Electrical Machines II	3	1		50	3	100
EE04 506	Electrical engineering Material Science	3	1		50	3	100
EE04 507(P)	Electronics Lab II			3	50	3	100
EE04 508(P)	Electrical Machines Lab I			3	50	3	100
	Total	**18**	**6**	**6**	**400**		**800**

Sixth Semester

Code	Subject	Hours/ Week			Sessional Marks	University Exam	
		L	T	P/D		Hrs	Marks
EE04 601	Microprocessors and Microcontrollers	3	1		50	3	100
EE04 602	Software Engineering	3	1		50	3	100
EE04 603	Control System I	3	1		50	3	100
EE04 604	Power System II	3	1		50	3	100
EE04 605	Electrical Engineering Drawing	1		3	50	3	100
EE04 606	Electrical Machine design	3	1		50	3	100
EE04 607(P)	Electrical Machines Lab II			3	50	3	100
EE04 608(P)	Mini Project			3	50	3	100
	Total	**16**	**5**	**9**	**400**		**700**

Seventh Semester

Code	Subject	Hours/ Week			Sessional Marks	University Exam	
		L	T	P/D		Hrs	Marks
EE04 701	Power Electronics	3	1		50	3	100
EE04 702	Digital Signal Processing	3	1		50	3	100
EE04 703	Control System II	3	1		50	3	100
EE04 704	Power System III	3	1		50	3	100
EE04 705	Elective I	3	1		50	3	100
EE04 706	Advanced Electrical Engineering Lab I			3	50	3	100

EE04 707(P)	Seminar			3	50	3	
EE04 708(P)	Project			4	50	3	
	Total	**15**	**5**	**10**	**400**		**600**

Elective I

EE04 705(A)	Numerical Analysis & Optimization Technique
EE04 705(B)	Modern Network Synthesis
EE04 705(C)	High Voltage Engineering
EE04 705(D)	Digital System Design
EE04 705(E)	Advanced Microprocessors & Microcontrollers
EE04 705(F)	Electrical Machine Modelling & Analysis

Eighth Semester

Code	Subject	Hours/ Week			Sessional Marks	University Exam	
		L	T	P/D		Hrs	Marks
EE04 801	Economics & Industrial Management	3	1		50	3	100
EE04 802	Industrial Drives	3	1		50	3	100
EE04 803	Instrumentation Systems	3	1		50	3	100
EE04 804	Elective II	3	1		50	3	100
EE04 805	Elective III	3	1		50	3	100
EE04 806	Advanced Electrical Engineering Lab II			3	50	3	100
EE04 807(P)	Project			7	100	3	
EE04 808(P)	Vivavoce					3	100
	Total	**15**	**5**	**10**	**400**		**700**

Elective II

EE04 804(A)	VLSI Design
EE04 804(B)	Soft Computing
EE04 804(C)	Industrial Robotics
EE04 804(D)	Organizational Behavior

Elective III

EE04 805(A)	Advanced Topics on Power Systems
EE04 805(B)	Switched mode Power Converters
EE04 805(C)	Biomedical Instrumentation
EE04 805(D)	Synthesis of Feedback systems

EN04- 101 : MATHEMATICS I

(common for all B. Tech. programmes)

3 hours lecture per week

Module I: Differential Calculus (15 hours)

Indeterminate forms - L` hospital`s rule - radius of curvature - centre of curvature - evolute - functions of more than one variable - idea of partial differentiation - Euler`s theorem for homogeneous functions - chain rule of partial differentiation - applications in errors and approximations - change of variables - Jacobians - maxima and minima of functions of two - method of Lagrange multipliers.

Module II: Infinite Series (15 hours)

Notion of convergence and divergence of infinite series - ratio test - comparison test - Raabe`s test - root test - series of positive and negative terms - absolute convergence - test for alternating series - power series - interval of convergence - Taylors and Maclaurins series expansion of functions - Leibnitz formula for the n^{th} derivative of the product of two functions - use of Leibnitz formula in the Taylor and Maclaurin expansions

Module III: Matrices (21 hours)

Rank of a matrix - reduction of a matrix to echelon and normal forms - system of linear equations - consistency of linear equations - Gauss` elimination - homogeneous linear equations - fundamental system of solutions - solution of a system of equations using matrix inversion - Eigen values and eigen vectors - Cayley-Hamilton theorem - Eigen values of Hermitian, skew-Hermitian and unitary matrices- Diagonalisation of a matrix using Eigen values and Eigen vectors- quadratic forms- matrix associated with a quadratic form- definite, semidefinite and indefinite forms.

Module IV: Fourier series and harmonic analysis (15 hours)

Periodic functions - trigonometric series - Fourier series - Euler formulae - even and odd functions - functions having arbitrary period - half range expansions - approximation by trigonometric polynomials - minimum square error - numerical method for determining Fourier coefficients - harmonic analysis

Reference books

1. Michael D. Greenberg, Advanced Engineeing Mathematics(second edition), Pearson Education Asia.
2. Wylie C.R. and L.C. Barrent, *Advanced Engineering Mathematics*, McGraw Hill
3. Kreyszig E., *Advanced Engineering Mathematics*, Wiley Eastern
4. Piskunov N., *Differential and Integral calculus*, MIR Publishers
5. Ayres F., *Matrices*, Schaum's Outline Series, McGraw Hill
6. Sastry, S.S., Engineering Mathematics-Vol.1 and2., Prentice Hall of India

Internal work assessment

60 % - Test papers (minimum 2)
30 % - Assignments/Term project/any other mode decided by the teacher.
10 % - Other measures like Regularity and Participation in Class.
Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15marks from module I with choice to answer any one
Q III - 2 questions A and B of 15marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15marks from module III with choice to answer any one
Q V - 2 questions A and B of 15marks from module IV with choice to answer any one

EN04-102 : MATHEMATICS II

(common for all B. Tech. programmes)

3 hours lecture per week

Module I: Ordinary differential equations (21 hours)

Equations of first order - separable, homogeneous and linear types - exact equations - orthogonal trajectories - linear second order equations - homogeneous linear equation of the second order with constant coefficients - fundamental system of solutions –Solutions of the general linear equations of second order with constant coefficients- method of variation of parameters - Cauchy's equation - simple applications of differential equations in engineering problems, including problems in mechanical vibrations, electric circuits and bending of beams

Module II: Laplace transforms (15 hours)

Gamma and Beta functions - definitions and simple properties - Laplace transform - inverse transform - Laplace transform -shifting theorems-Transforms of derivatives and integrals - differentiation and integration of transforms - transforms of unit step function and impulse function - transform of periodic functions - solution of ordinary differential equations using Laplace transforms

Module III: Vector differential calculus (15 hours)

Vector function of single variable - differentiation of vector functions - scalar and vector fields - gradient of a scalar field - divergence and curl of vector fields - their physical meanings - relations between the vector differential operators

Module IV: Vector integral calculus (15 hours)

Double and triple integrals and their evaluation - line, surface and volume integrals - Green`s theorem - Gauss` divergence theorem - Stokes` theorem (proofs of these theorems not expected) - line integrals independent of the path

Reference books

1. Michael D. Greenberg, Advanced Engineeing Mathematics(second edition), Pearson Education Asia.
2. Wylie C.R. and L.C. Barrent, *Advanced Engineering Mathematics*, McGraw Hill
3. Kreyszig E., *Advanced Engineering Mathematics*, Wiley Eastern
4. Piskunov N., *Differential and Integral calculus*, MIR Publishers
5. Ayres F., *Matrices*, Schaum's Outline Series, McGraw Hill
6. Sastry, S.S., Engineering Mathematics-Vol.1 and2., Prentice Hall of India

Internal work assessment

60 % - Test papers (minimum 2)
30 % - Assignments/Term project/any other mode decided by the teacher.
10 % - Other measures like Regularity and Participation in Class.
Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15marks from module I with choice to answer any one
Q III - 2 questions A and B of 15marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15marks from module III with choice to answer any one
Q V - 2 questions A and B of 15marks from module IV with choice to answer any one

EN04- 103A : ENGINEERING PHYSICS(A)

(common for AI, CS, EE, EC, IT, IC, BM,BT, PT)

2 hours lecture per week

Module I (11 hours)

Semi conductor Physics- Formation of energy bands in solids- Classification of solids on the basis of energy band gap-Intrinsic and extrinsic semiconductors- Elemental and compound Semiconductors- Fermi level in intrinsic semiconductor- Electron and hole concentrations in intrinsic semi conductor in thermal equilibrium- Law of mass action-Electrical conductivity of intrinsic semiconductor- Fermi level in n-type and p-type semiconductors- Electrical conductivity of extrinsic semi conductor- Diffusion and total current.

Application of semi conductors- Band model of p-n junction- Junction diode and its characteristics- characteristics of a transistor in common emitter configuration- Input, output resistance and current amplification factor- Light emitting diode, photo diode,solar cell, photo resistor (LDR),photo transistor, liquid crystal display(LCD) and zener diode- Avalanche and zener breakdown- Application of zener diode as a voltage regulator.

Hall effect in semiconductors- Derivation of Hall coefficient-Determination of Hall coefficient by measuring Hall voltage-Applications of Hall effect

Super conductivity- Properties of super conductors (critical magnetic field,Meisnner effect, critical current,flux quantisation)- Types of super conductors- BCS theory of super conductivity (qualitative)- Josephon's effect- Theory of d.c. Josephon's effect- SQUID - Applications of super conductivity

Module II (11 hours)

Interference of light- Interference due to division of amplitude- Interference from plane parallel thin films- Colours of thin films in reflected and transmitted light- Newton's rings- Meaurement of wavelength and refractive index- Thin wedge shaped film- Air wedge- Testing of optical planeness of surfaces.

Interferometry- Michelson's interferometer –Types of fringes- Visibility of fringes-Application of Michelson's interferometer in determination of wavelength of monochromatic light, resolution of spectral lines and refractive index of gases.

Diffration of light-Introduction of Fresnel and Fraunhoffer class of diffraction and their distinction- Fresnels diffraction and rectilinear propogation of light-Diffraction pattern due to straight edg and expression for intensity maximum and minimum- Fraunhoffer diffraction –Simple theory of diffraction grating, its construction and working- Rayleigh's criteria. for resolution of spectral lines- Resolving power and dispersive power of grating.

Module III (11 hours).

Poarisation of light- Double refraction- Huygen's explanationof double refraction in uniaxial crystals- Positive and negative crystals- Nicol prism, construction and working –Quarter and half wave plates- Theory of circularly and elliptically polarised light, their production and detection- Rotatory polarisation- Laurent's half shade (brief explanation)- Laurent's half shade polarimeter- Applications of polarised light.

Laser physics- Basic concepts and properties of laser- Spontaneous and stimulated emission- Expression for ratio of their coefficients- Absorption,-population inversion and optical pumping-Construction and components of a laser-Ruby,Helium and Neon and semiconductor lasers- Applicattion of lasers.

Basic principle of holography and its application.

Fibre optics- Basic principle –fibre dimensions and construction- Step index single mode and multi mode fibre- Graded index fibre-Numerical aperature and acceptance angle- Signal distortion in optical fibres and

transmission losses(brief ideas only)- optic fibre communication (block diagram) and it's advantages- Applications of optic fibres.

Module IV (11 hours).

Planck's quantum theory- Absorbing power, reflecting power and transmitting power of a body or surface- Perfect black body- Distribution energy in the spectrum of a black body- Wein's displacement law- Planck's hypothesis- Derivation of Planck's law of radiation.

Quantum mechanics- Distinction between Newtonian and quantum mechanics- Schroedinger wave equation for free particle –Potential in schrodinger equation –Time dependant and time independant schroedinger equations and their derivations- Expectation values- Applications-Particle in a box (motion in one dimension).

Ultrasonics- Piezo electric effect- Piezo electric crystal- Production of ultrasonics by piezo-electric

oscillater- Detection of ultrasonics – General properties and applications of ulltrasonics – Ultrasonic

diffractometer and determination of velocity of ultrasonics in a liquid.

Text

1. Sreenivasan M .R, *Physics for Engineers*, New Age International
2. Vasudeva A.S; *Modern Engineering Physics*, S. Chand
3. S.O. Pillai, *Solid state physics*, New Age International

Reference books

4. Tyagi, M.S. *Introduction to semi conductor materials and de*vices, John Wiley and Sons
5. Mayer, *Intoduction to classical and modern optics*, Arendt
6. John Senior, *Fibre optic communiction*
7. G Aruldhas *Quantum mechanics* Prentice Hall of India
8. Murukesan R. *Modern Physics* –-S.Chand and Co
9. Brijlal and Subrahmanyam N, *Text book of Optics*, S.Chand
10. Kale Gokhale; *Fundamentals of Solid State Electronics*, Kitab Mahal
11. Gupta S.L. and Kumar, V; *Solid State Physics*, K.Nath

Internal work assessment

60 % - Test papers (minimum 2)
30 % - Assignments/Term project/any other mode decided by the teacher.
10 % - Other measures like Regularity and Participation in Class.
Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15marks from module I with choice to answer any one
Q III - 2 questions A and B of 15marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15marks from module III with choice to answer any one
Q V - 2 questions A and B of 15marks from module IV with choice to answer any one

EN04- 103A(P) : PHYSICS LAB(A)

(common for AI, EE, EC, IC, BM, BT)

1 hour lab per week or 2 hours lab per alternate weeks

1. Band gap energy in a semi conductor using a reverse biased p-n junction.
2. Static characteristcs of a transistor (p-n-p or n-p-n)in common emitter configuration.
3. Characteristics of a Zener diode
4. Characterisitics of a LED.and wave length of emitted radiation
5. Characterisitc of a photo diode.
6. Characterisitic of a photo resistor (LDR)
7. Voltage regulation using Zener diode
8. Wavelength of mercury spectral lines using diffraction grating and spectrometer.
9. Refractive indices of ordinary and extra ordinary rays in calcite or in quarts prisms.
10. Wave length of sodium light by Newton's rings method.
11. Diameter of a thin wire or thickness of a thin paper by air wedge method.
12. Specific rotatory power of cane sugar solution using polarimeter.
13. Frequency of an electrically maintained tuning fork(transverse and longitudinal mode)
14. Wave length and velocity of ultrasonic waves using ultrasonic difractometer.
15. Divergence of laser beamsusing He-Ne laser or diode laser
16. Wave length of laser using transmission grating.
17. Resolving and dispersive power of a grating .
18. Wave length of a monochromatic light by straight edge using laser beam.
19. Characterics of a solar cell.
20. Planck's constant using photo-electric cell or solar cell
21. Hall coefficient by measuring Hall voltage in a semi conductor.
22. Measurement of numerical aperature , acceptance angle and attenuation in an optical fibre.
23. Measurement of displacements using optic fibre.
24. Michelson's inerfeometer-determination of wavelength of a monochromatic source, resolution of spectral lines and refractive index. of a gas.

(Any 12 experiments should be done)

Reference Books:-

1 " Practical Physics with viva voice"- Dr. S.L.Guptha and Dr.V Kumar- Publishers- Pragati Prakashan.

2 " Experiments in Engineering Physics"- M.N. Avadhanulu, A.A.Dani, and R.M.Pokley- Publishers- S. Chand.

Internal work assessment	
Lab practicals and record	= 15
Test/s	= 10
Total marks	= 25

EN04- 104A : ENGINEERING CHEMISTRY(A)

(common for AI, CS, EE, EC, IT, IC, BM, BT, PT)

2 hours lecture per week

SECTION-1

CHEMISTRY OF ENGINEERING MATERIALS:

Module 1(13 Hours)

Solids: Classification of solids with examples– (Crystalline – Polycrystalline – Amorphous – Partially melted solids – (KCN) – Super cooled liquids – (Glass) – liquid crystals.) (1Hour)

Crystalline state: Steno's law – Internal structure – Space lattices - Crystallographic axes- Law of rational indices-Crystal systems – Elements of symmetry – X-ray study- Braggs equation (derivation) single crystal and powder method –(Debye-Scherrer Camera) Cubic systems – structure elucidation - $\mathbf{d_{100}:d_{110}:d_{111}}$ ratio (problems to be worked out) – crystal imperfections(point-line-surface-volume -burgers vector-dislocations- edge and screw) Physical properties, bonding characteristics and Structure relation of– (Covalent solids – Ionic solids – metals) – metallic bonding- Stacking of atoms- (ABCABC….), (ABAB……)-tetrahedral and octahedral voids-Alloys – Hume Rothery rule-Conductivity – Resistivity – (Free electron theory–explanation with Fermi-Dirac statistics)– Fermi level –Applications of conductors-(transmission lines-OFHC Copper, ACSR, Contact materials, Precision resistors- heating elements-Resistance thermometers)- Super Conductors (type I and II-examples) (5 Hours)

Semi conductors – Band theory-(MOT) Valence band-Conduction band-intrinsic and extrinsic semiconductors-Fabrication of semiconductor materials-Crystal Growth-ultra pure Silicon production-zone refining-Fabrication of Integrated Circuits (IC) (2Hours)

Dielectric materials-Polarization – Ferro-electricity – Piezoelectricity – Applications with examples-Introduction to Nano Science –Carbon nano tubes and nanowires (1Hour)

Non-crystalline state – glass - properties – (applications- conducting glasses – solid supported liquids (stationary phases in reverse phase chromatography)- Optical fibre (1Hour)

Liquid crystals- Characterization- Nematic phases-Smectic Phases-Cholesteric Phases- Columnar Phases-Chemical Properties-thermotropic-lyotropic-epitaxial-growth-Freedericksz transition-applications –Liquid crystal thermometers- LCD displays (3 Hours)

Ref:

J. D. Lee (1996) "Concise Inorganic Chemistry" Chapman and Hall Ltd. London, pp-1032

S.Glasstone (1997) "Textbook of Physical Chemistry" Macmillan, New Delhi, pp-1320

P.W.Atkins (1987) "Physical Chemistry" Oxford University Press, Oxford, pp-857

P.W.Atkins and J.Depaula (2001) " Physical Chemistry" W.H.Freeman and Co, pp-1000

V.Raghavan (2000) "Material Science and Engineering-A First Course" Fourth edition, Prentice-Hall of India Pvt.Ltd , New Delhi, pp-485

L.H.Van Vlack (1998) "Elements of Materials Science and Engineering" Sixth edition, Addison-Wesley , London pp-598

J.W.Goodby (1997) "Chemistry of liquid crystals" VCH Publishing,pp-400.

K.W.Kolasinski (2002) "Surface Science: Foundations of Catalysis and Nano science" John-Wiley and Sons, pp-326

K.J.Klaubunde (2001) "Nano scale Materials in Chemistry" Wiley-Interscience,pp-304.

J.I.Gersten and F.W.Smith (2001) " The Physics and Chemistry of Materials" Wiley-Interscience, pp-856

Module2 (13 Hours)

High Polymers and Lubricants- Classification of Polymers-(Natural and Synthetic, Organic and Inorganic, Thermoplasic and Thermosetting, Plastics, Elastomers, Fibres and liquid resins) Polymerization (Chain polymerization Polythene- PVC- Teflon –polystyrene -poly-methylmethacrylate) Condensation polymerization(Polyamide and Polyesters) Co-polymerization (Buna-S, Buna-N, PVC- Co-polyvinylacetate, PAN-Co-polyvinyl Chloride),Coordination polymerization (Ziegler- Natta Polymerization)-Electrochemical Polymerization- Metathetical Polymerization-Group transfer Polymerization (3 Hours)

Mechanism of polymerization (Cationic, anionic, and free radical).Polymerization techniques(Bulk polymerization, Solution polymerization, Suspension polymerization, Emulsion polymerization, Melt

polycondensation, Solution polycondensation, Interfacial condensation, Solid and Gas Phase Polymerization (2 Hours)

Structure relation to properties(Chemical resistance, Strength, Plastic deformation, Extensibility, Crystallinity) -Mol.Wt of Polymers-Number average Molecular wt, Weight average Mol.wt- Gel Permeation Chromatography (1 Hour)

Thermosetting resins (Bakelite, Urea-Formaldehyde, Silicones), Thermoplastic resins (Acrylonitrile, PVC, PVA ,PS, PMMA, PE).-Fibres (Nylon6, Nylon66,Nylon6,10, Cellulose fibres, dacron, Kevlar) Application of polymers in electronic and electrical industry. Elastomers-Natural rubber-Structure-Vulcanization-Synthetic rubbers (Neoprene, Buna-S, Buna-N, thiokol, Silicone rubber) (3 Hours)

Compounding of Plastics (Fillers, Plasticizers, lubricants, pigments, antioxidants, Stabilizers) and Fabrication (Calendering, Die Casting, Film casting, Compression, injection, Extrusion and Blow moulding , Thermoforming, Foaming, Reinforcing) (1 Hour)

Lubricants: Theory of friction – mechanisms of lubrication –Fluid film or hydrodynamic, thin film or boundary lubrication, extreme pressure lubrication-Classification of Lubricants-(Liquid(animal and vegetable oils, Petroleum oils),Semi-solid (Ca-soap grease, Li-soap grease, Al-soap grease, Axle grease) Solid lubricants (Graphite, Molybdenum di-sulphide- Structure relation to lubrication property) and synthetic lubricants (Di-basic acid esters, Poly glycol ethers, Organo phosphates, Organo silicones)). Properties of Lubricants (Viscosity index, Cloud point and pour point, flash point and fire point, Corrosion stability, Emulsification, Aniline point). Additives and their functions (Fatty acids, Sulphurised fats, Phenols, Calcium sulphonates, Organo-metallics, Hexanol, Amine phosphates, Tricresyl phosphates, Silicon polymers)

(3 Hours)

Ref:

B.R.Gowariker et.al (2002) "Polymer Science" New Age International pp-505

B.W.Gonser et.al (1964) " Modern Materials-advances in development and application" Vol 1-7, Academic Press, New York.

Module -3 (9 Hours)

Electrochemistry: Single Electrode potential (theory – Nernst equation, derivation from thermodynamic principles) – types of electrodes ($M|M^+$, $M|MA|A^-$, $M|A^+,A^{+2,}$ $Pt|H_2|H^+$, $Pt|Cl_2|Cl^-$, $Pt|O_2|OH^-$ -glass electrode) Electrochemical cells-concentration cells-Salt bridge – Liquid junction potential- emf measurement – Poggendorf's compensation method- digital method – electrochemical series – over voltage – theory – application in corrosion control –Polarography- storage cells – lead acid, Ni/Cd, – Fuel cells – H_2/O_2 fuel cells(Bacon cell), Hydrocarbon/air fuel cell-Bio-chemical fuel Cell . (5 Hours)

Acid- Bases – (Lowry-Bronsted and Lewis concepts – examples) – concept of pH – pH measurement – (instrumental details required) - Dissociation constants-Potentiometric titrations-(Neutralization, Oxidation-reduction, and Precipitation) Buffer solutions – Henderson's equation for calculation of pH (4 Hours)

Ref:

S.Glasstone (1997) "Textbook of Physical Chemistry" Macmillan, New Delhi, pp-1320

P.W.Atkins (1987) "Physical Chemistry" Oxford University Press, Oxford, pp-857

C.A.Hampel (Ed)(1964) "Encyclopedia of Electrochemistry", Reinhold Publishing Corporation, New York, pp-1206

A.Standen (Ed) (1964) "Kirk-Othmr Encylopaedia of Chemical Technology", Vol.3, John Wiley and Sons.Inc, New York, pp-925

SECTION-2

CHEMISTRY OF MATERIAL AND ENVIRONMENTAL DAMAGE

Module -4 (9 Hours)

Material damages and prevention: Corrosion – theoretical aspects -(electrochemical theory) – Galvanic series – Pourbiax diagram – assessment of corrosion potential of materials – Types of corrosion – Dry corrosion-direct chemical –Wet Corrosion-Electrochemical- differential aeration –Corrosion of Iron in acidic neutral, basic condition (Corrosion in boilers) – Galvanic corrosion-(corrosion at contact points in computers-Ag/Au)-Inter granular corrosion (18-8 Steel).Microbial corrosion - Factors influencing corrosion.

Corrosion protection-Self protecting corrosion products-Pilling-Bedworth rule-Coatings-Organic-(paints and polymers)-Inorganic Coatings-Galvanizing (dip coating, Sherardizing, Wire-gun method)-Tinning-Electroplating-(Chromium, Nickel), Anodization of Aluminium- Passivation of metals by chemical treatment- Protection by Sacrificial Anode- Impressed current

(4 Hours)

Environmental damages and prevention:

Pollution – Definitions – Classification of pollutants (Global, Regional, Local; Persistent and Non-persistent; Pollutants – Eg: CO_2, CO, SO_x, NO_x, VOC, SPM, CFC, POP, Dissolved metals) – effects on environments – Air pollution – Fossil fuel burning – Automobile exhausts – Photochemical smog – PAN, PBN formation-chemical equations required) – Stratospheric Ozone depletion- CFCs -Nomenclature CFC's –Chapman cycle of Ozone formation- CFC dissociation and its reaction with Ozone – Alternate refrigerants – Monitoring of pollution – gases (CO, SO_2,NO_X)and particulate (High volume sampler) -Pollution from thermal power plants – Coal composition- fly ash – Thermal pollution .

Methods of control of Air pollution – Bag filters, cyclones, Scrubbing, ESP, Catalytic converters - composition and action with CO, NO_x. Water pollution-Pollutant Classification-(Organic, Inorganic, Suspended and Dissolved- Toxic metal waste- BOD-COD-) monitoring (analytical methods-brief discussion) and control -Waste water treatment-Aerobic, Anaerobic-USAB process-Industrial waste water treatment.- Soil pollution-Solid waste-radio nuclides-Toxic metals- monitoring and control-Incineration-Dioxins- hazardous waste - deep-well injection (5 Hours)

Ref:

L.L Shreir (Ed) " Corrosion Control" Vol. I and II Newnes-Butterworths, London

C.A.Hampel (Ed) "Encyclopedia of Electrochemistry" Reinhold Publishing corporation,pp-1206

V.Raghavan (2000) "Material Science and Engineering-A First Course" Prentice-Hall of India Pvt.Ltd , New Delhi, pp-485

A.K.De (1996),"Environmental Chemistry" New age International Pvt.Ltd, New Delhi, pp-364

C.N.Sawyer and P.L.McCarty,(1989)"Chemistry for Environmental Engineering" McGraw Hill Book Company, New-Delhi , pp-530

H.S.Peavy, D.R.Rowe and G.Tchobangoglous (1985) "Environmental Engineering" McGraw Hill International , pp-720

S.P.Mahajan (1985)" Pollution Control in Process Industries" Tata McGraw Hill, New Delhi, pp-273

S.E.Manahan (1975)"Environmental Chemistry" Willard Grant Press, Boston,pp-532.

Internal work assessment

60 % - Test papers (minimum 2)
30 % - Assignments/Term project/any other mode decided by the teacher.
10 % - Other measures like Regularity and Participation in Class.
Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15marks from module I with choice to answer any one
Q III - 2 questions A and B of 15marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15marks from module III with choice to answer any one
Q V - 2 questions A and B of 15marks from module IV with choice to answer any one

EN04-104A(P) : CHEMISTRY LAB(A)

(common for AI, EE, EC, IC, BM, BT)

1 hour lab per week or 2 hours lab per alternate weeks

List of Experiments

1.Estimation of purity of Copper(Iodometric method)
2.Estimation of purity of Aluminium (EDTA method)
3.Crystal growth (melt growth, Solution growth-$CuSO_4$,KDP,ADP crystals)
4..Phenol formaldehyde- preparationandstudy of properties
5.Urea formaldehyde- preparationandstudy of properties
6.Flash and fire point-Pensky –Martens apparatus
7.Measurement of Single Electrode potential – Poggendorf's method(M|M+ , M|MA|A-, Salt bridge preparation, Calculation of Junction potential)
8.Corrosion potential measurement of certain metals and alloys in 3.5% salt solution (Steel(18-8), Al, Cu, Brass, Bronze, Monel metal or any alloys of industrial use)-Potentiodynamic and Potentiostatic methods.
9.pH meter-Calibration and measurement of pH-Preparation of Buffers-Calculation of pH by Henderson's equation and verification.
10.Potentiometric titration of acid and base- plots of E / V, $\Delta E/\Delta V$, $\Delta^2E/\Delta V^2$ plots.
11.Electrodepostion-plating of Copper-detection of the thickness of the layer deposited.
Anodizing of Aluminium –Characteristics of the coating
12.Estimation of SO_2, NO_2, H_2S.Calculation of concentration in ppm and microgram per M^3 and comparison of data with permitted levels.
13.Estimation of Pb, Cd in water - colourimetric method.
14.Estimation of Fluoride (Alizarin dye method), Nitrate in water –colourimetric method
15.Estimation of Dissolved oxygen (Winklers method)
16.Identification tests for certain common plastics (PE, PVC, Nylon, PET, etc.)
17. Preparation of some liquid crystals and study of their properties.
(Atleast 12 experiments should be done)

Internal work assessment

Lab practicals and record	= 10+5
(Lab performance to be evaluated by the thoroughness of the procedure and practices, results of each experiment and punctuality in the submission of Rough and Fair Records)	
Test/s	= 10
Total marks	= 25

EN04-105 : HUMANITIES

(common for all B. Tech. programmes)

2 hours lecture per week

Module I (10 hours)

Introduction to English usage and grammar-Review of grammar - affixes, prefixes, suffixes, participles and gerunds - transformation of sentences - commonly misspelt words - correction of mistakes - punctuation - idioms - style - vocabulary building

Reading comprehension -Exposure to a variety of reading materials, articles, essays, graphic representation, journalistic articles, etc.

Writing comprehension-Skills to express ideas in sentences, paragraphs and essays

Module II (10 hours)

Technical communication and report writing

Need, importance and characteristics of technical communication – correspondance on technical matters-aspects of technical description of machinery, equipment and processes - giving instructions in an industrial situation - note taking and note making - correspondence on technical topics - different types of technical reports

Module III (14 hours)

History of science and technology

Science and technology in the primitive society – the development of human civilization from primitive to modern society- impact of sciences and technology on societies – Cultural and industrial revolutions - the rise and development of early Indian science – contribution of Indian scientist-JC Bose, CV Raman, Visweswaraya-Ramanujam and Bhabha- Gandhian concepts- recent advances in Indian science

Module IV (10 hours)

Humanities in a technological age

Importance of humanities to technology, education and society - relation of career interests of engineers to humanities - relevance of a scientific temper - science, society and culture

Reference books

1. Huddleston R., *English Grammer - An outline*, Cambridge University Press
2. Pennyor, *Grammar Practice Activities*, Cambridge University Press
3. Murphy, *Intermediate English Grammar*, Cambridge University Press
4. Hashemi, *Intermediate English Grammar-Supplementary Exercises with answers*", Cambridge University Press
5. Vesilind; *Engineering, Ethics and the Environment*, Cambridge University Press
6. Larson E; *History of Inventions*, Thompson Press India Ltd.
7. Bernal J.D., *Science in History*, Penguin Books Ltd
8. Dampier W.C., *History of Science*", Cambridge University Press
9. Encyclopedia Britannica, *History of Science, History of Technology*
10. Subrayappa; *History of Science in India*, National Academy of Science, India
11. Brownoski J, *Science and Human Values*, Harper and Row
12. Schrodinger, *Nature and Greeks and Science and Humanism*, Cambridge University Press
13. Bossel, H, *Earth at a Crossroads - paths to a sustainable Future*, Cambridge University Press
14. McCarthy, *English Vocabulary in Use*, Cambridge University Press
15. Anna University, English for Engineers and Technologists, Orient Longman
16. Meenakshi Raman et al., Technical communication –Principles and practice, Oxford University Press

Internal work assessment	
One essay on relevant topic	10
One technical report	10
2 test	2X15= 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15marks from module I with choice to answer any one
Q III - 2 questions A and B of 15marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15marks from module III with choice to answer any one
Q V - 2 questions A and B of 15marks from module IV with choice to answer any one

EN04- 106A : ENGINEERING GRAPHICS(A)

(common for AI, CS, EE, EC, IT, IC, PT, BM,PT)

1 hour lecture and 3 hours drawing

Module - 0 (8 Hours - 1 Drawing exercise)
Drawing instruments and their use - different types of lines - lettering and dimensioning - familiarization with current Indian Standard Code of practice for general engineering drawing. Construction of ellipse, parabola and hyperbola. Construction of cycloid, involute and helix. Introduction to Computer Aided Drafting. (For practice only, not for University Examination)

Module - 1 (12 Hours - 3 drawing exercises)
a) Introduction to orthographic projections - vertical, horizontal and profile planes - principles of first angle and third angle projections. Projections of points in different quadrants. Orthographic projections of straight lines parallel to one plane and inclined to the other plane - straight lines inclined to both the planes and occupied in one quadrant- traces of lines.
b) True length and inclination of a line with reference planes. Line occupied in more than one quadrant. Line inclined to the two reference planes but parallel to the profile plane. line dimensioned in surveyor's unit.

Module - II (16 Hours - 3 drawing exercises)
a) Projections of plane laminae of geometrical shapes parallel to one plane and inclined to the other plane - plane laminae inclined to both the planes. Auxiliary projections of plane laminae. Projections of laminae inclined to the two reference planes but perpenticular to the profile plane.
b) Projections of polyhedra and solids of revolution - frustums - projections of solids with axis parallel to one plane and inclined to the other plane. Projections of solids with the axis inclined to both the planes.(Solids to be drawn : Cube, prisms, pyramids, tetrahedron, cone, and cylinder.)Projections of solids on auxiliary planes. Projections of combinations of solids. (Solids to be drawn : Prisms, pyramids, tetrahedron, cube, cone, and sphere)

Module - III (12 Hours - 3 drawing exercises)
a) Sections of solids - sections by planes parallel to the horizontal or vertical planes and by planes inclined to the horizontal or vertical planes. True shape of section by projecting on auxiliary plane, (Solids to be drawn : Cube, prisms, pyramids, tetrahedron, cone, and cylinder.)
b) Development of surfaces of solids - method of parallel line, radial line, triangulation and approximate developments. Development of polyhedra, cylinder, cone, and sectioned solids. Development of solids having hole or cut.

Module - IV (12 Hours - 3 drawing exercises)

a) Introduction to isometric projection - isometric scale - isometric views - isometric projections of prisms, pyramids, cylinder, cone, spheres, sectioned solids and combinations of them. Principle of oblique projection - cavalier, cabinet and general oblique projections of solids and simple objects.
b) Introduction to perspective projections - Classification of perspective views - parallel, angular and oblique perspectives - visual ray method and vanishing point method of drawing perspective projection- perspective views of prisms, pyramids and circles.

Module - V(12 Hours - 6 drawing exercises)
a) Introduction to multiview projection of objects - the principle of the six orthographic views - convertion of pictorial views of simple engineering objects into orthographic views.
b) Conventional representation of threaded fasteners. Drawing of nuts, bolts, washers and screws . Locking arrangements of nuts. Bolted and Screwed joints. Foundation bolts of eye end type, hook end type and split end type.

NOTE: *All drawing exercises mentioned above are for class work. Additional exercises where ever necessary may be given as home assignments.*

Text books

1. John K.C., *Engineering Graphics*, Jet Publications
2. P.I. Varghese, Engineering Graphics, VIP Publications
3. Bhatt N.D., *Elementary Engineering Drawing*, Charotar Publishing House

Reference books

4. Luzadder W.J., *Fundamentals of Engineering Drawing*, Prentice Hall of India
5. Narayana K.L and Kannaiah P, *Engineering Graphics*, Tata McGraw Hill
6. Gill P.S., *Geometrical Drawing*, Kataria and sons

Internal work assessment

Drawing exercises (Best 10)	10x3	= 30
2 tests	2x10	= 20
Total marks		= 50

University examination pattern

No question from module 0
Q I - 2 questions A and B of 20 marks from module I with choice to answer any one
Q II - 2 questions A and B of 20 marks from module II with choice to answer any one
Q III - 2 questions A and B of 20 marks from module III with choice to answer any one
Q IV - 2 questions A and B of 20 marks from module IV with choice to answer any one
Q V - 2 questions A and B of 20 marks from module V with choice to answer any one

EN04- 107A : ENGINEERING MECHANICS(A)

(Common for CE, AI, CH, CS, EE, EC, IT, IC, BM, BT, PT)

2 hours lecture and 1 hour tutorial per week

Objectives

1. To acquaint the student with general methods of analyzing engineering problems
2. To illustrate the application of the methods to solve practical engineering problems

Module I (17 hours)

Principles of statics – Free body diagrams – Coplanar forces and Force systems – Resultant and equilibrium conditions for concurrent, parallel and general system of forces – Solution of problems by scalar approach. Introduction to vector approach (Application to simple problems only) – Concurrent forces in space – Resultant – Equilibrium of a particle in space – Non-concurrent forces in space - Resultant of force systems.

Module II (17 hours)

Friction – Laws of friction – Simple contact friction problems – Wedge – Screw jack and its efficiency. Properties of surfaces – First moment and centroid of curve and area – Centroid of composite plane figures – Theorems of Pappus-guldinus- Second moments of plane figures and composite sections – Transfer theorems – Polar moment of area – Product of area and Principal axes (conceptual level treatment only). Moment of inertia of a rigid body – M.I of a lamina – M.I of 3 dimensional bodies (cylinder, circular rod, sphere).

Module III (17 hours)

Introduction to structural mechanics – Different types of supports, loads and beams – Reactions at supports.Shear force and Bending moment in beams – Shear force and bending moment diagrams for cantilever and simply supported beams (only for concentrated and uniformly distributed load cases). Plane trusses – Types of trusses (Perfect, Deficient and Redundant trusses) – Analysis of trusses - Method of joints - Method of sections.

Module IV (15 hours)

Kinetics of rectilinear motion – Newton's second law– D'Alembert's principle – Motion on horizontal and inclined surfaces – Analysis of lift motion - Motion of connected bodies.
Curvilinear motion – Equation of motion – Tangential and normal acceleration - Centripetal and centrifugal forces – Motion of vehicles on circular path.
Work, Power and Energy – Work done by a force – Work of the force of gravity and force of spring - Work-energy equation – Transformation and conservation of energy – Applications to problems.
Kinematics of rotation – Rigid body rotation about a fixed axis – Rotation under the action of constant moment.
Introduction to mechanical vibrations - Simple harmonic motion – free vibration – Oscillation of spring - Torsional vibration

Text Books

1. Timoshenko and Young, "Engineering Mechanics", McGraw Hill Publishers
2. Hibbeler, Engineering Mechanics, Vol.I statics, Vol II Dynamics, Pearson
3. Shames, I.H., "Engineering Mechanics- Statics and Dynamics", Prentice Hall of India

Reference Books

1. Beer,F.P. and Johnson, E.R., "Mechanics for Engineers- Statics and Dynamics", McGraw Hill Publishers.
2. Rajasekharan and Sankarasubramanian, "Engineering Mechanics", Vikas Publishing House

Internal work assessment

60 % - Test papers (minimum 2)
30 % - Assignments/Term project/any other mode decided by the teacher. (At least one assignment should be computer based using spread sheet or suitable tools)
10 % - Other measures like Regularity and Participation in Class.
Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module (in which, at least 5 questions to be numerical)
Q II - 2 questions A and B of 15marks from module I with choice to answer any one
Q III - 2 questions A and B of 15marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15marks from module III with choice to answer any one
Q V - 2 questions A and B of 15marks from module IV with choice to answer any one
(QII to V can have subdivisions and **at least 80% weightage** for numerical problems)

EE04- 108 MECHANICAL ENGINEERING I

2 hours lecture per week

Module 1 (Hours 12)

Basic concepts- Terms and definition, system and control, volume - Continuum concept - Microscopic and Macroscopic approaches. State, properties, processes, cycles. Thermodynamic Equilibrium Equation of state.. Zeroth law of Thermodynamics. Temperature concept, Temperature scales.
First Law of Thermodynamics- Joules Experiment, Internal energy, enthalpy. First law applied to closed and open systems. Steady and unsteady flow processes. Simple numerical problems.

Module II (Hours 10)

Second law of thermodynamics, Kelvin Planck's and Clausius statements, heat engine, heat pump and refrigerator, efficiency and COP, Carnot cycle, Carnot's engine, Entropy and availability, principles of entropy increase-physical interpretation of entropy, I C engines- classification, Types , Working principles of 2 stroke & 4 stroke engine, S I and C I engines.

Module III (Hours 10)

Air Power , Vapour power and Refrigeration cycles- Otto cycles, Diesel cycle, expression for efficiency, simple Brayton cycle, expressions for efficiency. Properties of steam - use of steam tables & Mollier diagram, Rankine cycle, expression for efficiency. Refrigeration cycles, vapour compression refrigeration cycle- simple numerical problems.

Module IV (Hours 12)

Power plant engineering- lay out of steam, gas turbine , diesel, hydel , nuclear power plants, various components and their functions, nuclear power plant safety and nuclear waste disposal systems.
Alternative sources of energy solar, geothermal, wind, tidal OTEC and Biomass energy utilization (detailed study not expected)

Text Books

1. Thermodynamics & Heat engines- R Yadhav-Central Publishing House
2. Thermodynamics- P K Nag, Tata Mcgraw hill

3. Power Plant Engineering- Nagpal, Khanna Publishers
4. Power Plant Engineering- Dom Kundwar, Dhanpat Rai Sons Ltd

Reference

1. Introduction to Thermodynamics-Van Wyn and Richard Sonntag-New Age International
2. Power Plant Technology- E L Wakil -Mcgraaw Hill

Internal work assessment

60 % - Test papers (minimum 2)
30 % - Assignments/Term project/any other mode decided by the teacher.
10 % - Other measures like Regularity and Participation in Class.
Total marks = 50

University Examination Pattern

QI – 8 short questions of 5 marks, 2 from each module

QII – 2 questions A and B of 15 marks from module I with choice to answer any one and Each full question can have two parts with one part from theory and the other a problem

QIII – 2 questions A and B of 15 marks from module I with choice to answer any one and Each full question can have two parts with one part from theory and the other a problem

QIV – 2 questions A and B of 15 marks from module I with choice to answer any one and Each full question can have two parts with one part from theory and the other a problem

QV – 2 questions A and B of 15 marks from module I with choice to answer any one and Each full question can have two parts with one part from theory and the other a problem

EE04-109 BASIC ELECTRICAL ENGINEERING

(Common for EE, EC, AI, IC, BM, BT, PT)

2 hours lecture per week

Module 1 (10 hours)

Elementary concept and definitions of current, voltage, power and energy – Introductory circuit analysis - Independent voltage and current sources- Dependent voltage and current sources - Source transformation - Ohm's law – Kirchoff's laws –Solutions of simple series, parallel and series-parallel circuits with DC excitation – Solutions of resistive circuits with dependent sources – Mesh analysis and Nodal analysis – Nodal conductance matrix and mesh resistance matrix.

Basic network theorems – Linearity – Concept of a linear element – Concept of a linear circuit – Passive vs. active elements – Bilateral & unilateral elements – Thevenin's theorem – Norton's theorem – Superposition theorem – Substitution theorem – Maximum power transfer theorem.

Module II (12 hours)

Magnetic circuits – MMF – Magnetic flux – Reluctance – Comparison of magnetic and electric circuits – Magnitisation curves of ferromagnetic materials – Solution of magnetic circuits.

Faraday's laws of electromagnetic induction - Lenz's law - Dynamically and statically induced emfs - Self and mutual inductances - Inductances in series and parallel – Mutual flux and leakage flux - Coefficient of coupling - Dot convention- Cumulative and differential connection of coupled coils.

Electostatics - Capacitance- Parallel plate capacitor - Capacitors in series and parallel – Charging and discharging of capacitor - Energy stored in electrostatic fields – potential gradient – Dielectric strength.

Two terminal element relationships – V-I relationship for inductance and capacitance.

Time domain analysis of circuits - Linier differential equations for series RL and RC, parallel RL and RC, series RLC and parallel RLC circuits - Complete solution for step/dc, voltage/current inputs – Natural response – Transient response - Time constant - Rise and fall times – Determination of initial conditions.

Module III. (12 hours)

Single phase AC circuits: Alternating quantities - Generation sinusoidal emf.-Mathematical equations - Definitions and explanations of the terms: wave form, cycle, time period, frequency, amplitude, phase, phase difference, rms value, average value, form factor and peak factor - Calculations for square, triangle, trapezoidal and sinusoidal waveforms.

Phasor representation of sinusoidal qualities - Phase difference - Addition and subtraction of sinusoids –Symbolic representation - Cartesian, polar and exponential forms.

Analysis of ac circuits: R, L, C, RL, RC and RLC circuits using phasor concept -Concept of impedance, admittance, conductance and susceptance – Power in single phase circuits – Instantaneous power - Average power - Active and reactive powers - Apparent power - Power factor - Complex power – Solutions of series, parallel and series-parallel AC circuits. - Series and parallel resonances – Q-factor - Frequency response curves - Half power frequencies – Bandwidth – Application of Thevenin's and Norton's theorems for AC circuits.

Module IV (10 hours)

Analysis of polyphase circuits – 2 phase circuits – Three phase AC circuits – Generation of 3 phase AC voltages – Balanced system – Phase sequence – Star-delta transformation – Balanced 3 phase AC source supplying balanced 3 phase star connected and delta connected loads – 3 wire and 4 wire systems - Neutral current – Active power, reactive power, apparent power, and power factor – Power factor

improvement – Unbalanced systems – Neutral shift (explanation and concept only) – Three phase power measurement – Three wattmeter and Two wattmeter methods.

Text Books

Hughes E. ***Electrical technology***, Pearson Education.
D.P. Kothari & Nagarth – ***Theory and problems of Basic Electrical Engineering*** – Prentice Hall (India) PVT LTD.

Referance

Edminister J A. ***Electric circuits***, Schaum's series. McGraw Hill
Van valkenberg***, Electric circuits and network analysis***, Prentice Hall (India) PVT LTD.
Smarjith Ghosh – ***Fundamentals of Electrical and Electronics Engineering*** Prentice Hall (India) PVT LTD.

Internal work assessment

60 % - Test papers (minimum 2)
30 % - Assignments/Term project/any other mode decided by the teacher.
10 % - Other measures like Regularity and Participation in Class.
Total marks = 50

University examination pattern

Q1 – 8 short type questions of 5 marks 2 from each module.
QII – 2 questions A and B of 15 marks from module I with choice to answer any one
QIII – 2 questions A and B of 15 marks from module II with choice to answer any one
QIV – 2 questions A and B of 15 marks from module III with choice to answer any one
Q V – 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04-110(P) : CIVIL AND MECHANICAL WORKSHOP

(common for EE, CS, IT, PT)

3 hours practicals per week (Part A and Part B in alternate week)

Part A: Civil engineering workshop(33 hours)

1. Chain surveying - study of instruments and chain survey traverse
2. Compass surveying - study of instruments and compass traverse
3. Plane table surveying - study of instruments and plane tabling by intersection and radiation methods
4. Plane table surveying - plane table traverse
5. Levelling - study of instruments, temporary adjustments of dumpy level
6. Fly levelling
7. Theodolite surveying - study of instruments, temporary adjustments,
8. Theodolite surveying - measurement of horizontal angles by reiteration method and repetition method
9. Study of electronic distance/ level measuring equipment (or total station)

Internal work assessment	
Surveying practicals and record	= 15
Test	= 10
Total marks	= 25

Part B: Mechanical engineering workshop (33 hours)

Machine shop practice (9 hours)

Study of different machine tools - lathe, shaper, milling machine, drilling machine grinding machine - exercises on lathe - models involving straight turning, taper turning, facing knurling, and thread machining

Fitting practice (6 hours)

Study of hand tools and measuring tools used in fitting work - fabrication exercises involving cutting, chiseling, filing and drilling - use of thread dies and taps

Welding practice (6 hours)

Study of electric arc welding and gas welding equipments - accessories and tools - safety practices - exercises involving preparation of different types of welded joints - lap and butt joints - gas cutting equipment and demonstration

Sheet metal practice (6 hours)

Study of shearing bending and folding machines, press brake etc. used in sheet metal work - hand tools in sheet metal work - development and fabrication of simple sheet metal components like cylindrical dish, funnel, rectangular duct, tray, panel board etc. - soldering and brazing of joints - die cutting operations

Carpentry practice (6 hours)

Wood and its processing - shop equipment - measuring and marking tools - wood working hand tools - wood working machinery - preparation of joints - lap, butt, dovetail, mortise and tenon and bridle joints - wood turning

Internal work assessment	
Workshop practicals and record	= 15
Test	= 10

Total marks	= 25

EE04- 111(P) : ELECTRICAL AND ELECTRONICS WORKSHOP

(Common for EE,EC, AI, IC,BT, BM, CS, IT, PT)

2 hours practicals per week

Part A: Electrical Workshop (2 hours per alternate weeks)

1. Familiarisation of various types of Service mains - Wiring installations - Accessories and house-hold electrical appliances
2. Methods of earthing - Measurement of earth resistance - Testing of electrical installations - Precautions against and cure from electric shock
3. Practice of making Britannia joints on copper / aluminium bare conductors
4. Practice of making Married joints on copper / aluminium conductors
5. Practice of making T joints on copper / aluminium conductors
6. Wiring practice of a circuit to control 2 lamps by 2 SPST switches
7. Wiring practice of a circuit to control 1 lamp by 2 SPDT switches
8. Wiring practice of a circuit to control 1 fluorescent lamp and 1 three-pin plug socket
9. Wiring practice of a main switch board consisting of ICDP switch, DB, MCB's, and ELCB's
10. Familiarisation of various parts and assembling of electrical motors and Wiring practice of connecting a 3-phase / 1-phase motor with starter

Internal work assessment	
Workshop practicals and record	= 15
Test/s	= 10
Total marks	= 25

Part B – Electronics Workshop (2 hours per alternate weeks)

1. Familiarisation of various electronics components such as resistors, AF&RF chokes, capacitors, transistors, diodes, IC's and transformers
2. Assembling and soldering practice of single phase full wave bridge rectifiers circuit with capacitor filter
3. Assembling and soldering practice of common emitter amplifier circuit
4. Assembling and soldering practice of common emitter amplifier circuit on PCB
5. Assembling and soldering practice of non inverter amplifier circuit using OPAMP on PCB
6. Assembling of a timer circuit IC555, phase shift oscillator circuit using OPAMP and JK flip-flop using NAND gates on a bread-board
7. Coil winding - Single layer and multi layer - Demonstration
8. Miniature transformer winding - Demonstration
9. PCB layout using software like ORCARD, CIRCUITMAKER, EDWIN
10. PCB fabrication - Demonstration

Internal work assessment	
Workshop practicals and record	= 15
Test/s	= 10
Total marks	= 25

EN04 301A ENGINEERING MATHEMATICS-III

(Common for all branches except CS and IT)

3 hours lecture and 1 hour tutorial per week

Module I : Linear Algebra

Vector spaces – Linear dependence and independence, and their computation – Bases and dimension – Subspaces – Inner product spaces – Gram-Schmidt orthogonalisation process – Linear transformations – Elementary properties of linear transformations – Matrix of a linear transformation. (Proofs of theorems omitted.)

Module II : Fourier Transforms

Fourier integral theorem (proof not required) – Fourier sine and cosine integral representations – Fourier transforms – Fourier sine and cosine transforms – Properties of Fourier transforms – Singularity functions and their Fourier transforms.

Module III : Probability Distributions

Random variables – Mean and variance of probability distributions – Binomial and Poisson distributions – Poisson approximation to binomial distribution – Hypergeometric and geometric distributions – Probability densities - Normal, uniform, and gamma distributions.

Module IV : Theory of Inference

Population and samples – Sampling distributions of mean and variance – Point and interval estimations – Confidence intervals for mean and variance - Tests of hypotheses - Hypotheses concerning one mean, two means, one variance, and two variances – Test of goodness of fit.

TEXT BOOKS

For Module I

K. B. Datta, *Matrix and Linear Algebra for Engineers,* Prentice-Hall of India, New Delhi, 2003.
(Sections: 5.1, 5.2, 5.3, 5.4, 5.5, 5.8, 6.1, 6.2, 6.3)

For Module II

C R Wylie & L C Barrett, *Advanced Engineering Mathematics (Sixth Edition),* McGraw Hill.
(Sections: 9.1, 9.3, 9.5)

For Module III

Richard A Johnson, *Miller & Freund's Probability and Statistics for Engineers,* Pearson Education, 2000.
(Sections: 4.1, 4.2, 4.3, 4.4, 4.6, 4.8, 5.1, 5.2, 5.5, 5.7)

For Module IV

Richard A Johnson, *Miller & Freund's Probability and Statistics for Engineers,* Pearson Education, 2000.
(Sections: 6.1, 6.2, 6.3, 7.1, 7.2, 7.4, 7.5, 7.8, 8.1, 8.2,
8.3, 9.5)

REFERENCES

1. Bernard Kolman & David R Hill, *Introductory Linear Algebra with Applications (Seventh Edition),* Pearson Education, 2003.
2. Lipschutz S, *Linear Algebra – Schaum's Outline Series,* McGraw Hill
3. Erwin Kreyszig, *Advanced Engineering Mathematics (Eighth Edition),* John Wiley & Sons.
4. Larry C Andrews & Bhimsen K Shivamoggi, *Integral Transforms for Engineers,* Prentice-Hall of India, 2003.
5. Ronald E Walpole, et al, *Probability and Statistics for Engineers and Scientists(Seventh Edition),* Pearson Education, 2004
6. Robert V Hogg & Elliot A Tanis, *Probability and Statistical Inference,* Pearson Education, 2003.
7. Chatfield C, *Statistics for Technology, Chapman & Hall*

Sessional work assessment:

Assignments 30%
2 tests 60%
Regularity &Participation in class 10%
Total marks = 50
University examination pattern
Q1 - 8 short type questions of 5 marks, 2 from each module
QII - 2 questions of 15 marks from module I with choice to answer any one
QIII - 2 questions of 15 marks from module II with choice to answer any one
QIV - 2 questions of 15 marks from module III with choice to answer any one
QV - 2 questions of 15 marks from module IV with choice to answer any one

EE04 302 COMPUTER PROGRAMMING IN C
(Common to all Branches except CS, IT & PT)
2 hours lecture & 2 hours practical per week
Module 1(12 hours)
Programming and problem solving – Basic computer organization – Developing algorithms – Flow charts – High level and low level languages – Compilers and Interpreters – Steps involved in computer programming –
Writing, Compiling and Executing a program – Debugging a program – Description of a programming language.
Module II (18 hours)
Basics of C – Overview of C – Program structure – Lexical elements – Numerical constants – Variables – Arithmetic operators – Arithmetic Expressions – Arithmetic conversion – Increment and Decrement operators
– Assignment Expressions – Multiple assignments – Input and Output – Format specifiers – Fundamental data
types – Bit level operators and applications – Relational operators – Relational expressions – Logical operators
– Logical expressions – Conditional operator – Precedence and associativity of operators.
Module III (16 hours)
Compound statements – Conditional statements – if statement – if else statement – nested if statement – switch
statement – Loop control statements – while statement - do while statement – for statement – continue statement – break statement – go to statement – Functions – user-defined functions – library functions – Recursion – Global, local and static variables.
Module IV(20hours)
Arrays – single dimensional – multi dimensional – Arrays in functions – Stacks – Strings – String processing –
Bit-wise operators – Enumerated data types – Structures – Typedef – Structures in Arrays – Arrays in Structures – Unions – Pointers – Pointers and Arrays – Pointers and Functions – Linear linked lists and list operations – Files – sequential files – unformatted files – text files.
Text Book:
Rajaraman V, Computer Programming in C, Prentice Hall of India
Reference Books:
1. Kernighan B.W. & Ritchie, D.M., The C Programming Language, Prentice Hall of India
2. Balaguruswami E, Progrmming in ANCI C, Tata McGraw Hill
3. Venugopal K.R. & Prasad S.R., Programming with C, Tata McGraw Hill
Sessional work assessment
Assignments 30%
2 tests 60%
Regularity &Participation in class 10%
Total marks = 50
University examination pattern

Q1 - 8 short type questions of 5 marks, 2 from each module
QII - 2 questions of 15 marks from module I with choice to answer any one
QIII - 2 questions of 15 marks from module II with choice to answer any one
QIV - 2 questions of 15 marks from module III with choice to answer any one
QV - 2 questions of 15 marks from module IV with choice to answer any one

EE04 303 MECHANICS OF SOLIDS
(COMMON WITH CE04-303)

Objective:

The objective of this subject is to study the internal effects produced and deformations of bodies caused by externally applied forces. The subject projects strength characteristics of different materials and structural members subjected to shear, torsion and bending.

Module I

Tension, compression & shear: (8 hours)

Types of external loads - internal stresses - normal and shear stresses - strain - Hooke's law - Poisson's ratio - relationship between elastic constants - working stress - stress strain diagrams - elongation of bars of constant and varying sections - statically indeterminate problems in tension and compression –Force & Displacement methods of analysis-Temperature and Prestrain effects - strain energy.

Analysis of stress on oblique sections and strain: (5 hours)

Stress on inclined planes for axial and biaxial stress fields - principal stresses - Mohr's circle of stress - principal strains - strain rosette

Module II

Review of Bending moment and shear force of various types of loading (SS & Over hanging) (3 hours)

Stresses in laterally loaded symmetrical beams: (7 hours)

Theory of simple bending –assumptions and limitations – Normal stresses in beams – Stresses in nonprismatic beams-moment of resistance - beams of uniform strength - beams of two materials –Beams with axial loads-core of a section- strain energy due to bending - shearing stresses in bending

Unsymmetrical bending and shear centre (4 hours)

Doubly symmetric beams with skew loads-pure bending of unsymmetrical beams-Generalized theory of pure bending-Deflections in unsymmetrical bending-shear centre of thin walled open cross sections.

Module III

Deflection of beams: (12 hours)

Differential equation of the elastic curve - Method of successive integration, Method of superposition, moment area method and conjugate beam method –Use of discontinuity functions to obtain beam deflections -deflection due to shear

Module IV

Theory of columns: (5 hours)

Buckling and stability-Euler's load for columns with different end conditions-Eccentric loads and the secant formula-Imperfections in columns.

Torsion: (3 hours)

Torsion of circular bars-Nonuniform torsion-Pure shear- strain energy in pure shear and torsion.

Springs (2 hours)

Close coiled and open coiled helical springs.

Thin and Thick Cylinders: (3 hours)

Stress in thin cylinders-Lame's equation - stresses in thick cylinders due to internal and external pressures - compound cylinders - shrink fit - wire wound pipes and cylinders

Text Books:

1. Timoshenko , Strength of Materials Vol. I & Vol. II , CBS Publishers & Distributers, New Delhi
2. James M Gere & Stephen P Timoshenko , Mechanics of Materials , CBS Publishers & Distributers, New Delhi
3. Egor P Popov , Mechanics of solids, Prentice Hall of India, New Delhi.

Reference books:

Hearn E.J., Mechanics of Materials, Pergamon Press, Oxford
Warnock F.V., Strength of Materials, Isaac Pitman

Nash W.A., Strength of Materials, Schaum's Outline Series, McGraw Hill
Wang C.K., Statically Intermediate Structures, McGraw Hill

Sessional work assessment:

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern:

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 304 MECHANICAL ENGINEERING II

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Fluid Mechanics – Fluid properties – density, viscosity, surface tension and capillarity – Newton Law of viscosity – Fluid statics – Fluid pressure – Variation of pressure in static fluid – Absolute and gauge pressure, Burden tube pressure gauge, manometers – Hydrostatic forces on plane and curved surfaces – Centre of pressure – Buoyancy and stability of submerged and floating bodies – Metacentric height – Simple numerical problems.

Module II (14 hours)

Fluid dynamics – Continuity equation, momentum equation and energy equations. One dimensional flow along a streamline – Euler's momentum equation, Bernoulli's equation, Pitot and pitot static tubes – Venturimeter, orifice meter, flow nozzle, notches and weirs – simple numerical problems.

Module III (14 hours)

Dimensional analysis – Rayleigh's method, Buckingham – _-Theorem – Principles of modelling and similitude as applied to fluid mechanics problems – Non-dimensional parameter on fluid mechanics and fluid machinery.

Hydraulic machines – Hydraulic turbines – Impulse and reaction turbines – Pelton Wheel, Francis turbine and Kaplan turbines – their constructional features and performance characteristics – factors affecting performance – turbine selection criteria – Governing, Surging and Cavitation (theory only detailed analysis not expected)

Module IV (14 hours)

Hydraulic pumps – General features of positive displacement anxd roto dynamic pumps, Centrifugal pump – Classification – Principles of working. Multi-stage pumpsd – Self priming pumps – Deep well pumps. Reciprocating pumps – Use of air vessels – Pump characteristics. Rotary pumps – Gear pumps – Rotary piston pumps – Wane pump – Screw pumps (working principle only. Detailed syllabus not expected)

Mechanical Power Transmission – Belts and pulleys – Classification – Expression for ration of belt tension, slip, length of belt, centrifugal tension, Simple problems (V belts and flat belts) chain drivers – Classification, uses, ropes – application.

Text Books

1. Fluid Mechanics & Hydraulic Machines - Modi & Seth
2. Theory of Machines - P.L. Bellaney

Reference books

1. Hydraulic Machines - Dr. Jagdish Lal
2. Fluid mechanics - K.L. Kumar
3. Fluid mechanics - D.S. Kumar
4. Theory of Machines - Dr. Jagdish Lal

Sessional work assessment

Assignments 30%
2 tests 60%
Regularity &Participation in class 10%
Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 305: ELECTRONICS I

3 hours lecture & 1 hour tutorial per week

Module I: Semiconductors and devices (14 hours)

Field intensity - Potential energy - Mobility - Conductivity - Electrons and holes - Charge density in semiconductors - Electrical properties of silicon and germanium - Diffusion - Potential variation within graded semiconductors - Open circuit p-n junction - p-n junction as a rectifier - V-I characteristics - Temperature dependence - Diode resistance - Transition capacitance - Minority carrier storage - Diffusion capacitance - Breakdown diode - Schottky diode - Junction transistor - Current components - Construction - CE and CB characteristics - Ratings - Construction and characteristics of JFETS and MOSFETS

Module II: Diode circuits (12 hours)

Diode as a circuit element - Load line - Piecewise linear model - Single phase half wave and full wave rectifier circuits - Voltage regulation - Ripple factor - Rectifier efficiency - Transformer utilization factor- Bridge rectifier- Rectifier filters - LC and RC filters and comparison - Diode currents and supply line currents for various filters - Diode clipping circuits - Single level and two level clippers - Clamping circuits - Clamping circuit theorem

Module III: Amplifier circuits (13 hours)

Operating point of a BJT - Bias stability - Thermal runaway - Fixed bias and self bias design - Concept of small signal operation - Amplification in CE amplifier - Transconductance and its relation to CE voltage gain - h parameter model of a BJT- CE, CB and Emitter follower analysis and comparison using hybrid equivalent circuit - Considerations in cascading transistor amplifiers - Biasing a JFET and MOSFET - Small signal model - CS and CD amplifiers- Class B and Class AB - Power amplifiers using BJT

Module IV: Frequency response of amplifiers (s-domain approach is envisaged) (13 hours)

Low frequency response of BJT and FET amplifiers - Dominant time constant - selection of coupling and bypass capacitors - Hybrid Π equivalent circuit of BJT - High frequency response of CE current gain - α cut off and β cut off frequencies - Gain bandwidth product - Miller effect - Emitter follower at high frequencies - FET at high frequencies.- Differential amplifiers - Common mode and differential mode gains - CMMR - Current source biasing - Offset behavior

Text Book :

1. Millman J., *Microelectronics*, McGraw Hill
2. David Abell- Electronic Devices and Circuits, Prentice Hall of India

Reference books

1. Schilling & Belove, *Electronic Circuits,* McGraw Hill
2. Sedra & Smith, *Microelectronic Circuits* Oxford University Press
3. Jaeger R.C., *Microelectronic Circuit Design*, McGraw Hill
4. Horowitz P. & Hill W., *The Art of Electronics*, Foundation
5. Boylested & Nashesky, *Electronic Devices & Circuit Theory,* Prentice Hall of India
6. Rama Reddy. S, Electronic Devices and Circuits, Narosa publications

Sessional work assessment	
Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 306 ELECTRIC CIRCUIT THEORY

3 hours lecture and 1 hour tutorial per week

Module I Three phase systems(12 hours)

Review of three phase systems, Three phase loads with mutual coupling between phases - 3 wire and 4 wire systems - Neutral shift - Neutral current - Active power, reactive power, complex power, apparent power and power factor in balanced and unbalanced three phase systems - Symmetrical components - Analysis of unbalanced systems using symmetrical components - Sequence impedances - Analysis of three phase unbalanced systems with mutual coupling between phases using symmetrical components - Sequence coupling

Module II: S-domain analysis of circuits (12 hours)

Laplace transform - Transform pairs - Gate functions - Shifting theorem - Solution of differential equations by Laplace transforms - Initial and final value theorems - Laplace transforms of periodic signals - Inversion of transforms by partial fractions - Convolution theorem and convolution integral - Transformation of a circuit into s-domain - Transformed equivalent of inductance - Capacitance and mutual inductance - Impedance and admittance in the transform domain - Node analysis and mesh analysis of the transformed circuit - Nodal admittance matrix and mesh impedance matrix in the s -domain - Solution of transformed circuits including mutually coupled circuits - Input and transfer immittance functions - Transfer functions - Impulse response and transfer function - Poles and Zeros - Pole Zero plots.- Sinusoidal steady state from Laplace transform inversion - Frequency response by transform evaluation on $j\omega$ axis - Frequency response from pole-zero plot by geometrical interpretation

Module III (13 hours)

Two port networks

Two port networks - Characterization in terms of impedances and admittances - Hybrid and transmission parameters - Inter relationships among parameter sets - Reciprocity theorem - Interconnection of two port networks - Series, parallel and cascade – Network functions - Pole zero plots and steady state response from pole - zero plots

Symmetrical two port networks

T and Π Equivalent of a two port network – Image impedance – Characteristic impedance and propagation constant of a symmetrical two port network – Properties of a symmetrical two port network

Symmetrical two port reactive networks as filters

Filter fundamentals - Pass and stop bands-behavior of iterative impedance-Constant-k low pass filter-Constant-k high pass filter- m-derived T and Π sections and their applications for infinite attenuation and filter terminations-band pass and band elimination filters

Module IV (15 hours)

Elementary synthesis operations- LC network synthesis- properties of RC network functions- Foster form of RC networks – properties of RL network functions - Foster form of RL networks- the Cauer form of RC and RL networks

Introduction to network topology

Definition of graph, trees, incidence matrix - Properties of incidence matrix - Cut sets - Fundamental cut sets - Cut set schedule - Tie sets - Fundamental tie sets - Tie set schedule - relationships among incidence matrix, cut set matrix and tie set matrix - Kirchhoff's laws in terms of network topological matrices - Formulation and solution of network equations using topological methods - Loop analysis - Cut set analysis

Text Book

1. Valkenberg, *Network Analysis*, Prentice Hall of India

2. Abhijit Chakrabarthi, Electric Circuit Theory, Dhanpat Rai &Sons

Reference books

1. Desoer C.A. & Kuh E.S., *Basic Circuit Theory*, McGraw Hill
2. Siskind C.S., *Electrical Circuits*, McGraw Hill
3. Ryder J.D., *Networks, Lines & Fields*, Prentice Hall
4. Edminister, *Electric Circuits - Schaum's Outline Series*, McGraw Hill
5. Huelsman L.P., *Basic Circuit Theory*, Prentice Hall of India
6. Balabanian, Network Synthesis , Prentice Hall of India
7. M.A.Pai, Introduction to Electric Circuits & Machines, East West.
8. Nilson, Electric Circuits, Adison Wiley.

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 307(P) ELECTRONICS LABORATORY I

3 hours practicals per week

1. Study & Use of CRO: a) Measurement of current voltage, frequency and phase shift.
2. Semiconductor diodes: V-I and transfer characteristics of Si, Ge and zener diodes
3. Transistor characteristics in CB and CE configurations - Identification of cut off, active and saturation regions
4. JFET characteristics in the common source configuration- Determination of equivalent circuit parameters
5. RC coupled amplifier using BJT in CE configuration- Measurement of gain, input and output impedance and frequency response
6. FET amplifier- Measurement of voltage gain, current gain, input and output impedance
7. UJT relaxation oscillator- Design for a particular frequency
8. Rectifiers and filters with and without shunt capacitors- Characteristics of half-wave, full wave and bridge rectifiers- Ripple factor, Rectification efficiency, and % regulation
9. BJT emitter follower- Measurement of voltage gain, current gain, input impedance, output impedance and load characteristics
10. Characteristics of clipping and clamping circuits using diodes and zener diodes
11. Characteristics of voltage regulators- Design and testing of: a) simple zener voltage regulator b) zener regulator with emitter follower output

Sessional work assessment	
Lab practicals & record	= 30
2 tests	2x10 = 20
Total marks	= 50

EE04 308(P): BASIC ELECTRICAL ENGINEERING LAB

[common with PT2K 308(P)]

3 hours practical per week

1. Study of PMMC/MI voltmeters/ammeters, dynamometer type wattmeter, clip on ammeter and analog/digital multimeters

2. a) Determination of voltage-current characteristics of a wire-wound rheostat and (b) an incandescent lamp

3. Methods of measurement for low/high resistance using voltmeter and ammeter

4. Potential divider connection of a rheostat and study of the dependence of output voltage upon the value of the load resistance

5. Verification of Kirchoff's laws in D.C circuit

6. Verification of super position theorem in a D.C circuit

7. Verification of Thevenin's theorem in D.C circuit

8. Verification of Generalised Reciprocity theorem in a D.C circuit

9. Determination of impedance, admittance, power factor and real/reactive/apparent power drawn in RLC series/parallel circuits

10. Determination of fusing time versus current characteristics and fusing factor different specimens of fuse wires

11. Single-phase power measurement using a dynamometer type wattmeter

12. Single-phase power measurement of 3 ammeter method and 3 voltmeter method

13. Three-phase power measurement using one wattmeter and two wattmeters.

Sessional work assessment		
Lab practicals & record	= 30	
2 tests	2 X 10	= 20
Total marks		= 50

EN04 401A ENGINEERING MATHEMATICS-IV

(Common for all branches except CS and IT)

3 hours lecture and 1 hour tutorial per week

Module I : Functions of a Complex Variable I

Functions of a complex variable – Derivatives and analytic functions – Cauchy-Reimann equations - Laplace equation – Conformal mapping – Exponential function – Trigonometric functions - Hyperbolic functions - Logarithm - Linear fractional transformations

Module II : Functions of a Complex Variable II

Line integral in the complex plane – Cauchy's integral theorem (Proof of existence of indefinite integral to be omitted) – Cauchy's integral formula – Derivatives of analytic functions (Proof to be omitted) -Taylor series – Laurent series – Singularities and zeros - Residues and residue theorem – Evaluation of real integrals

Module III : Series Solutions of Differential Equations

(i) Power series method for solving ordinary differential equations – Legendre's equation and Legendre polynomials – Rodrigue's formula – Generating functions – Relations between Legendre polynomials – Orthogonality property of Legendre polynomials (proof omitted)

(ii) Frobenius method for solving ordinary differential equations – Bessel's equation – Bessel functions – Generating functions – Relations between Bessel functions – Orthogonality property of Bessel functions (proof omitted).

Module IV : Partial Differential Equations

Basic concepts - Classification of linear PDE's –Derivation of the one-dimensional wave equation and the one-dimensional heat equation – Solutions of these equations by the method of separation of variables – Solutions satisfying initial and boundary conditions – D' Alembert's solution of the one-dimensional wave equation – Steady-state two dimensional heat flow.

TEXT BOOK: Erwin Kreyszig, *Advanced Engineering Mathematics* (8th Edition) John Wiley & Sons.

Module 1

Sections: 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9

Module 2

Sections: 13.1, 13.2, 13.3, 14.4, 15.1, 15.2, 15.3, 15.4

Module 3

Sections: 4.1, 4.3, 4.4, 4.5

Module 4

Sections: 11.1, 11.2, 11.3, 11.4, 11.5.

REFERENCES

1. C R Wylie & L C Barrett, *Advanced Engineering Mathematics (Sixth Edition),* McGraw Hill.
2. Churchill R V, Brown J W & Verhey R F, *Complex Variables and Applications,* McGraw Hill .
3. Pipes L A & Harvill L R, *Applied Mathematics for Engineers & Physicists,* McGraw Hill
4. Michael D Greenberg, *Advanced Engineering Mathematics* (*Second Edition*) Pearson education Asia.
5. Sastry S S, *Engineering Mathematics – Volumes 1 & 2,* Prentice Hall of India

Sessional work assessment:

2Assignments 30%

2 tests 60%

Regularity &Participation in class 10%

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module

Q II - 2 questions A and B of 15 marks from module I with choice to answer any one

Q III - 2 questions A and B of 15 marks from module II with choice to answer any one

Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one

Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 402 Environmental Studies

(Common for all branches)

3 hours lecture & 1 hour tutorial per week

Objective:

The importance of environmental science and environmental studies cannot be disputed. Continuing problems of pollution, loss of forest, solid waste disposal, degradation of environment, loss of bio diversity etc have made everyone aware of environment issues. The objective of this course is to create general awareness among the students regarding these environmental issues.

Module I (12 Hours)

The Multidisciplinary nature of environmental studies

Definition - scope and importance-need for public awareness.

Natural Resources

Renewable and non-renewable resources:

Natural resources and associated problems - forest resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their defects on forests and tribal people. - Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. - Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies - Land resources: Land as a resource, land degradation, man induced land slides, soil crosion and desertification - Role of an individual in conversation of natural resources - Equitable use of resources for sustainable lifestyle.

Module II (14 Hours)

Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids - Introduction, types, characteristic features , structure and function of the following ecosystem:-Forest ecosystem - Grassland ecosystem - Desert ecosystem - Aquatic ecosystem(ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation

Introduction – Definition: genetic, species and ecosystem diversity - Biogeographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels - India as a mega-diversity nation – Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wild life, man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Module III (11 Hours)

Environmental Pollution

Definition - Causes, effects and control measures of:- Air pollution - Water pollution - Soil pollution - Marine pollution-Noise pollution -Thermal pollution - Nuclear hazards - Solid waste Management: Causes, effects and control measures of urban and industrial wastes -Role of an individual in prevention of pollution - Pollution case studies - Disaster management : floods, earthquake, cyclone and landslides - Environmental Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and Control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation - Public Awareness

Module IV (10 Hours) Social Issues and the Environment

From unsustainable to sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, watershed management - Resettlement and rehabilitation of people; its problems and concerns,case studies - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies - Wasteland reclamation - Consumerism and waste products

Human Population and the environment

Population growth, variation among nations - Population explosion – Family welfare Programme - Environment and human health – Pollution hazards, Sanitation and health - Human Rights for clean

environment - Value Education - HIV/AIDS-social concern - Women and Child Welfare - Role of information Technology in Environment and human health - Case studies

Field Work (5 Hours)

Visit to a local area to document environmental assets – river/forest/grassland/hill/mountain
Visit to local polluted site – Urban/Rural/Industrial/Agricultural
Study of common plants, insects, birds
Study of simple ecosystems – pond, river, hill slopes, etc.

Text books:

1.Clark, R.S. Marine Pollution. Clanderson Press Oxford
2.Mhaskar A.K, Matter Hazardous. Techno-science Publications
3.Miller, T.G. Jr. Environmental Science. Wadsworth Publishing Co.
4.Townsend, C., Harper, J. and Michael Begon, Essential of Ecology. Blackwell Science
5.Trivedi. R.K. and Goel . P.K. Introduction to air pollution. Techno – Science Publications

References:

1. Agarval. K.C.2001 Environmental biology. Nidi Publ. Ltd. Bikaner
2. Bharucha Erach, Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email: mapin@icenet.net
3. Brunner, R.C. 1989. Hazardous Waste Incineration. McGraw Hill Inc. 480p
4. Cunningham, W.P., Cooper, T.H., Gorhani, E & Hepworth, M.T. 2001Environmental encyclopedia Jaico publ. House Mumbai 1196p
5. De, A.K. Environmental Chemistry. Wiley Eastern Ltd.
6. Down to Earth, Centre for Science and Environment
7. Gleick, H.P. 1993. Water in crisis. Pacific Institute for Studies in Dev., Environment and security, Stockholm Env. Institute. Oxford Univ. Press. 473p
8. Hawkins, R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay
9. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
10.Jadhav, H. & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi
11. Mckinney, M.L. & School, R.M. 1996. Environmental Science system & Solutions, Web enhanced edition, 639p.
12.Odum, E.P. 1971. Fundamentals of Ecology. W.B.Saunders Co. USA, 574p
13. Rao, M.N. & Datta, A.K 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd., 345p
14.Sharma, B.K. 2001. Environmental Chemistry. Goel Publ. House, Meerut.
15. Survey of the Environment, The Hindu (M)
16.Trivedi, R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol I and II . Enviro Media
17.Wagner.K.D. 1998. Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p
(M) Magazine

Internal assessment:

2 Tests = 20
Field work and Report (Internal Assessment) = 25
Regularity = 5
Total marks = 50

UniversityExamination Pattern :

Part A: Short answer questions 12 out of 16(4 from each module) - 12x5 = 60 Marks
Q II - 2 questions A and B of 10 marks from module I with choice to answer any one
Q III - 2 questions A and B of 10 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 10 marks from module III with choice to answer any one
Q V - 2 questions A and B of 10 marks from module IV with choice to answer any one

EE04 403 ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Indicating instruments

Principle - Different types of control and damping arrangements in indicating instruments - Permanent magnet moving coil, moving iron, hot wire, electrostatic and dynamometer type meters - Ammeters and Voltmeters - Errors in indicating instruments - Rectifier type meters - Factors influencing its performance - Extension of instrument range - Shunts for ammeters - Voltmeter multipliers - Instrument transformers - Current transformer - Phasor diagram - Ratio and phase angle error - Use of instrument transformers with wattmeter - Clip on meters - Hall effect clip on meters - Errors

Module II (13 hours)

Wattmeters, energy meters and other measuring instruments

Measurement of energy and power - Dynamometer type wattmeter - Error and Compensation - Principle of working of ampere hour meter - Single and Three phase energy meters - Errors and Compensation - Calibration using wattmeter and rotating substandard - Static watt meters and Energy meters - Principles and block diagram - Tri vector meter - Frequency meters - Power factor meters

Module III (13 hours)

Measurement of resistance

Wheatstone`s bridge – Kelvin`s double bridge - Carry Foster Slide wire bridge - Sensitivity of dc bridges - Interchange of battery and galvanometer - Bridge current limitations - ohmmeter - Meggar - Measurement of insulation resistance by direct deflection method - Earth electrodes - Earth resistance - Earth tester - Localization of cable fault by Murray and Varley loop tests

AC bridges

Measurement of inductance using Maxwell and Anderson bridges - Measurement of capacitance using schering bridge

Module IV (13 hours)

Potentiometers

General principle - Modern form of dc potentiometers - Vernier dial principle - Standardization - ac potentiometers - Coordinate and polar types - Application of dc and ac potentiometers

Magnetic measurements

Classification of magnetic measurements - Measurement of flux and permeability - Hibbert’s magnetic standard - Fluxmeter - Hall Effect Gaussmeter - Ballistic galvanometer - BH curve and permeability - Measurement of bar and ring specimen - Hysteresis measurement - Core loss and measurement with Lloyd - Fisher square

Text books

1. Sawhney A.K., *A course in Electrical & Electronic Measurements & Instrumentation*, Dhanpat Rai.
2. Golding E.W., *Electrical Measurements & Measuring Instruments*, Wheeler Pub

References

1. Cooper W.D., *Modern Electronics Instrumentation*, Prentice Hall of India
2. Stout M.B., *Basic Electrical Measurements*, Prentice Hall
3. Harris F.K., *Electrical Measurement*, John Wiley
4. Oliver & Cage, *Electronic Measurements & Instrumentation*, McGraw Hill
5. Baldwin C.T., *Fundamentals of Electrical Measurement*, Lyall Book Depo

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 404 :ELECTRONICS II

3 hours lecture and 1 hour tutorial per week

Module 1: Concepts of Feed back (13 hours)

Basics – negative and positive feed back – loop gain – types of feed back – analysis of the advantages of negative feed back – stability and positive feed back – analysis of voltage series, voltage shunt, current series, current shunt, feed back circuits of BJT's

Oscillators basics bark hausen's criterion – phase shift oscillators- wein bridge oscillators – crystal oscillators.

Module II: Linear Op amp Circuits (13 hours)

Operational amplifier - Ideal opamp properties - Properties of practical opamps - Different stages in an opamp - Internally compensated and externally compensated opamps - Slew rate - Offsets - Analysis of opamp circuits using ideal opamp model - Concept of virtual short and its relation to negative feedback - Non inverting amplifier - Gain bandwidth product - Voltage follower - Inverting amplifier - Summing amplifier - Subtracting circuits - Instrumentation amplifier - Voltage to current converter for floating and grounded loads - Opamp integrator - Opamp differentiator - Series voltage regulators - Monolithic regulators - Three terminal regulators - Regenerative comparator circuits using opamps - Comparator IC LM311 and its applications - Square, triangle and ramp generator circuits using opamps and comparator ICs - Effect of slew rate on waveform generation - Principles of VCO circuits.

Module III: Nonlinear IC Applications (13 hours)

Opamp based astable and monostable circuits - Precision half wave and full wave rectification using opamps - Log and anti-log amplifiers and applications - Analog multiplier based on log/antilog amplifiers.- Phase locked loops – Principles - Lock and Capture ranges - Capture process - Loop filter - PLL dynamics under locked condition - Study of NE565 - Applications of PLL in signal reconstruction - Noise rejection - Frequency multiplication - Frequency synthesis - FSK demodulation - FM demodulation - Line synchronization etc. Timer - 555 applications - Active filtering - Butterworth lowpass filter functions - Lowpass filter specifications - Order and cut off frequency of Butterworth function from lowpass specifications - Sallen and Key second order LP section - gain adjustment in Butterworth LP filters - Butterworth high pass filters - Second order wide band and narrow band bandpass filters.

Module IV: Signal conditioning and signal conversion (13 hours)

Analog switches - Sample and hold amplifier - Data conversion fundamentals - D/A conversion - Weighed resistor DAC - R/2R ladder DAC - Current switching DAC - Multiplying DAC - Bipolar DACs - A/D conversion - Quantiser characteristics - Single slope and dual slope ADCs - Counter ramp ADC - Tracking ADC - Successive approximation ADC - Simultaneous ADC.

Linear wave shaping - high pass and low pass – Responses to step, pulse, ramp and square wave inputs.

Text Book:

1. Millman J., *Microelectronics*, McGraw Hill
2. Gayakwad R.A., *OPAMPS & Linear Integrated Circuits*, Prentice Hall of India

Reference books

1. Schilling & Belove, *Electronic Circuits*, McGraw Hill
2. Sedra & Smith, *Microelectronic Circuits*, Oxford University Press
3. Jaeger R.C., *Microelectronic Circuit Design*, McGraw Hill

4. Anvekar D.K. & Sonde B.S., *Electronic Data Converters*, Tata McGraw Hill
5. Clayton G.B., *Operational Amplifiers*, ELBS
6. Frederiksen T.M., *Intuitive Operational Amplifiers*, McGraw Hill
7. Millman & Taub., Pulse Digital and switching waveforms
8. Robert F Coughlin, Operational Amplifiers and Linear Integrated Circuits

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 405 : ELECTRICAL MACHINES I

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Electromagnetic Machines: Fundamental principles - Classification - Generators, motors and transformers - Elements of electromagnetic machines -
DC Machines: Construction - Principle of operation - Magnetic circuit - Flux distribution curve in the air-gap -Armature windings - Lap and Wave Windings - Dummy coils Equalizer connections - Armature reaction - Demagnetising and cross magnetising ampere turns - Commutation - Methods to improve commutation performance

Module II (10 hours)

DC Generators: Working principle - EMF Equation - Types of Excitation - Power flow diagram - Circuit model - Magnetisation characteristics - Process of voltage build up - Terminal characteristics - Control of terminal voltage - Parallel operation - Applications

Module III (14 hours)
DC Motors: Working principle - Back EMF - Torque and speed equations - Power flow diagram - Circuit model - - Performance characteristics – Applications - Starting methods - Design of starters - Methods of speed control -Solid state speed controllers (Block Diagram) Testing - Swinburne's test - Hopkinson's test - Separation of losses - Retardation test - Permanent magnet DC motor

Module IV (16 hours)
Transformers: Types and construction - Principle of operation - Magnetising current – Harmonics - Ideal and real transformer - Dot convention - Current and voltage ratio - Equivalent circuit - Phasor diagram - Per unit impedance - OC and SC test Losses - efficiency and regulation - All day efficiency - Sumpner's test - Parallel operation - Tap changing - Switching transients - Auto transformers - Voltage and current relationships - Saving of copper - Different connections of three phase transformers - Notations - Scott connection - Cooling methods - Three winding transformer.

Text Books

1.Clayton & Hancock, *Performance & Design Of DC Machines*, ELBS
2.Dr.P.S.Bhimbra, Electrical Machinery, Khanna Publishers
3.Dr.K.Murukesh Kumar , DC Machines & Transformers, Vikas Publishing House Pvt Ltd.

Reference books

Langsdorf A. S., *Theory of DC Machinery*, McGraw Hill
Nagarath I. J. & Kothari. D. P., *Electric Machines*, Tata McGraw Hill
Fitzgerald,Charles Kingsley, Stephen Dumas, Electrical Machinery, Tata McGraw Hill
Chapman S.J., *Electric Machine Fundamentals*, McGraw Hill.
Toro V.D., *Electrical Machines & Power Systems*, Prentice Hall.
J.B.Gupta, Theory and Perfomance of Electrical Machines, S.Kataria and Sons.
Charles Hubert, Electric Machines., Pearson Education.

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 406 LINEAR SYSTEM ANALYSIS

3 hours lecture and 1 hour tutorial per week

Module I: System concepts and modelling of systems (11 hours)

Systems – Subsystems - Elements - Systems approach - Classification of systems - Static and dynamic systems - Linear and Nonlinear Systems - Distributed and lumped systems - Time invariant and time varying systems - Stochastic and deterministic systems - System modeling and approximations - Superposition principle - Homogeneity and additivity - Modelling of electrical systems - Active and Passive elements - Resistance inductance and capacitance - dynamic equations using Kirchhoff's current and voltage laws. RL, RC and RLC circuits and their dynamic equations - Block diagrams and signal flow graphs - Masons gain formula

Module II: Modelling of non-electrical systems (11 hours)

Modelling of translational and rotational mechanical systems - Differential equations for mass spring dashpot elements, D'Alembert's principle - Rotational Inertia - Stiffness and bearing friction - Gear trains - Equivalent inertia and Friction referred to primary and secondary shafts - Dynamic equations for typical mechanical systems - Electromechanical Analogues - Force-current and force-voltage analogue - Capacitance and Resistance of thermal, hydraulic pneumatic systems - Dynamic equations for simple systems - Comparison of electrical, electromechanical, hydraulic and pneumatic systems

Module III (16 hours)

Fourier series

Fourier series representation of non-sinusoidal periodic waveforms – Fourier coefficients -Determination of coefficients - Waveform symmetry - Exponential Fourier Series - Discrete amplitude and phase spectra - Steady state solution of circuits with non-sinusoidal periodic inputs by Fourier Series - Harmonics in three phase sources - Harmonic currents in star and delta connected non-linear loads - Triplen harmonics in three phase voltages and currents

Fourier transforms

Fourier representation of aperiodic signals - Fourier transform and inverse transform - Transform pairs - Properties of Fourier transforms - Continuous amplitude and phase spectra - Frequency response function - Impulse response and its Fourier transform - Relation between Laplace transforms and Fourier transforms - Power spectral density - Energy spectral density - Parseval's theorem - Signal transmission systems - Signal distortion - Bandwidth requirement for signal transmission

Module IV: Transfer function and time domain analysis (12 hours)

Review of Laplace transforms - Impulse response - Convolution theorem and integral - Response to arbitrary inputs - Transfer function of typical systems discussed in Module I - Time domain analysis - Test Inputs - Step - velocity and ramp inputs - Transient and steady state response - First and second order - under damped and over damped responses - Maximum Overshoot - settling time - Rise time and time constant - Higher order systems - Steady state error - Error constants and error different types of inputs

Text books

1. Cheng D.K. Addison Wesley, *Linear Systems Analysis*, Addison Wesley
2. Tripati J.N., *Linear Systems Analysis*, New Age International
3. Nilson, Electric Circuits, Adison Wiley.
4. Umesh Sinha, Electric Circuit Theory, Network Analysis & Synthesis, Sathya Prakash

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 407(P) MECHANICAL ENGINEERING LAB

EE04 408(P) : ELECTRICAL MEASUREMENTS LAB

3 hours per week

1. Determination of B-H curve of an iron ring specimen
2. Calibration of magnetic flux meter using standard solenoid and search coil and Hibbertz's magnetic standard
3. Measurement of resistance using Wheat stone's bridge and Kelvin's double bridge
4. Measurement of self/mutual inductance and coupling coefficient of iron cored coil and air cored coil

5. Calibration of dynamometer type wattmeter, using precision type vernier potentiometer
6. Extension of range of ammeter/voltmeter and calibration of the extended meters using standard ammeter/voltmeter
7. Extension of range of a dynamometer type wattmeter using CT/PT and calibration of the extended meter using a standard wattmeter
8. Calibration of single-phase energy meter by direct loading and phantom loading at various power factors
9. Calibration of 3 phase energy meter using standard wattmeter
10. Measurement of capacitance using Schering bridge
11. Determination of hysteresis loop of an iron ring specimen using 6 point method and CRO
12. Measurement of branch voltages in a series RLC circuit using A.C potentiometer

Sessional work assessment Lab practicals & record = 30 2 tests 2x I 0 = 20 Total marks = 50

EE04 502 ELECTROMAGNETIC FIELD THEORY

Module – 1 (12 hours)

The Electric Field - Co-ordinate transformation, Vector fields, Divergence Theorem – Stokes Theorem, Static Electric field : Electric flux, Gauss's law, Electric scalar potential, Electric dipole moment, Electric field polarization, condition at boundary between dielectrics, method of images, Capacitance of isolated sphere, Capacitance between co-axial cylinder, Capacitance between parallel wires, Energy density in static field – Solution of Laplace's and Poisson's equation in electrostatics

Module – 2 (12 hours)

The Magnetic Field- : Steady magnetic field, Conduction current, Conduction current density, Biot-Savart's Law and Ampere's Law, Vector potential Concept of inductance, Inductance of solenoid, toroid Concept of resistance, magnetic moment, Torque on a loop, transmission lines Electromagnetic induction – Faraday's law.

Module – 3 (14 hours)

Maxwell's Equations - Continuity equation, Displacement current, Maxwell's equation, Plane waves, Poyinting vector and Poyintings theorem, solutions for free space condition, wave equation for a conducting medium, Harmonically varying field, wave polarization, linear, elliptic and circular polarization

Module – 4 (14hours)

Waves and Transmission Lines - Wave equation on transmission line. Co-axial and two wire transmission lines. Phase velocity and group velocity, Characteristic impedance, reflection coefficient, Standing wave ratio, Impedance matching, stub matching, Smith chart .Reflection and transmission of plane wave at boundaries, continuity equation at boundaries, dielectric – dielectric boundary, dielectric – conductor boundary, Law of reflection, Law of refraction(Snell's law),Concept of Brewster's angle.

Text books

1.W. H. Hayt -Engineering Electromagnetics(Mc Graw Hill, Kogakusha
2.David K. Cheng -Field and Wave Electromagnetics , Pearson Education

References

1. John D. Kraus - Electromagnetics (Mc Graw Hill)
2.Mattew N.O Sadiku - Elements of Electromagnetics(Addison – Wesley,2-nd edition)
3.B. Premlet -Electromagnetic Theory with Applications (Phasor Books, Kollam)
4.Guru & Hiziroglu -Electromagnetic field theory – Fundamentals
5.Pramanik - Electromagnetism, Theory and Application, Prentice Hall of India.

Sessional work assessment

Assignments	2 x 10 = 20
2 Tests	2 x 15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.

Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.

Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.

Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.

Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one.

EE04 503 PULSE AND DIGITAL ELECTRONICS

3 hours lecture and 1 hour tutorial per week

Module – 1 (13 Hours)

Pulse Circuits

Forward Recovery and Reverse Recovery of Diodes, Switching Times of Diode, Switching Behavior of Transistors-Switch-on time components-resistive switching and clamped inductive switching of BJTs and switching times-Storage time and Schottky BJTs-Bistable Circuit-Symmetrical and Asymmetrical triggering of Bistable-Collector Coupled Monostable-Collector Coupled Astable-Transistor Schmitt Trigger Circuit-Voltage Sweep Errors-Constant Current Sweep Circuit-Miller Sweep using Opamps-Current Sweep Generation.

Module – 2 (15 Hours)

Logic Families Ideal Logic Gates-Truth Tables of basic gates-Logic Levels-Noise Margin-Basic Boolean algebra-De Morgan's Theorems-Different Logic Families- Comparison- Tristate logic.

Combinational Circuits

Number Systems-Boolean Functions-Canonical and Standard forms-Simplification of Boolean Functions by Karnaugh Map up to five variable map-NAND, NOR, EX-OR & EX-NOR implementation – Codes and Code Converters – Multi Level NAND Circuits-Multi Level NOR Circuits- Adders-Subtractors-Signed and unsigned numbers-one's complement and two's complement-BCD Adder-Magnitude Comparator-BCD Multiplier-Decoders and Encoders-Multiplexers and Demultiplexers- Implementation of Combinational Logic by using Multiplexers, ROM, PLA and PAL

Module – 3 (13 Hours)

Sequential Circuits and Memories

Flip Flops - RS , JK , T and D Flip Flops - Triggering of Flip Flops – Registers - Shift Registers - Ripple Counters - Synchronous Counters - Ring Counter - Johnson Counter - Memories -ROM , Static and Dynamic RAM, Read/Write Memory , EPROM , EEPROM, Memory Decoding. Analysis of clocked sequential circuits-state tables and state diagrams-state reduction and assignment-Flip Flop Excitation Tables-Algorithmic State Machine Design Procedure-Design of Modulo-m counters-Introduction to ASM Charts.

Module – 4 (11 Hours)

Computer Organization fundamentals- basic micro computer elements- data bus- control bus- address bus - arithmetic logic units- programme counter- flag- instructions- single and multibyte instructions- basic micro computer operations – Introduction to 8085 microprocessor – Architecture – Programming.

TEXT BOOK:

1.Millman & Taub	Pulse, Digital and Switching Waveforms
2. Gaonleer R S	:Microprocessor Architecture – Programming and Application

REFERENCE BOOKS

1.	Richard C Jaeger :	Microelectronic Circuit Design
2.	M.Morris Mano :	Digital Design
3.	Taub & Schilling :	Digital Integrated Electronics
4.	Morris & Miller :	Designing with TTL Integrated Circuits

Sessional work assessment

Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

EE04 504 POWER SYSTEMS – I

3 hours lecture and 1 hour tutorial per week

Module 1 (13 Hrs)
Conventional & non-conventional sources of energy – thermal, hydroelectric, diesel, nuclear power plants - solar, wind geothermal, tidal, MHD power Generation.[Layout & description needed] – Power Plant economics-load factor – demand factor – diversity factor – plant factor – tariff – depreciation – economics of pf improvement – capacity of phase advancing plant.

Module 2 (16 Hrs)
Overhead Transmission Systems: Arrangement of conductors, transmission line supports and their location ,economic span, choice of transmission voltage, line insulation types, string efficiency, impulse ratio, arcing horns and rings, failure of insulation.
Corona: Disruptive critical voltage, advantages and disadvantages of corona.
Underground cables: Different types, insulation resistance, capacitance of single core cables, grading of cables, capacitance of three core cables, sheath effects, laying and testing of cables.

Module 3 (10 Hrs)
Distribution systems – classification and arrangement of distribution systems – Kelvin's law – Voltage drop calculations in radial and ring mains – comparison of different systems - DC ,AC - single phase , three phase 3 wire -4 wire systems – calculation of sag and tension
Module 4 (13 Hrs)
Performance of Transmission Lines: Calculation of transmission line inductance and capacitance, GMD and GMR, bundled conductors, transposition, representation of short, medium and long lines, ABCD constants ,Effect of capacitance: Nominal **T** and π methods of calculations, rigorous solution of long lines., power flow through a transmission line.

Text Book
1. Sony, Gupta, Bhatnagar - A Course in Electrical Power, Dhanpat Rai and Sons.
2. C.L.Wadhwa - Electric Power Systems, Wiley Eastern Ltd.

References:
1.Turan Gonen - Electric Power Transmission System Engineering, John Wiley
2. S.L.Uppal - Electrical Power, Khanna Publishers.
3. A.S.Pabla - Electric Power Distribution Systems, Tata McGraw Hill.

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 505 ELECTRICAL MACHINES II

3 hours lecture and 1 hour tutorial per week

Module I (14 Hours)

Alternators: Construction – Principle of operation - Type and selection - Emf Equation - Distribution Factor - Chording Factor - Armature reaction – Voltage regulation - Predetermination of voltage regulation - EMF method -Synchronous reactance and short circuit ratio - MMF method - Potier method - Phasor diagrams - Two reaction theory - modified phasor diagram - Analysis by two reaction theory - Slip Test - Reluctance Power - Power angle characteristics - Sudden short circuit - Current waveforms - Transient and subtransient reactances - DC excitation - Static excitation - Brush less excitation and self excitation - Losses and Efficiency..

Module II (16 Hours)

Synchronous generator: Active and reactive power control - Parallel Operation - Load sharing - effect of armature reaction - Automatic synchronizing - Effect of change of fuel supply - Alternator connected to infinite bus - Governor characteristics - Synchronizing power and torque - Two identical generators in parallel - Locus of generated voltage for constant real power and variable excitation - Automatic voltage regulators.
Synchronous motor: Principle of operation - Equivalent circuit -Torque and Power relations - Effect of load changes on synchronous motor - Mechanical load diagram - Armature current as function of power developed and excitation -V curves - Inverted V curves - O curves -Transition of a machine from generator mode to motor mode - Phasor diagram - Minimum excitation for given power – Hunting - Periodicity of hunting – Suppression - Different starting methods.

Module III (12 Hours)

Theory of Induction Machines: 3 phase Induction motors - construction - Principle of operation - Flux and MMF wave in induction machines - Rotor MMF and production of torque - slip and frequency of rotor current - Phasor diagram - Equivalent circuit - Mechanical power developed - Maximum torque -Torque slip characteristics - Losses and power flow - Single phasing - No-load and blocked rotor tests - The circle diagram – Effect of deep bar and double cage rotors - Effects of air gap flux harmonics - Cogging and crawling - Line excited and self excited induction generators -Principle of Operation and applications - Single phase Induction motors - Double revolving field theory - equivalent circuit – Principle of operation of linear induction motor - Applications of all types of induction motors.

Module IV (10 Hours)

Starting and Speed control of Induction Motors: Starting methods for three phase Induction motors - Direct on line starting - Auto transformer starting - Star delta starting - Rotor resistance starting - Starters and contactors - Speed control - Basic methods - Voltage control - Frequency control - Rotor resistance control - Pole changing - Static frequency conversion and slip power recovery scheme - starting methods of single phase induction motors.

Text Books

1. M.G.Say , Perfomance and Design of AC Machines, Pitman ELBS

2. Dr.P.S.Bhimbra, Electrical Machinery ,Khanna Publishers.

3.Dr. K.Murukesh Kumar, Induction and Synchronous Machines, Vikas Publishing House Pvt Ltd

Reference Books

Fitzgerald A.E. and Kingsley : Electrical Machinery, Mc Graw Hill.
Langsdorf A.S. : Theory of A.C Machinery, Mc Graw Hill.
Nagrath I.J. and Kothari D.P. : Electric Machines, Tata Mc Graw Hill.
Stephen J Chapman : Electric Machinery Fundamentals, Mc Graw Hill.
Vincent Del Toro : Electrical Machines and Power Systems, Prentice Hall.
Charles Hubert,. Electric Machines ,Pearson Education.
J.B.Gupta ,Theory andPerfomance of Electrical Machines,S.Kataria and Sons

Sessional work assessment

Assignments 2 x 10 = 20 marks
2 Tests 2 x 15 = 30 marks
Total marks = 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.

Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.

Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.

Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.

Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one.

EE04 506 ELECTRICAL ENGINEERING MATERIAL SCIENCE

3 hours lecture and 1 hour tutorial per week

MODULE I (13 hours)

Conducting materials: Review of metallic conduction on the basis of free electron theory - Fermi-Diac distribution - Variation of conductivity with temperature and composition - Contact potential - Materials for electric resistances, brushes of electrical machines, lamp filaments, fuses and solders.

Semiconductors: Compound semiconductors - Basic ideas of amorphous and organic semiconductors

Magnetic materials: Classification of magnetic materials - Ferromagnetism - Hysterisis curve - Ferromagnetic domains (qualitative explanation only) - Curie - Weiss law - Hard and soft magnetic materials and applications - Ferrites - Magnetic materials used in electrical machines, instruments and relays.

Module II (13 hours)

Dielectrics: Dielectric polarization under static fields - Derivation of the expression for electronic polarization in monoatomic gases - Expressions for electronic, ionic and dipolar polarizations in polyatomic gases - Derivation of expression for polarization in solids and liquids - Clausius - Mosotti relation - Behaviour of dielectrics in alternating fields - Complex dielectric constant - Dipolar relaxation - Dielectric loss - Ferroelectricity - Main features - Domain theory and explanation of hysterisis curve - (qualitative explanations only)

Module III (13 hours)

Dielectric breakdown: Mechanism of breakdown in gases, liquids and solids - Factors influencing dielectric strength - Capacitor materials .

Insulating materials: Good insulator properties and classification on temperature basis - Common insulator materials used in electrical apparatus - 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 IV (13 hours)

Solar energy materials: Photothermal conversion - Use of coatings for enhanced solar thermal energy collection - Solar selective coatings - Cold mirror coatings - Heat mirror coatings - Antireflection coatings - Photovoltaic conversion - Solar cells - Silicon, Cadmium sulphide and Gallium arsenide - Magnetic resonance - Nuclear magnetic resonance - Electron spin resonance - Ferromagnetic resonance .

Text books

1. Indulkar C.S.& Thiruvengadam S., *An Introduction to Electrical Engineering Materials*, S. Chand
2. Seth S.P.& Gupta P.V., *A Course in Electrical Engineering Materials*, Ganapath Rai

Reference:

1.A.J.Dekker, Electrical Engineering Materials,Prentice Hall of India.
2.Agnihotri .O.P and Gupta B.K, Solar Selective Surfaces, John Wiley.
3.Tereev, Electrical Engineering Materials, Mir Publishers.
4.Arumugham M, Material Science, Anuradha Agencies.

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 507 (P) ELECTRONICS LABORATORY II

3 hours practical per week

1. OPAMP circuits – Design and set up of inverter, scale changer, adder, non-inverting amplifier, integrator and differentiator.
2. OPAMP comparator – Design and set up of Schmit Trigger – Window comparator.
3. Phase shift and Wein's Bridge oscillator with amplitude stabilization using OPAMPs.
4. Waveform generation – Square, triangular and sawtooth wave form generation using OPAMPs.
5. Precision rectification – Absolute value and averaging circuit using OPAMPs.
6. Second order LP and BP filters using single OPAMP.
7. Set up Analog to Digital converter (a) Successive Approximation method (b) Dual Slope Method.
8. a) Using Cd 40447 IC design and set up gated/ungated astable and monostable multivibrators.
   b) Using Cd 4093 Schmitt NAND IC design and set up astable and monostable.
9. Design of Half adder and half subtractor circuits with NAND gates using mode control.
10. a) Design and realization of ripple counter using JK flip-flop. b) Cascading of ripple counters.
11. Design and realization of Johnson & Ring Counter using a) JK Flip Flop b) Shift Register
12. Synchronous UP/DOWN Counter design and realization.
13. IC 555 Applications.

Sessional work assessment

Lab practical & record	= 30
2 tests	2x10 = 20
Total marks	= 50

EE04 508(P) ELECTRICAL MACHINES LAB – 1

DC MACHINE

1. Obtain the open circuit characteristic at rated speed.
   1) Predetermine the OCC at different speeds.
   2) Find the critical resistance and the critical speed for a given field circuit resistance.

2. Load test on DC shunt generator.
   1) The performance characteristics by conducting load test
   2) Deduce the armature reaction curve.

3. Break test on Dc shunt and series motor.

Objectives

Plot the following characteristics.

a) Output vs Efficiency
b) Output vs Line current
c) Output vs Speed
d) Speed vs Torque
e) Line current vs Torque

4. Perform Swinburne's test on a DC shunt machine.

Objectives

Predetermine the armature current and percentage efficiency when the machine operates as a motor and as a generator delivering 1/4,1/2,3/4 and full rated output.

5. Hopkinson's Test on a pair of DC machines.

Objectives

Predetermination of the efficiency of the machine working as a motor and generator under various load conditions on the generator.

6. Perform Retardation test on a DC machine .

Objectives

1) Separate the losses.
2) Find the moment of inertia of the rotating system.

7. By conducting a no load test at different excitations on DC shunt motors.

Objectives

Plot the efficiency vs output and % regulation vs output characteristics.

8. O.C and S.C test on the single phase transformer. Pre-determination of the following.

Objectives

1) Efficiency at 1/4,1/2,3/4 and full loads at 0.5,0.86 and unity p.f.
2) Regulation at same loads and p.f's.
3) Equivalent circuit referred to HV and LV sides.
4) Upf load at which efficiency is minimum.

9. At normal voltage and frequency separate the hysteresis and eddy current losses of a single phase transformer.

10. Conducting Sumpner's test

Objectives

Predetermination of efficiency and regulation at various loads and p.f.

11. Scott connection of the single phase transformers to find performance under various load conditions at upf and plotting the efficiency curves with

1) Main transformer secondary alone loaded.
2) Teaser transformer secondary alone loaded.
3) Balanced loading
4) Unbalanced loading.

Sessional Work Assessment	
Laboratory practicals and record	=30
Tests	=20
Total marks	=50

EE04 601 MICROPROCESSORS AND MICROCONTROLLERS

3 hours lecture and 1 hour tutorial per week

Module 1 (14 hours)
Architecture of Intel 8086/8088 processors – Memory Segmentation – Addressing nodes – Introduction set – Assembly language programming – Assembler directives – Basic concepts of modular programming – minimum node configuration of 8086 – Interrupt system of 8086 – maximum node – Queue station and lock facility – Multi processor Configuration – Co Processor – loosely coupled and closely coupled configurations – 8087 numeric data processor - 8089 Input Output Processor

Module 2 (Hours 12)
Interfacing – Programmable Peripheral Interface (8255) – Serial communication – Programmable communication interface(8251) – Programmable timer (8253) – DMA controller (8257) – Interrupt controller (8259) – key board and display interface (8279) – Data acquisition system – interfacing of A/D and D/A converters.

Module 3 (Hours 12)
Advancements in microprocessor Architecture – 80286 processor Architecture – real addressing mode – protected virtual addressing mode – 80286 Bus Interface – Instruction set - features – Introduction to 80386 and Pentium processors – Special features – (Basic Concepts only)

Module 4 (Hours 14)
Micro controllers – overview of 8051 Microprocessor – Architecture – Basic Assembly language Programming concepts – Arithmetic and Logic Operators – Jump and CALL instructions – interfacing memory to 8051 – 8051 micro controller design – Application

Text Books

1. Lio Y C & Gibson.C.A Micro computer Systems – 8086/8088 family
2. Gaonleer R.S Micro Processor Architecture – Programming and Application
3. Brey B.B The Intel Microprocessor system – Architecture, Programming and interfacing
4. Ayaila K.J, The 8051, Micro controller – Architecture – Programming and Application

Reference Books

5. Hall DV Microprocessor & Interfacing
6. Ray A.K & Bhun chandi K.W. Advanced microprocessor and peripherals
7. Avter System – Microprocessor and Application
8. Mohammed Ali Ma and Janva Githspie

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 602 SOFTWARE ENGINEERING

3 hours lecture and 1 hour tutorial per week

Module I: 10 Hours

Introduction: FAQs about Software Engineering, professional and ethical responsibility.. The Software Process: Life cycle models, iteration, specification, design and implementation, validation, evolution , automated process support. Software Requirements: Functional and non-functional requirements, user requirements, system requirements, SRS. Requirements Engineering Processes: Feasibility studies, elicitation and analysis, validation, management.

Module II: 16 Hours

Architectural design: System structuring, control models, modular decomposition, domain-specific architectures, distributed systems architecture. *Object-oriented Design:* Objects and classes, an object oriented design process case study, design evolution. *Design with Reuse:* Component-based development, application families, design patterns. *User Interface Design:* Design principles, user interaction, information presentation, user support, interface evaluation.

Module III: 14 Hours

Dependability: Critical systems, availability and reliability, safety, security, critical systems specifications, critical system development. *Verification and Validation:* Planning, software inspection, automated static analysis, clean room software development. *Software Testing:* Defect testing, integration testing, object-oriented testing, testing workbenches, critical system validation. *Software Evolution:* Legacy systems, software change, software maintenance, architectural evolution, software re-engineering, data re-engineering.

Module IV: 12Hours

Software prototyping: Prototyping in the software process, rapid prototyping techniques. Formal specification: Formal specification in the software process- Interface specification- Behavior specification. Software Project Management: Project planning, scheduling, risk management. Managing People: Group working, choosing and keeping people, the people capability maturity model. Quality Management: Quality assurance and standards, quality planning, quality control, software measurement and metrics. Process Improvement: Process and product quality, process analysis and modeling, process measurement, process CMM.

Text Book

1. Ian Sommerville, *Software Engineering*, 6/e, Pearson Education Asia, 2001.

References

1. R. S. Pressman, *Software Engineering*, 4/e, McGraw Hill, 1997.
2. R. Mall, *Fundamentals of Software Engineering*, Prentice Hall of India, 2000.
3. A. Behferooz and F.J. Hudson, *Software Engineering Fundamentals*, Oxford University Press, 1996.
4. P. Jalote, *An Integrated Approach to Software Engineering*, Narosa, 1993.

Sessional work assessment

Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

EE04 603CONTROL SYSTEMS I

3 hours lecture and 1 hour tutorial per week

Module I: State space analysis and stability of systems (14 hours)

Concept of state - State space and state variables – comparison with transfer function approach - State equations for typical electrical and mechanical and electromechanical systems - Representation for linear time varying and time invariant systems - Solution of state equation for typical test inputs - Zero state and zero input response - Concept of stability - Bounded input bounded output stability.

Module 2: System models – Discrete time (12 hours)

Sample data control systems – sampling process – Mathematical analysis of the sampling process – Data reconstruction and hold circuits – Zero and first order hold – z-transform – Inverse z-transform – Solution of difference equations – Pulse transfer function – System time response - Discrete time state equations– z-transform decomposition – Discrete time state models. Stability in the z-plane – Bilinear transformation and the w-plane - Routh's stability criterion for discrete data systems – Jury's stability test.

Module 3: Time and frequency domain analysis (12 Hours)

Root locus method – Construction of root locus – Effect of poles and zeros and their locations on the root locus – Extension to discrete data systems.
Frequency response representation – Polar plot – Logarithmic plots – Frequency domain specifications – Non-minimum phase systems – Transportation lag.
Nyquist stability criterion – Stability from polar and Bode plots – Relative stability – Gain margin and phase margin – M-N circles – Nichol's chart.
Extension of frequency response methods to discrete-data systems.

Module 4: Design using conventional methods (12 Hours)

Cascade compensation – PI, PD and PID control – Lead, lag and lag-lead compensation using RC networks – Design of lead, lag and lead-lag compensators using Frequency response and root locus methods – Design of discrete-data systems using frequency response and root locus methods – Effect of sampling period on time response.

Text Books

1. K. Ogata : Modern control engineering, Prentice Hall
2. K. Ogata : Discrete-time control systems, Prentice Hall
3. Kuo : Automatic control systems, Prentice Hal
4. Kuo : Analysis and synthesis of sampled data systems,

References:

1. Nagarath and Gopal : Control system engineering, Wiley Eastern
   Prentice Hall
2. Sushil Das Gupta : Control System , Khanna Publishers
3. Gibson and Tutter : Control system components, Mc Graw Hall

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 604 POWER SYSTEMS II

3 hours lecture and 1 hour tutorial per week

Module 1(12 Hours)
Representation of power systems – one line diagrams , impedance and reactance diagrams ,per unit and percent quantities , primitive networks , y-bus matrix formulation by singular transformation and Direct determination , z-bus matrices – Building algorithm.

Load flow studies : problem formulation ,classification of buses , Gauss –Siedal method, Newton -Raphson method and fast decoupled load flow method.

Module 2 (14 Hours)
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 .
Speed governing mechanism : speed governing of turbo generator , load sharing and governor characteristics , transfer function model , load frequency Control ,Automatic voltage regulation

Module 3 (12 Hours)
Short circuit studies : Faults on power systems , three phase to ground faults,SLG , DLG , LL faults, Sequence impedance and sequence networks ., symmetrical component methods of analysis of unsymmetrical faults at the terminals of an unloaded generator , Faults on power systems ,fault analysis using z-bus , faults through impedance , short circuit capacity of a bus and circuit breaker rating .

Module 4(14 Hours)
Power system stability studies : steady state , dynamic and transient stability , electrical stiffness, Swing equation, inertia constant , equal area criterion, Step by step method of solution of swing equation , factors affecting stability.
Voltage stability problem , causes and improvement methods
.

Text books
Stevenson Jr : Elements of power system analysis: Tata Mc Graw Hill.
J.Nagrath & D.P.Kothari: Modern Power systwem analysis: Tata Mc Graw Hill.

References

1.O.I. Elgard : Electric energy system theory- an introduction : Tata Mc Graw Hill.
2. B.F.Wollenberg: Power System Engineering
3. B .R.Gupta :Power system analysis and design: Wheeler Publishing & Co.NewDelhi.

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 605 ELECTRICAL ENGINEERING DRAWING

1 hour lecture and 3 hours drawing per week

Module I (10 Hours)
DC Windings
Simplex lap and wave dc armature windings.

AC Windings
Mush and concentric type single layer three phase ac armature windings.
Simplex lap and wave, integral and fractional slot, double layer three phase ac armature windings.

Introduction to AUTOCAD- Developed winding diagrams(Auto Cad not included for Examination)

Module II (14 Hours)
Transformers:
1.Sectional plan and elevation of a transformer limb with windings.
2.Sectional plan and elevation of the core assembly of a power transformer .
3.Sectional plan and elevation of a distribution transformer tank with its accessories .
4. Sketches of capacitor and oil filled type transformer bushings.
5.Layout and single line diagram of a distribution transformer.

Substation Layouts:

1.Layouts and single line diagrams of outdoor and indoor substations .
2.Layout of a 220KV substation.
3.Layout of a captive power substation.
4.Single line diagram of a distribution centre.

Module III (12 Hours)
DC Machines:
1.Sectional front and side elevation of armature with commutator of a dc machine.
2.Sectional front and side elevation of the yoke and pole assembly with field winding of a dc machine.
3.Sectional front and side elevation of an assembled dc Machine.

Module IV(16 hours)
Alternators:
1.Sectional front and side elevation of a water wheel rotor assembly with winding.
2.Sectional front and side elevation of a salient pole alternator.
3.Sectional front and side elevation of a Turbo alternator.
4.Sketches of the methods of pole fixing and slot details of Turbo and Water wheel alternators**.**

Induction motors:
1. Sectional front and side elevation of a slip ring induction motor.
2. Sectional front and side elevation of a squirrel cage induction motor.

Text Book
1.Narang K.L.: A Text Book of Electrical Engineering Drawing, Tech India Publications
2. C.R.Dargan ,Electrical Drawing and Estimation ,New Asian Publishers

Reference Books

1. Bhattacharya S.K. :Electrical Engineering Drawing, Wiley Eastern.
2. Clayton and Hancock : Performance and design of dc machines, ELBS.
3. Sawhney: Electrical Machine Design, Dhanpath Rai &Sons.
4. Say M.G. : Performance and design of AC machines, Pitman, ELBS.

Sessional work assessment

Assignments (Class work)	= 30
1 Test	= 20
Total marks	= 50

University examination pattern

Q I - 2 questions A and B of 25 marks from module I with choice to answer any one.

Q II - 2 questions A and B of 25 marks from module II with choice to answer any one.

Q III - 1 question of 50 marks from module III or module IV .(No choice)

EE04 606 ELECTRICAL MACHINE DESIGN

3 hours lecture and 1 hour tutorial per week

Module I (14 Hours)

DC Machines: 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, commutator, interpoles, compensating winding and brushes - Carter's coefficient - Real and apparent flux density – Design examples.

Module II (14 Hours)

Transformers: Single phase and three phase power transformers - Output equation - Main dimensions - Choice of specific electric and magnetic loadings- Design of core, LV winding, HV winding, tank and cooling tubes - Prediction of no load current, forces on winding during short circuit, leakage reactance and equivalent circuit based on design data – Design examples - Design principles of current transformers - Temperature rise calculations -Continuous and intermittent rating.

Module III (12 Hours)
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 (12 Hours)
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.

Text Book

Sawhney A.K : Electrical Machine Design, Dhanpath Rai &Sons

Reference Books

1. Clayton and Hancock : Performance and design of dc machines, ELBS.
2. Say M.G. : Performance and design of AC machines, Pitman, ELBS.
3. Bhattacharya ,. Electrical Machine Design,

Sessional work assessment

Assignments	2 x 10 = 20
2 Tests	2 x 15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.

Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.

Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.

Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.

Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one.

EE04 607(P) ELECTRICAL MACHINES LABORATORY – II

3Hours Laboratory per Week

1.No load and Blocked rotor tests on a 3 Ø squirrel cage Induction motors and slip ring Induction motors.

1. Conduct no load blocked rotor tests on both types of M/cs.
2. Determine the equivalent circuit parameters and draw the equivalent circuit.
3. Draw the circle diagram and therefrom predetermine the performance characteristics.

2. Load tests on 3 Ø squirrel cage and slip ring Induction motors.
    1. Conduct the brake test on both types of machines.
    2. Obtain and plot the various performance characteristics.
    3. Find the KVAR required to improve the power factor to 0.95 at various loads and find the relation.

3. Performance of Induction machine as a generator and motor.
    1. To operate the given 3 Ø Induction machine coupled with a DC machine as
        a) An Induction motor
        b) An Induction generator working in supply mains.

    2. To conduct load test in both generating and motoring modes and plot the following characteristics on the same graph – efficiency, line current, power factor and slip as a function of output power.

    3. Plot output vs slip and obtain hysteresis, power and corresponding torque.

4. Pole changing as a method of speed control and load test on pole changing induction motor .
    1. To study the different modes of operation of a 3 Ø pole changing Induction motor.
    1. Perform load test and obtain the performance characteristics and compare the results obtained for different pole combinations at different load condition.

5. Speed control of 3 Ø Induction motor by variable frequency method..
    1. Plot speed vs frequency characteristics of a 3 Ø cage Induction motor under variable frequency method of speed control, under no load and constant load conditions.
    2.Plot the different load and load conditions parameters.

6. Alternator
    1.Slip test on Salient pole alternator.

Objectives

1.Conduct the slip test on 3 Ø salient pole alternator to obtain direct axis and quadrature axis reactance.
    2. Predetermine the regulation at different loads and power factors and to derive the power vs torque angle diagram

7. V curves of a 3 Ø synchronous machine.

Objectives

1.Synchronise a 3 phase alternator to the supply mains using Dark or Bright lamp method.
2.Plot the V curves and inverted V curves as a generator and motor under no load condition

8. Voltage regulation of a 3 alternator

Objectives

1. Conduct open circuit and short circuit test on a 3 Ø alternator and plot OCC and SCC.
2. Predetermine the voltage regulation at upf, 0.8 pf, 0.5 pf lead and zero pf for half and full load by emf and mmf methods and verify these results by direct loading.

9.Single Phase Induction Motor

Study the different type of single phase Induction machine.
Perform no load and blocked rotor test on a single phase Induction machine and find the equivalent circuit.
Predetermine the performance characteristics.
Conduct speed control of a fan motor by variable voltage method and plot the different characteristics.

Sessional Work Assessment	
Laboratory practicals and record	=30
Tests	=20
Total marks	=50

EE 04 701 – POWER ELECTRONICS

3 hours lecture and 1 hour tutorial per week

Module-I (14 hours)

Silicon Controlled Rectifier-structure- V-I Characteristics- Two transistor analogy- turn-on Characteristics-gate – gate triggering circuits-turn on characteristics- turn-off characteristics-methods of turning off-device specifications and ratings-series and parallel connection of SCRs-structure and characteristics of GTO thyristors, power diodes, power transistors, power MOSFET and IGBT-working of TRIAC

Module-II (13 hours)

Phase control using SCR-single phase half wave and half controlled converters with R and RL loads- single phase fully controlled bridge converter with R and RL loads- output voltage and waveforms-principle of discontinuous operation- fully controlled and half controlled 3 phase bridge converter- output voltage and waveforms- dual converter- Inverters-single phase series and parallel inverters-single phase bridge inverter- 3 phase bridge inverter-120 and 180 operation-PWM inverters.

Module III (13 hours)

Choppers-step down chopper-principle operation-classes of chopper-Jone's chopper and Morgan's chopper-voltage commutated and current commutated choppers- step up chopper-single phase to single phase cycloconverters- principle of operation-single phase ac regulator-R and RL loads.

Module-IV (13 hours)

Switching regulators-buck regulators-boost regulators- buck- boost regulators-cuk regulators- switched mode power supply-principle of operation and analysis- comparison with linear power supply-basic circuit operation-different configurations characteristics and applications

Text Book

1. H. Rashid : Power Electronics , 3rd edition Pearsons Educations
2. Ashfaq Ahmed : Power Electronics for Technology, Pearson Education

References

1. Singh MD & Khandhandani KB: Power Electronics, Mc Graw Hill
2. Dubey.G.K. Thyristorised Power Controllers,
3. Bimbhra: Power Electronics,

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one

Q III-2 questions A and B of 15 marks from module II with choice to answer any one Q IV-2 questions A and B of 15 marks from module III with choice to answer any one QV - 2 questions A and B of 15 marks from module V with choice to answer any one

EE 04- 702 DIGITAL SIGNAL PROCESSING

3 hours lecture and 1 hour tutorial per week

Module-1 (12 hours)

Introduction to signals and systems- classification of signals- basic operations on signals-elementary signals-concept of systems-properties of systems- stability invert ability-time invariance—linearity-causality-time domain description- convolution-impulse response-representation of Linear Time Invariant systems-differential equation and difference equation representation of LTI systems.

Module II (15 hours)

Fourier transform-existence of fourier integral-FT theorems-energy spectral density and power spectral density-frequency response of LTI systems- correlation theory of deterministic signals. Properties of DFT-linear convolution using DFT-Circular convolution -overlap-add method-overlap save method- FFT-decimation in time and frequency algorithms-Butterfly structure.

Module III (12 hours)

Basic filter structure direct form I&II- lattice-ladder structure- parameler quantization effects-
DSP chips- Architecture of DSP Processor-TMS-320 Applications.

Module IV (15 hours)

Digital filer design techniques-design of IIR filler from analog filter-Butterworth and chebyshev filler-design examples-Impulse invariant and bilinear transformation methods- FIR filler design-design of FIR filter using windows- comparison of FIR&IIR filters- finite word length effects in digital filter.

Text books

1. Oppenheim A.V willsky A.S & Nawah S.H. signals and systems, Tatta Mc Graw Hill.
2. Oppenheim A. V& Sehafex R.W-Discrete time signal processing prentice Hall of India
3. Dr. D. Ganash Rao & Satish Tunga-Signals &Systems- A computer based approach - Sangure Technical Publishers Bangolore.

Reference books

1 Proakins J.G. & Manolakins D.G.:Digital signal processing- principles
Algorithms- Applications Prentice Hall of India.
2 Rabiner L.R, Gold B, Theory and Applications of Digital signal processing,
Prentice Hall of India
3 Mitva S.K-Digital signal processing-A Computer Based approach-Tata McGraw Hill

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module

Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III-2 questions A and B of 15 marks from module II with choice to answer any one
Q IV -2 questions A and B of 15 marks from module III with choice to answer any one
QV - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE2K 703 CONTROL SYSTEMS II

3 hours lecture and 1 hour tutorial per week

Module:1 Non-linear systems (12 hours)

Characteristics of non-linear systems – Types of nonlinearities – Phase plane analysis – Construction – Singular points – Classification of singular points.
Describing function analysis – Definition – Describing functions of common non- linearities – Stability analysis – Amplitude and frequency of limit cycle using DF.

Module: 2 Liapunov methods (10hours)

Liapunov stability – Definition of stability, Asymptotic stability and instability – Liapunov second method – Liapunov stability analysis of LTIV continuous time and discrete time systems,methods of construction of Liapunov function for non linear sytems ,Popov's criterion, variable gradient method

Module: 3 Controllability, Observability and optimal control (16 hours)

Concept and criteria for controllability and observability – Transfer function and controllability/ observability – State feed back – Design- for continuous and discrete systems- via pole-placement, state feedback with integral control, state observers.

Introduction to optimal control –transfer function and state variable approaches, state regulator problem, infinite time regulator problem, quadratic regulator problem - Solution of the reduced matrix Riccati equation.
Introduction to Robust control, analysis , design of Robust PID controller

Module: 4 Robust Control and Robotics (14 hours)

Robust control systems- introduction- sensitivity-analysis of Robustness- system with uncertain parameters-design of Robust PID controlled systems.
Introduction to Robotics- The direct Kinematics problem- The inverse Kinematics solution.

Text Book

1. K. Ogata : Modern control engineering, Prentice Hall
2. Nagarath and Gopal : Control system engineering, Wiley Eastern
3. B. C. Kuo : Automatic control systems, Prentice Hall
4. K. Ogata : Discrete-time control systems, Prentice Hall
5. Donald E. Kirk : Optimal control theory, Prentice Hall

7. K.S.Fu, R.C.Gonzalez, C.S.G.Lee : Robotics, Control, Sensing & Intelligence, McGrawhill

References

1. Richard .c. Dorf and R.H. Bishop : Modern control system, Addison Wesly
2. M.N.Bandyopadhyay : Control Engineering Theory and Practice, Prentice Hall

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30

Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 704 POWER SYSTEMS III

3 hours lecture and 1 hour tutorial per week

Module 1 (13 hours)

Circuit Breakers : Principles of operation, different types and their operations, ABCB, oil CB, SF6, vacuum CB, circuit breaker ratings, cause of over voltages, surges and traveling waves, voltage waves on transmission 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 2 (13 hours)

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 busbars, static relays, amplitude and phase comparators, block diagrams of static relays, microprocessor based protective relaying- overcurrent & impedance relays.

Module 3 (13 hours)

Electric Traction: Systems of traction, speed time curve, mechanics of traction, braking, power supply, systems of current collection.

Electric Heating : Advantage of electric heating, resistance and induction arc furnaces, construction and field of application, high frequency power supply and the principle and application of dielectric heating - .

Module 4 (13 hours)

Introduction to SCADA systems - block diagram -communication between various control centres -three level control systems - functions and features.

. Introduction to HVDC transmission – kinds of DC links – comparison with HVAC systems – PQ problems - introduction to FACTS – FACTS controllers – SVC - STATCOM - UPFC

.

Text Books

1 Sunil S Rao :Switch gear protections ; Khanna Publishers(11th edition)

2. Soni, Gupta & Bhatnagar :A course in Electrical Power ; Dhanpat Rai & Sons.

References:

1. A.R.Van.C.Warrington :Protective Relays Vol 1 & 2 ; Chappman & Hall
2. Ravindranath M. Chander:Power System Protection and Switchgear.
3. G. T. Haydt :Electric Power Quality.
4. Badriram : D.N Viswakarma : Power system protection & switchgear .Tata McGraw Hill
5. Narain .G. Hingorani:Understanding FACTS. IEEE PRESS.

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE 04- 705 (A) NUMERICAL ANALYSIS AND OPTIMIZATION TECHNIQUES

3 hours lecture and 1 hour tutorial per week

Module I (14 Hours)

Numerical Analysis - Errors in numerical calculations - sources of errors - significant digits - Numerical solution of polynomial and transidental equations - Bisection method - Regula falsi method - Newton - Raphson method - Fixed point method of iteration - Rates of convergence of these methods - solution of system of algebraic equations - Exact methods - Guass elimination - Crout's triangularization method - Iterative methods - Guass-Jacobi and Guass siedal method - Relaxation method.

Polynomial interpolation - Lagrange interpolation polynomial - Divided differences- Newton divided difference interpolation polynomial - finite differences - operators Δ,δ,V, E - Gregory Newton forward and backward difference interpolation polynomials- central differences - sterlings interpolation formula.

Module II(14 Hours)

Numerical differentiation - Differentiation formula in the case of equally spaced points - Numerical integration - Trapezoidal and Simpsons rules - Compounded rules - errors of interpolation and integration formulae - Numerical solution of ordinary differential equations - single step methods - Taylor series - Eulers and Modified Eulers methods - Picard's iteration method - Runga-Kutta methods (Second ,third and forth order formulae, third and forth order derivations not required) Multi step method - Milne's predictor and corrector formulae.

Module III(12 Hours)

Optimization Methods - Systems of linear equation and inequalities - Basic concepts of linear vector spaces - Mathematical formulation of linear programming problem - Theory of simplex method - Simplex algorithm - Charnes M method - Two phase technique - Duality - Dual simplex method.

Module IV(12 Hours)

Transportation, Assignment and routing problems - Dynamic programming - (Introduction and mathematical formulation only) Belman's optimality principle.

Text Book

1.Dr .M.K.Venkataraman, Numerical Methods in Science and Engineering, National Publishing Company.
2.Kanti Swarup, Gupta and Manmohan, Introduction to Linear Programming, Tata McGraw Hill.

Reference Books

1.S.S. Sastry, Numerical Analysis ,Prentice Hall of India.
2.Gerald, Applied Numerical Analysis, Addison Wesley.
3.Kandaswamy.P,Thilakavathy.K,Gunavathy.K,Numerical Methods,S Chand & Co
4. Hadley G, Linear Programming, Addison Wesley.
5. Dr.M.K.Venkataraman,Linear Programming, National Publishing Company.
6. Garwin .W.W, Introduction to Linear Programming ,McGraw Hill.

Sessional work assessment

Assignments	2 x 10 = 20
2 Tests	2 x 15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.

Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.

Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.

Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.

Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one.

EE04 705(B) MODERN NETWORK SYNTHESIS

3 hours lecture and 1-hour tutorial per week

Module 1(15hours)
Introduction to Network functions – Poles and zeros – restrictions on poles and zeros for driving point functions, transfer functions – time domain behavior from pole zero plot – image impedance – image transfer parameter.

Symmetrical two port reactive Networks as filters – attenuation and phase shifts in symmetrical Networks – lattice filters – high pass and low pass – band pass and band stop filters – design.

Module II(15hours)
Review of positive real functions – driving point functions – Brune's positive real function – properties, image parameter methods – image parameters – image parameters for the symmetrical lattice – more complicated lattices – design of filters with resistive terminations – the ladder equivalent of the lattice filter – design of composite filters – frequency transformations.

Module III(13hours)
Imittance of RLC Networks – rational properties of Z(s) – properties of Z(s) – lossless Networks -RL and RC Networks – Stieljas continued fraction – series parallel realization – introduction – Chop – chop methods – arbitrary expansion for Z(s) - arbitrary Networks for Z(s) for bolt – Duflin synthesis

Module IV(14hours)
Darlington Synthesis – introduction – reciprocal darlington synthesis – equivalent darlington Networks – scaling constants – non reciprocal darlington synthesis – evenport split to avoid surplus factors – cascade 1 port synthesis and even port synthesis – extension of richard's theorm – positive realness of V and G brune's synthesis – darlington D section tranformer less darlington synthesis – mygata synthesis – impedance operator sysnthesis.

Text Books
1. M.E. Van Valkenberg – Introduction to Modern Network Synthesis, John Wiley and Sons.
2. Devhazony – Elements of Network Synthesis, East West EDU

References:
1. Valavanian, Network Synthesis, Prentice Hall.
2. Umesh Sinha, Network Analysis & Synthesis, Sathyaprakashan.

Sessional work

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University Examination Pattern
Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 705(C) HIGH VOLTAGE ENGINEERING

3 hours lecture and 1 hour tutorial per week

Module 1 (13 Hrs.)
Breakdown mechanisms in solids , liquids, vacuum , gases & gas mixtures- breakdown in uniform fields- breakdown in composite dielectrics - partial discharge , penning effect time tag & paschen's law. Townsends criterion.

Module 2 (13 Hrs.)

Generation of High Voltages and Currents

D.C.Voltages : voltage doubler, cascade circuits, electrostatic machines, voltage stabilization.
A.C. Voltages : Cascade transformers, series resonance circuits.
Impulse Voltages : Single stage and multistage circuits, wave shaping, tripping and control of impulse generators, synchronization with oscilloscope, generation of switching surge voltage, generation of impulse currents.

Module 3 (13 Hrs.)
Measurement of High Voltages and Currents : D.C.,A.C. and impulse voltages and currents, CRO, electrostatic generating and peak voltmeters, sphere gaps, factors affecting measurements, potential dividers(capacitive and resistive) ,series impedance ammeters, Ragowski coils, magnetic links, Hall effect generators, PT's (magnetic and capacitive types) and CT's.

Module 4 (13 Hrs.)
Dielectric loss measurements:- Schering's bridge- inductively coupled ratio arm bridge.
Partial discharge measurement technologies. radio interference measurements.
Over voltage phenomenon -travelling waves- line equations ,wave transmission , reflection & attenuation, lightning phenomenon. -Switching surges- protection against surges. Testing of circuit breakers and generators.

Text book

1. High Voltage Engineering : Naidu M.S & Kamaraju V. Tata Mc Graw Hill

REFERENCES

1. Travelling Waves on Transmission : Bewley L.V.Lines Dover Publishers
2. High Voltage Engineering : Kuffel. and Abdulla M.Pergman Press
3. H. V. Technology : Alston L. L. OxfordUniversity Press
4. H. V. Technique : Craggs J. D & Meed J. M Butterworths
5. An Introduction to H.V. : Dieter Kind Wiley Ltd Experimental Technique
6. Discharge Detection in H.V. : Kreuger Haywood, London Equipment
7. Power System Transients and High Voltage Principles : B. Thapar etal Capital Pub.
8. IEEE Standard Technique for High Voltage Testing : IEEE John Wiley and Sons.
9. Indian Standards :

IS : 2070 – 1962	IS : 2070 – 1962
IS : 2544 – 1963	IS : 2079 – 1962
IS : 2099 – 1962	IS : 2026 – 1962
IS : 166 – 1962	IS : 5959 – 1970
IS : 1544 – 1964, 1970	IS : 7098 – 1973
IS : 3070 – 1965	IS : 4004 - 1967
IS : 6209 – 1971	IS : 4950 – 1968

British Standards : B5 : 3659,B5 : 3070, B5 : 2914-1957
IEC Publications : No, 99-1, Part1-1970

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 705(D) DIGITAL SYSTEM DESIGN

(3 hours lecture and 1 hour tutorial per week)

Module 1 (13 Hours)
Finite State Machine Design: The Concept of State Machine - Timing in State Machine - FSM Design Procedure - ASM notation - Moore and Mealy Machine Design - Examples of Moore and Mealy Machines - Finite State Machine Word Problems.

Module 2 (13 Hours)
Asynchonous Design: Asynchronous ASM - Asynchronous System - Design Principles - Problem of Asynchronous Circuits _ Hazards - Critical Races - Examples

Module 3 (13 Hours)
Designing with programmable Devices: Programmable LSI Techniques - PLA, Logic Cell Array and Atifuse FPGAs - Designing with FPGAs - Large PAL Structures - XILINK 4000 series

Module 4 (13 Hours)
Hardware Description Languages: Introduction to VHDL - Behavioral Modeling - Transport vs Inertial Delay - Simulation Deltas - Sequential Processing - Process Statement - Signal Assignment vs Variable Assignment - Sequential Statements - Data Types - Subprograms and Packages - Predefined Attrbutes - Configurations - Subprogram Overloading - VHDL synthesis - Design Examples

Textbooks recommended

1. David J. Comer "Digital Logic and State machine Design" Saunders College publishing
2. Randy H. Katz, "Contemporary Logic Design", Benjamin/Cummings Publishing Co. 1995
3. Geoff Bostock, "FPGAs and programmable LSI", Butterworth Heinemann, 1996
4. Douglas L. Perry, "VHDL", McGraw Hill, 1999
5. Charles S. Roth, "Fundamentals of Logic Design", Jaico Publishing House, 1999

References

1. Zoran Salacic, "Digital System Design and prototyping using Field Programmable Logic", Kluwer Academic Publishers
2. Stephen Brown and Zvonoko Vranesic, "Fundamentals of Digital Logic with VHDL Design", McGraw Hill
3. J. Bhasker, "A VHDL primer", Addison-Wesley 3rd Ed. , 2000
4. Z.Navabi, "VHDL: Analysis and Modeling of Digital Systems", McGraw Hill, 1998

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 705(E) ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

3 hours lecture and 1 hour tutorial per week

Module I (14 hours)
Evolution of 16 and 32 bit Processor – Salient features of advanced processors – 80386 processor – Architecture – Programming model – memory management unit – Descriptors-Selectors – description table and TSS – real and protection mode – Memory Paging- Addressing modes and Instruction sets – Interrupt systems of 80386 in PVAM – switching to PVAM – Intel Pentium Processors – Architecture and special features of Pentium processors – Branch Prediction Logic – Super scalar Architecture – Special Pentium registers – Memory management – Basic concepts of cache, pipelining-

Module II (14 hours)
Evolution of 16 bit microcontrollers – 80196microcontroller – modes of operation – Interrupt status – Times – High speed Inputs – Analog Interface – PWM output – Serial ports – Input Output expansion methods– memory expansion-serial port expansion- application – examples – 80196 micro controller Architecture- Register set of 80196 – General features of 80196 – Addressing modes -special function registers – Minimum configuration-

Module III (12 hours)
Micro controllers and Embedded systems -PIC Micro controllers – features – Architecture – Programming considerations – On Chip Peripherals – Programming examples – Atmel micro controllers – features – architecture – Programming considerations- On Chip Peripherals-Programming examples – Real time controls – concepts and issues

Module IV (12 hours)
Development tools – Programmers – Compilers –Assemblers- Debuggers – Simulators – Emulators – External interface design – LCD, Key pad - Practical design examples

Text Books

1. Advanced Microprocessors and Peripherals – A.K.Ray Bharchendi – Tata Mc Graw Hill
2. Microprocessor and Micro controller Applications – A.P. Godse & D.A Godse,
3. PIC Microcontrollers – John B Peatman, Pearson Education

Reference Books

1. Dr.B.P.Singh : Microprocessors and Microcontrollers
2. Brey B.R :The Intel Microprocessor system – Architecture, Programming and Interfacing

Sessional work assessment	
Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 705 (F) : ELECTRICAL MACHINE MODELLING & ANALYSIS

3 hours lecture and 1 hour tutorial per week

Module I: Modeling and analysis of DC machines (15 hours)

Introducton to generalized machine theory-diagramatic representation of genaralized machine-formation of emf eqations-expression s for power and torque-representation of D C machines .

Electrodynamical equations and their solution - a spring and plunger system - rotational motion system - mutually coupled coils - Lagrange's equation - application of Lagrange's equation to electromechanical systems - solution of electrodynamical equations by Euler's method and Runge-Kutta method - linearisation of the dynamic equations and small signal stability - *the primitive 4 winding commutator machine*- the commutator primitive machine - the brush axis and its significance - self and mutually induced voltages in the stationary and commutator windings - speed e.m.f induced in commutator winding - rotational inductance coefficients - sign of speed e.m.f terms in the voltage equation - the complete voltage equation of primitive 4 winding commutator machine - the torque equation - *DC Machines* - analysis of simple DC machines using the primitive machine equations - analysis of cross-field DC machines using the primitive machine equations

Module II: Modeling and analysis of induction motors (13 hours)

Representation of Induction machine using Generalised machine theory - Formation of general equations - *The three phase induction motor* - equivalent two phase machine by m.m.f equivalence - equivalent two phase machine currents from three phase machine currents - power invariant phase transformation - voltage transformation - voltage and torque equations of the equivalent two phase machine - commutator transformation and its interpretation - transformed equations - different reference frames for induction motor analysis - choice of reference frame- nonlinearities in machine equations - equations under steady state - solution of large signal transients in an induction machine - linearised equations of induction machine in current variables and flux linkage variables - small signal stability - eigen values - transfer function formulation - application of large signal and small signal equations

Module III: Modeling and analysis of synchronous machines (13 hours)

Modelling and analysis of synchronous machines - Synchronous machine representation using generalised machine theory - general equations - three phase to two phase transformation - voltage and torque equations in stator, rotor and air-gap field reference frames - commutator transformation and transformed equations - parks transformation - suitability of reference frame Vs kind of analysis to be carried out - steady state analysis - large signal transient analysis - linearisation and eigen value analysis - general equations for small oscillations - small oscillation equations in state variable form - damping and synchronizing torques in small oscillation stability analysis - application of small oscillation models in power system dynamics

Module IV: Dynamical analysis of interconnected machines (11 hours)

Machine interconnection matrices - transformation of voltage and torque equations using interconnection matrix - large signal transient analysis using transformed equations - small signal model using transformed equations - the DC generator/DC motor system - the alternator/synchronous motor system - the Ward-Leonard system - hunting analysis of interconnected machines - selection of proper reference frames for individual machines in an interconnected system

Text Books

1. Dr.P.S.Bhimbra, Generalised machine Theory, Khanna Publishers.
2. Sengupta D.P. & Lynn J.B., *Electrical Machine Dynamics*, The Macmillan Press Ltd

Reference books

1. .Jones C.V., *The Unified Theory of Electrical Machines*, Butterworth
2. Woodson & Melcher, *Electromechanical Dynamics*, John Wiley

3. Kraus P.C., *Analysis of Electrical Machines*, McGraw Hill Book Company
4. Boldia I. & Nasar S.A., *Electrical Machine Dynamics*, The Macmillan Press Ltd.

Sessional work assessment

2 Tests	2x15 = 30
2 assignments	2x10 = 20
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module
Q II - 2 questions of 15marks each from module I with choice to answer any one
Q III - 2 questions of 15marks each from module II with choice to answer any one
Q IV - 2 questions of 15marks each from module III with choice to answer any one
Q V - 2 questions of 15marks each from module IV with choice to answer any one

EE04 802 INDUSTRIAL DRIVES

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Basic principle of Electric Drives – Block diagram – Parts of Electrical Drives – Dynamics of electric drive – torque equation -speed torque conventions – loads with rotational and translational motion – components of load torques – nature and classification of load torques – load equalization – control of electrical drives – closed loop speed control – current limit control – closed loop torque control – speed sensing current sensing – phase locked loop control

Module II (13 hours)

Dc motor drives – basic equations – constant torque and constant power control – fully controlled and half controlled converter fed DC drives – continuous and discontinuous operation – two quadrant operation – three phase controlled rectifier fed dc drives – dual converter fed control – chopper fed DC drives – closed loop control scheme for control below and above base speed – solar powered drives – solar powered pump drives – battery powered vehicles - braking of dc drives

Module III (13 hours)

Three phase induction motor drives – AC Voltage controlled drives – variable frequency control -V/f control- VSI fed induction motor drive – operation with field weakening – CSI controlled induction motor drives – slip power recovery scheme – rotor frequency control – single phase induction motor drives – PWM Drives

Module IV (13 hours)

Synchronous motor drives – synchronous motor variable speed drives – methods of control- VSI and CSI fed drives – variable frequency control – self controlled synchronous motor drives – brushless dc motor drives - μp controlled DC and AC drives – block diagrams and flow charts- Energy conservation in electrical drives.

Text Books

1. Dubey G.K : Fundamentals of Electric Drives
2. R.Krishnan : Electric Motor Drives – Modeling Analysis & control – Pearson Education

References

1. Vedam Subramaniam : Thyrister control of Electric Drives –
2. Sen PC Thyrister DC Drives

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE2K 803 INSTRUMENTATION SYSTEMS

3 hours lecture & 1 hour tutorial per week

Module -1 (12 hrs)
Transducers
Definition -Different types of transducers -criteria for selection –General characteristics -Dynamic characteristics -Calibration -Transducers for measurement of displacement, velocity, acceleration, speed ,angular rotation, altitude ,flow, liquid level, force, torque, humidity and moisture, pressure, strain and temperature Hall effect transducers and applications.

Module -2 (12 hrs)
Signal conditioning, data transmission, telemetry and digital instruments
Signal conditioning -Instrumentation amplifiers -Differential amplifier- Transducer bridges -null type and deflection bridges -Ac bridges using push- pull transducers. Data transmission and telemetry -Methods of data transmission -General telemetry systems -Sampling process

Digital instruments-operating principle of DVM using successive approximation - V IF conversion and integrating principles- counters- Digital methods of frequency, phase, time & period measurements.

Module -3 (12 hrs)
Display methods, recorders, experiments and statistical analysis
Display methods and devices -Different types of display -Display system building blocks -Recorders -Galvanometric recorders -Pen driving system –Servo recorders -Magnetic recorders -Digital recorders.
Experiments and statistical analysis -Performance of experiment -The record of experiment -Accuracy and precision. Classification of errors -The characteristics of experimental data -Description of dispensed data -Type of probability distribution - Probability error -combination of variances -combined error -Guarantee errors.

Module -4 (16 hrs)
Instrumentation Systems
Basic measuring systems -Analog and digital data acquisition systems -Generalized
input-output configuration of measuring systems -Dynamic characteristics - mathematical models -The concept of transfer function (with special reference to measuring systems) – procedure for developing transfer function – response to various types of inputs – Classification of instruments based on their order & dynamic and frequency response studies.
Introduction to the recent developments in the process instrumentation – PLC development of ladder logic designs for simple applications – introduction to SCADA system

Text Books :

1. Earnest O Doblin : Measurement system application and design, Mc Graw Hill
2. A.K. Sawhney : A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai and sons
3. Joseph J Carr : Elements of Electronic instrumentation and Measurement – Pearson Education

References

1. William David Cooper : Electronic Instrumentation and Measurement Techniques, Prentice Hall, India
2. Ernet C. Doblin : Measurement System Application and Design, Mc Graw Hill International Editions
3. K.B.Klaassan : Electronic Measurement and Instrumentation Cambridge University Press
4. John P Bentley : Principles of Measurement Systems – Pearson Education

Sessional Particulars		
2 Tests	(2 X 15)	= 30 marks
2 Assignments	(2 X 10)	= 20 marks
Total		= 50 marks

EE04 804(A) VLSI DESIGN

3 hours lecture and 1 hour tutorial per week

Module 1 (10 hours)

Overview Of VLSI Design Methodology: VLSI design process -. Architectural design -Logical design - Physical design -Layout styles -Full custom -Semi custom approaches. .

VLSI Fabrication Techniques : .An overview of wafer fabrication –Wafer Processing -Oxidation - Patterning -Diffusion -Ion Implantation -Deposition –Silicon gate nMOS process -CMOS processes -nWel1 -PWell -Twin tub -Silicon on insulator-CMOS process (enhancements -Interconnect -Circuit elements. (5)

Module 2 (12 Hours)

. **Basic Electrical Properties Of MOS And CMOS Circuits:** nMOS enhancement transistor -PMOS enhancement transistor -Threshold voltage - Threshold voltage equations -MOS device equations -Basic DC equations -Second order effects - MOS modules -Small signal AC characteristics -nMOS inverter - Steered input to an nMOS inverter -Depletion mode and enhancement mode pull ups –CMOS inverter -DC characteristics -Inverter delay -Pass transistor -Transmission gate. (12)

Module 3 (Hours 8)

Layout Design Rules: Need for design rules -Mead conway design rules for the.silicon gate nMOS process -CMOS nwell-Pwel1 design rules -Simple layout examples - Sheet resistance -Area capacitance - Wiring capacitance -Drive large capacitive loads. (8)

Module 4 (Hours 12)

. Logic Design : Switch logic -Pass transistor and transmission gate -Gate logic - Inverter -Two input NAND gate -NOR gate -Other forms of CMOS logic –Dynamic CMOS logic -Clocked CMOS logic - Precharged domino CMOS logic -Structured design -Simple combinational logic design examples –Parity generator -Multiplexers –Clocked sequential circuits -Two phase clocking -Charge storage –Dynamic register element -nMOS and CMOS -Dynamic shift register -Semi static register - JK flip flop circuit. (12)

Text Books:

1.Douglas A PuckJ1ell and Kamran Eshranghian, "Basic VLSI Design", Prentice Hail of India, New Delhi, 3rd Edition, 1994.

2.Neil H E West and Kamran Eshranghian, "Principles of CMOS VLSI Design: A systemPerspective", Addision-Wesley, 2nd Edition, 1993.

3. Amar Mukherjee, "Introduction to nMOS and CMOS VLSI System Design", Prentice Hall, USA, 1986.

References;-

1. Caver Mead and LyTUl Conway, "introduction to VLSI Systems", Addision-Wesley, USA, 1980.

2. Eugene D Fabricus, "Introduction to VLSI Design", McGraw Hill International Edition, 1990.

Sessional work assessment	
Assignments	2x10 = 20
Tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

EE04 804(C) INDUSTRIAL ROBOTICS

3 hours lecture and 1-hour tutorial per week

Module I (15hours)

Automation and Robotics - Robotics in Science Fiction - A Brief History of Robotics - The Robot and Its Peripherals-Robot Activation and Feedback Components - Position Sensors - Velocity Sensors - Actuators - Power Transmissions Systems - Robot Joint Control Design- Introduction to Manipulator Kinematics - Homogeneous Transformations and Robot Kinematics -Manipulator Path Control - Robot Dynamics - Configuration of a Robot Controller .

Module II (15hours)

Types of End Effectors - Mechanical Grippers - Other Types of Grippers - Tools as End Effectors - The Robot/End Effector Interface - Considerations in Gripper Selection and Design - Sensors in Robotics - Tactile Sensors - Proximity and Range Sensors - Miscellaneous Sensors and Sensor-Based Systems - Uses of Sensors in Robotics - Introduction to Machine Vision - The Sensing and Digitizing Function in Machine Vision - Image Processing and Analysis - Training and Vision System - Robotic Applications.

Module III (15hours)

Methods of Robot Programming - Leadthrough Programming Methods - A Robot Program as a Path in Space - Motion Interpolation - WAIT, SIGNAL, and DELAY Commands - Branching - apabilities and Limitations of Leatlthrough Methods - The Textual Robot Languages - enerations of Robot Programming Languages - Robot Language Structure - Constants, Variables, and Other Data Objects - Motion Commands - End Effector and Sensor Commands - Computations and perations - Program Control and Subroutines - Communications and Data Processing - Monitor Mode Commands.

Module IV(15hours)

Introduction to robot intelligence and task planning- state space search-problem reduction-use of predicate logic-means –end analysis-problem-solving –robot learning-robot task planning-expert systems and knowledge learning.

Text Books

1. Mikell P.Groover -et al, Industrial robotics, technology programming and applications, McGraw-Hill
2. K.S.Fu, R.C.Gonzalez, C.S.G.Lee : Robotics, Control, Sensing & Intelligence, McGrawhill

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

Sessional work assessment

Assignments 2 x 10 = 20 marks
2 Tests 2 x 15 = 30 marks
Total marks = 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.

Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.

Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.

Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.

Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one.

EE 04- 804 (D) ORGANISATIONAL BEHAVIOUR

3 hours lecture and 1 hour tutorial per week

Module I (12 Hours)
Nature of Organisation - Organisational Goals - Definition of Organisational Behavior – Nature of people – Personality – Perception – Learning and behavior modification – Attitudes and Values.

Module II (14 Hours)
Motivation – Theories of Motivation – Need theory – Hygiene theory – Theory X and Y – Expectancy model – ERG Theory – Job Design and Motivation.

Communication – Dynamics of Communication – Process and Forms of Communication – Barriers in Communication – Managing Communication.

Module III (13 Hours)
Interpersonal Behavior – Group and Group Dynamics – Group Behavior – Group Effectiveness.

Leadership – Theories of Leadership – Triat Theory – Behavioral Theory – Situational and Contigency model – Leadership Styles.

Module IV (13 Hours)
Organisational Change – Nature and Factors – Resistance to Change – Organisational Effectiveness – Approach to measure Organisational Effectiveness.

Organisational Development – Concept of Organisational Development –Organisational Development Interventions - Values and Organisational Development.

Text Book

1.Organisational Behavior – Uma Sekharan , Tata McGraw Hill Publishing Company Ltd.
2.Organisational Behavior – L M Prasad, Sulthan Chand & Sons, New Delhi.

References:-

1. Schermerhorn J.R. Jr., Hunt J.G. & Osborn R.N., "*Managing Organizational Behavior*", John Willy
2. Luthans, Organisational Behavior, McGraw Hill International
3. Kieth Davis : Human Relations at Work, McGraw Hill,Inc

Sessional work assessment

Assignments	2 x 10 = 20
2 Tests	2 x 15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.

Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.

Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.

Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.

Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one.

* Case study is beyond the scope of this paper.

EE04 805(A) ADVANCED TOPICS IN POWER SYSTEMS

3 hours lecture and 1 hour tutorial per week

Module 1 (13 hours)
Power system optimization -unit commitment -priority list and dynamic programming methods -optimal load flow solution -optimal scheduling of hydrothermal system.

Module 2 (13 hours)
Power system, security -Factors affecting security -state transition diagram - contingency analysis using network sensitivity method and ac power flow method - colTecting the generation dispatch using sensitivity methods.

Module 3(13 hours)
State Estimation -least square estimation -basic solution, sequential form of solution - static state estimation -tracking state estimation.

Module 4(13 hours)
Fault Analysis: [Z_{BUS}] building algorithm -sequence matrices -symmetrical and unsymmetrical short-circuit_ana1ysis of 1arge power systems -phase shift in sequence quantities due to transformers.

Text books

1 B.R. Gupta, "Power System Analysis and Design",(3rd Edition), A.H. Wheeler & Co.Ltd. New Delhi, 1998.
2 J. Wood, B.F. Wollenberg, "Power Generation, Operation and Control", John -Wiley & Sons, New York, 1984.

References

3. I.J. Nagarath, D.P. Kothari, " Power System Engineering", Tata McGraw-Hill publishing Co. Ltd., New Delhi 1994.
4. J.Arrillaga, C.P. Arnold, B.J. Harker, "Computer Modelling of Electric Power Systems".
5. A.K. Mahalanabis, D.P. Kothari, S.I. Ahson, "Computer Aided Power System .Aiialysis & Control" Tata McGraw-Hill, New Delhi, 1988.
6. Hadi A. Sadat, "Power System Analysis", McGraw-Hill Co. Ltd. , India, 2000.
7. O.I. Elgard, "Electric Energy System Theory: An Introduction", 2nd Edition, McGraw-Hill, New York, 1982.

Sessional work assessment

Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 805(B) SWITCHED MODE POWER CONVERTERS

3 hours lecture and 1 hour tutorial per week

Module I (Hours 13)

DC to DC converters without Galvanic Isolation – Linear Power Supplies – Overview of Switching Power Supplies – Introduction to DC to DC switched mode converters -Step down converters – continuous conduction mode – boundary between continuous and discontinuous conduction - discontinuous conduction mode – output Voltage ripple -Step up converter – continuous conduction mode- boundary between continuous and discontinuous conduction - discontinuous conduction mode – Buck Boost converter – continuous conduction mode - boundary between continuous and discontinuous conduction - output voltage ripple -Cuk dc– dc converter – full bridge dc– dc converter – PWM with bipolar and unipolar voltage switching – dc– dc converter comparison

Module II (Hours 13)

Switching DC Power supplies with isolation – dc – dc converters with electrical isolation – fly back converters – double ended fly back converter- forward converters- double ended forward converter- push pull converters-half bridge converters-full bridge converters

Voltage Mode control of SMPS-loop gain and stability consideration-shaping the error amplitude frequency response- error amplitude transfer function – transconductance error amplitudes.

Current mode control of SMPS-current mode control advantages-current mode vs. voltage mode-current mode deficiencies-slope compensation.

Module III (Hours 13)

Switched mode dc-ac converters-basic concepts of switched mode converters-PWM switching scheme-square wave switching scheme-single and three phase inverters –switching utilization-ripple in the inverter output-effect of blanking time on voltage in PWM inverters-square wave pulse switching- programmed harmonic elimination switching – current regulated modulation- single phase switched mode rectifier and its control.

Module IV (Hours 13)

Introduction to modelling of switching mode power supplies –state space averaging- state space averaged models-equivalent circuits and small signal transfer function for basic converters. Introduction to resonant converters- classification of resonant converters-basic resonant circuit concepts-load resonant converters-resonant DC link inverters with zero voltage switching – high frequency link integral half cycle converters.

Text Books

1.Power Electronics- ConvertersApplications and Design :Mohan Undeland Robbins -2nd edition-John Wiley and sons

2. Switching Power Supply Design : Abraham Pressman –McGraw Hill

Sessional work assessment	
Assignments	2x10 = 20
2 tests	2x15 = 30
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 805(D) SYNTHESIS OF FEEDBACK SYSTEMS

3 hours lecture and 1 hour tutorial per week

Module I (Hours 15)

Introduction to feedback theory - Plant identification-representations-condition for linear electrical analogue- analogue of gyroscope-model of transducer Foundations of linear feedback theory-fundamental feedback equation-subjective nature of feedback-return difference-bilinear theorem and its exceptions-null return difference Introduction to properties of feedback-cost of feedback-systems with multiple inputs-effect of feedback on nonlinear system-classification of reasons for using feedback-effect of feedback on system response-positive feedback-loop shaping for stability -single order systems-extension to higher order systems.

Module II (Hours18)

Design of feedback systems with single degree of freedom configuration - Distinction between the feedback problem, the filter problem and the control problem- introduction to single degree of freedom feedback control design- Design for simultaneous achievement of error constant and phase margin by means of lag compensation, lead compensation – optimization of loop transmission function – correlation between system Frequency Response and Time Response – Relation between the Loop Transmission L and the System Transfer Function T – Synthesis from Pole-Zero Specifications of T(s) – Realization of Any combination of *Kv*, Bandwidth, and Overshoot with a pair of Poles and One Zero – Increase of velocity Constant by Lag Compensation – Comparison of Lead and Lag Compensation Having the Same *Kv*, Bandwidth, and Overshoot – Determination of the Loop Transmission L(s); Validity of Canceling Plant Dynamics – Relative Merits of the Open – Loop Frequency Response Method and the T(s) Pole-Zero Method – The Price That Is Paid for a Dominant Type T *(s)* – T(s) Pole – Zero – Method for Complicated Dominant Pole – Zero patterns – Design of High-order System .

Module III (Hours14)

Design of feedback control systems for independent control of transmission and sensitivity functions - Configuration with two Degrees of Freedom – Root Locus synthesis to control System Sensitivity to Variations in plant Gain Factor – Root Locus s-Plane Synthesis for General plant Parameter Variations – Location of the Far – Off Poles of L – Sensitivity of the dominant Zeros of T(s) – Feasibility of Root Locus Sensitivity Design in High – Order Systems – Philosophy of the Frequency Response Approach to the sensitivity problems – Realization of Sensitivity Specifications – Frequency response Method – Cost of Feed Back, and Comparison of two-Degree-of-Freedom Structures – The problem of the Far-Off poles – Design for Multiple Inputs – Design for Disturbance Attenuation Accompanied by plant parameter Variation – Analytical specification of the Sensitivity Function – Achievable Benefits of Feedback in Two-Degree-of-Freedom Structure

Module IV (Hours14)

Fundamental properties and Limitations of the Loop Transmission Function- Resistance integral theorem - Mathematical Background - Resistance Integral Theorem and the Equality of Positive and Negative Feedback Areas - Real or Imaginary Part Sufficiency - Relation between Loop Transmission Lag Angle and Optimum Loop Transmission Function - Specification of F (s) from Its Real and Imaginary Parts in Different Frequency Ranges - The Ideal Bode Characteristic - A Different Kind of Optimum - Minimum Phase Functions - Conditionally Stable Systems - Maximum Rate at Which $|L(j\omega)|$ May Be Decreased for Conditionally Stable Systems - Loop Transmissions for Systems with Time Delay -- Conditionally Stable Systems with Pure Time Delay - Systems with Unstable Loop Transmissions - Systems with Combined Positive and Negative Feedback- Zero-Sensitivity Systems – Advanced topics in Linear system theory to multi loop systems -time varying plants – Application of Linear techniques to NL systems.

Text Books :

1. Horowitz, Synthesis of Systems, Academic Press.
2. John C, Analytical Techniques for NL control system, English University Press, London.

Sessional work assessment

Assignments 2 x 10 = 20 marks
2 Tests 2 x 15 = 30 marks
Total marks = 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.

Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.

Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.

Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.

Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one.