BANGALORE UNIVERSITY
DEPARTMENT OF ELECTRICAL ENGINEERING
SCHEME OF STUDY AND EXAMINATION OF I Sem toVIII Sem B.E(ELECTRICAL &ELECTRONICS)
2K11 SCHEME

I SEMESTER B.E(ELECTRICAL & ELECTRONICS)

Sl No	Code No.	Subject	No. of Hr/week Theory	Pract	Duration of Exam Theory	Pract	Class / Sessional Marks	Exam Marks
1.	2K11SM1101	Engineering Mathematics – I	4	-	3	-	25	100
2.	2K11CE1101	Engineering Mechanics	4	-	3	-	25	100
3.	2K11EE1101	Electrical Sciences	4	-	3	-	25	100
4.	2K11SP1101/ 2K11SC1101	Engineering Physics / Engineering Chemistry	4	-	3	-	25	100
5.	2K11SP1102/ 2K11SC1102	Engineering Physics lab / Engineering Chemistry lab	-	3	-	3	25	100
6.	2K11CI1301	Programming in C	4	-	3	-	25	100
7.	2K11EE1302/ 2K11CI1302	Electrical laboratory / C Programming lab	-	3	-	3	25	100
8.	2K11EM1101 / 2K11EM1102	Mechanical Engineering Science / Workshop Practice	4/3		-	3	25	100
							200	800
						TOTAL		**1000**

II SEMESTER B.E(ELECTRICAL & ELECTRONICS)

Sl No.	Code No.	Subject	No. of Hr/week Theory	Pract	Duration of Exam Theory	Pract	Class / Sessional Marks	Exam Marks
1.	2K11SM1201	Engineering Mathematics – II	4	-	3	-	25	100
2.	2K11CE1201	Strength of Materials	4	-	3	-	25	100
3.	2K11EC1201	Basic Electronics	4	-	3	-	25	100
4.	2K11SP1101/ 2K11SC1101	Engineering Physics / Engineering Chemistry	4	-	3	-	25	100
5.	2K11SP1102/ 2K11SC1102	Engineering Physics lab / Engineering Chemistry lab	-	3	-	3	25	100
6.	2K11EM1201	Engineering Drawing	4	-	3	-	25	100
7.	2K11CI1302/ 2K11EE1302	C Programming lab / Electrical laboratory	-	3	-	3	25	100
8.	2K11EM1101/ 2K11EM1102	Mechanical Engineering Science / Workshop Practice	4/3		3		25	100
							200	800
						TOTAL		**1000**

III SEMESTER B.E(ELECTRICAL & ELECTRONICS)

Sl No	Code No.	Subject	No. of Hr/week Theory	Pract	Duration of Exam Theory	Pract	Class / Sessional Marks	Exam Marks	Total Marks
1.	2K11SM301	Engineering Mathematics – III	4	-	3	-	25	100	125
2.	2K11EE301	Analog Electronic Circuits	4	-	3	-	25	100	125
3.	2K11EE302	Electric Circuits	4	-	3	-	25	100	125
4.	2K11EE303	DC Machines & Transformers	4	-	3	-	25	100	125
5.	2K11EE304	Electrical & Electronics Measurements	4	-	3	-	25	100	125
6.	2K11EE305	OOPs using C++	4	-	3	-	25	100	125
7.	2K11EE306	Analog Electronic Circuits laboratory	-	3	-	3	25	100	125
8.	2K11EE307	Measurements laboratory	-	3	-	3	25	100	125
						TOTAL	200	800	1000

IV SEMESTER B.E(ELECTRICAL & ELECTRONICS)

Sl No.	Code No.	Subject	No. of Hr/week Theory	Pract	Duration of Exam Theory	Pract	Class / Sessional Marks	Exam Marks	Total Marks
1.	2K11SM401	Engineering Mathematics – IV	4	-	3	-	25	100	125
2.	2K11EE401	Data Structures	4	-	3	-	25	100	125
3.	2K11EE402	Micro Electronics	4	-	3	-	25	100	125
4.	2K11EE403	Signals and Systems	4	-	3	-	25	100	125
5.	2K11EE404	AC machines	4	-	3	-	25	100	125
6.	2K11EE405	Electro Magnetic Field Theory	4	-	3	-	25	100	125
7.	2K11EE406	Electrical Machines laboratory	-	3	-	3	25	100	125
8.	2K11EE407	IC laboratory	-	3	-	3	25	100	125
						TOTAL	200	800	1000

V SEMESTER B.E(ELECTRICAL & ELECTRONICS)

Sl No.	Code No.	Subject	No. of Hr/week Theory	Pract	Duration of Exam Theory	Pract	Class / Sessional Marks	Exam Marks	Total Marks
1.	2K11EE501	Control Systems	4	-	3	-	25	100	125
2.	2K11EE502	Electrical Machine Design	4	-	3	-	25	100	125
3.	2K11EE503	Generation, Transmission & Distribution	4	-	3	-	25	100	125
4.	2K11EE504	Power Electronics	4	-	3	-	25	100	125
5.	2K11EE505	Digital Signal Processing	4	-	3	-	25	100	125
6.	2K11EE506	Computer Organization and Architecture	4	-	3	-	25	100	125
7.	2K11EE507	Simulation lab using Labview	4	-	3	-	25	100	125
8.	2K11EE508	Power Electronics & Drives laboratory	-	3	-	3	25	100	125
						TOTAL	200	800	1000

VI SEMESTER B.E(ELECTRICAL & ELECTRONICS)

Sl No.	Code No.	Subject	No. of Hr/week Theory	Pract	Duration of Exam Theory	Pract	Class / Sessional Marks	Exam Marks	Total Marks
1.	2K11EE601	Microprocessor & Micro Controller (8086/8051)	4	-	3	-	25	100	125
2.	2K11EE602	Power System Analysis	4	-	3	-	25	100	125
3.	2K11EE603	Electric Drives	4	-	3	-	25	100	125
4.	2K11EE604	Switch Gear & Protection	4	-	3	-	25	100	125
5.	2K11EE605	Communication Engineering	4	-	3	-	25	100	125
6.	2K11EE606	Modern Control Theory	4	-	3	-	25	100	125
7.	2K11EE607	AC Machine & Protection laboratory	-	3	-	3	25	100	125
8.	2K11EE608	Microprocessor & Micro Controller laboratory (8086/8051)	-	3	-	3	25	100	125
						TOTAL	200	800	1000

VII SEMESTER B.E(ELECTRICAL & ELECTRONICS)

Sl No.	Code No.	Subject	No. of Hr/week Theory	Pract	Duration of Exam Theory	Pract	Class / Sessional Marks	Exam Marks	Total Marks
1.	2K11EE701	High Voltage Engineering	4	-	3	-	25	100	125
2.	2K11EE702	Estimation, Specification and Engineering Management	4	-	3	-	25	100	125
3.	2K11EE703	Non-Conventional Energy Sources	4	-	3	-	25	100	125
4.	2K11EE704	Computer Techniques in Power System Analysis	4	-	3	-	25	100	125
5.	2K11EE705	Testing & Commissioning of Electrical Equipment	4	-	3	-	25	100	125
6.	2K11EE706	Elective-I	4	-	3	-	25	100	125
7.	2K11EE707	Control Systems and DSP laboratory	-	3	-	3	25	100	125
8.	2K11EE708	Project Tour visit	Project Tour involving visit to Industries, Substations/ Receiving stations, Hydel plants, Thermal plant and Nuclear plants and is for a duration not exceeding 5 days				25	-	25
						TOTAL	200	700	900

Elective-I

2K11EE706.1 Transducers and Signal Conditioning
2K11EE706.2 Energy Management and Auditing
2K11EE706.3 VLSI Design
2K11EE706.4 Programmable Logic Controllers

VIII SEMESTER B.E(ELECTRICAL & ELECTRONICS)

Sl No.	Code No.	Subject	No. of Hr/week Theory	Pract	Duration of Exam Theory	Pract	Class / Sessional Marks	Exam Marks	Total Marks
1.	2K11EE801	HVDC and FACTS	4	-	3	-	25	100	125
2.	2K11EE802	Utilization of Electric Power	4	-	3	-	25	100	125
3.	2K11EE803	Illumination Engineering	4	-	3	-	25	100	125
4.	2K11EE804	Elective-II	4	-	3	-	25	100	125
5.	2K11EE805	Project work	-	6	-	3	50	100	150
6.	2K11EE806	Power Systems Simulation laboratory	-	3	-	3	25	100	125
7.	2K11EE807	Technical Seminar	-	-	-	-	25	-	25
						TOTAL	200	600	800

Elective-II

2K11EE804.1 Artificial Intelligence Techniques for Power Systems
2K11EE804.2 Analog & Mixed mode VLSI
2K11EE804.3 Micro Electro Mechanical Systems (MEMS)
2K11EE804.4 Process Instrumentation

2K11SM1101 ENGINEERING MATHEMATICS – I

PART - A

Unit-1: Successive Differentiation: nth derivative of standard functions, Leibnitz theorem and problems, Polar curves and angle between two polar curves, Pedal equation of polar curves 6+1*=7 hrs

Unit-2: Rolle 's Theorem, Lagrange and Cauchy mean value theorem and applications, Applications of Taylor and Maclaurin's expansion for a single and two variables (without proof). Indeterminate forms, evaluation of limits by L-Hospital rule (without proof). Maxima and Minima for a function of two variables. 7+2*=9 hrs

Unit-3: Derivative of an arc in Cartesian, parametric and polar forms. Curvature of plane curves-formula for radius of curvature in Cartesian, parametric, polar and pedal forms, centre of curvature – evolutes, singular points, asymptotes and envelopes. 6+1*=7 hrs

Unit-4: Partial differentiation : First and higher order derivatives, Euler theorem, Total differentiation, differentiation of implicit functions and composite functions, Jacobians, Errors and approximations. 6+1*=7 hrs

PART - B

Unit-5: Standard reduction formulae for definite and indefinite integrals, Evaluation of these integrals with standard limits, problems, Tracing of standard curves in Cartesian form, parametric form and polar form. 6+1*=7 hrs

Unit-6: Double and Triple integrals, evaluation by the change of order of integration, change of variables and applications to area and volume, Beta and Gamma functions, Relation between beta and gamma functions, applications. 5+3*=8 hrs

Unit-7: Sequence of real numbers : Definition of a sequence, Bounded sequence, limit of a sequences Convergent, divergent and oscillatory sequences, Monotonic sequences and their properties Cauchy's criteria. 6+1*=7 hrs

Unit-8: Infinite series : Convergence, divergence and oscillation of an infinite series, comparison tests, p-series, D'Alembert's ratio test, Raabe's test, Cauchy's root test, Cauchy's integral test (all tests without proof) for series of positive terms. Alternating series : absolute and conditional convergence, Leibnitz's test (without proof, summation of binomial, exponential and logarithmic series. 7+1*=8 hrs

Total number of hours is 64 (50 hours of teaching, 10 hours of Tutorials and 4 hours internal test (*Tutorial hour))

Question paper pattern : The question paper contains two parts namely, Part A and Part B. Each part contains 4 questions. Five full questions are to be answered in all out of 8 questions, choosing at least two from each part.

Text Books:

1. Thomas, G B & R L Finney, Calculus, Addison Wesley, 9th Edition, 1998.
2. E. Kreyszig, "Advanced Engineering Mathematics" 8th Edition, 2004, John Wiley and sons.
3. P V O Neil Advanced Engineering Mathematics, Pearson / Thomson.

2K11CE1101 ENGINEERING MECHANICS

(Common to all branches except B.Arch)

Hours / Week : 4 Exam : 3 Hours
Total : 60 hours Max Marks : 100

PART A

1. Introduction : Concept of particle and rigid body, force and its characteristics, classification of force system, principle of transmissibility of a force, composition of force, resolution of a force, moment of a force, couple and its characteristics, replacement of force at some other point, varignon's theorem, free body diagrams. 4 hrs
2. Resultant of coplanar force system : Resultant and coplanar concurrent force system, resultant of coplanar parallel force system, resultant of coplanar non-concurrent force system, force polygon and funicular polygon. 6 hrs
3. Equilibrium of coplanar force system : Equilibrium of coplanar concurrent force system, Lami's theorem, Equilibrium of coplanar parallel force system, Types of beams, types of loadings, types of supports, Equilibrium of coplanar non-concurrent force system, reaction of statically determinate beams subjected to various types of loads. 6 hrs
4. Trusses: Introduction, classification of trusses, analysis of perfect plane trusses by the method of joints and method of sections. 7 hrs

5. Friction: Introduction, theory of friction laws of dry friction, equilibrium of block on horizontal and inclined planes, equilibrium of ladder, equilibrium of block and wedge. 7 hrs

PART B

5. Centroid and moment of inertia: Centroid of simple geometric areas (from first principles), centroid of composite areas and built up sections. Rectangular MI, Polar MI, radius of gyration, product of inertia, parallel axes theorem, perpendicular axis theorem, MI of simple geometric areas (from first principles), MI of composite areas and built up sections. 8 hrs
6. Kinematics : Kinematics of rectilinear motion with uniform and variable acceleration, kinematics of curvilinear motion in vertical plane – projectiles. 8 hrs
7. Kinetics: Kinetics of rectilinear motion, D'Alembert's principle of dynamic equilibrium, kinetics of curvilinear motion-banking and super elevation, Design speed, Max speed , Min speed, motion on level circular path and motion on banked circular path. 8 hrs
8. Work and Energy : Potential energy, kinetic energy, work done by a force, work-energy equation, work done by force on spring, virtual work, principles of virtual work. 6 hrs

Question paper pattern :
The question paper contains of 4 question from Part A and 4 questions from Part B. The students have to answer 5 full questions, selecting at least 2 questions from each part.

Reference books :

1. Engineering Mechanics – S S Bhavikatti, New Age International (P) Ltd.,
2. Engineering Mechanics – R K Bansal, Laxmi Publications (P) Ltd.,
3. Engineering Mechanics – S Ramamrutham, Dhanpat Rai Publishing Company (P) Ltd.,
4. Mechanics for Engineers – Beer and Johnston, Mc Graw Hill book Company.

2K11EE1101 ELECTRICAL SCIENCES

PART A

1. ELECTROMAGNETISM: Faraday's laws of Electromagnetic induction, Lenz's law, Concept of Inductance – Self and mutual, Inductance as a circuit element. 3+1* hrs
2. DC CIRCUITS: Concept of an Electric circuit, Kirchhoff's laws. Analysis of DC circuit by (i)Network reduction method (ii) Kirchhoff's laws (iii) Mesh current method. 5+1* hrs
3. AC CIRCUITS :
   A. SINGLE-PHASE CIRCUITS: Generation of ac power, Average and effective values of sine wave, form factor and peak factor. Phasor representation, voltage, current and power relations in R-L, R-C and R-L-C circuits. Analysis of series, parallel, and Series-Parallel circuits.
   B. THREE-PHASE CIRCUITS: Advantage of three phase systems. Star and delta connections. Relationship between line and phase values. Measurement of three phase power using two wattmeters in a three phase balanced system. 10+2* hrs

4. DC MACHINES :
   A. DC GENERATOR: Basic principle of working, constructional features, Lap and Wave Windings. Types of Generators, EMF equation, Concept of armature reaction and commutation. Characteristics and applications of DC machines.
   B. DC MOTOR: Principle of operation, back EMF, Torque equation, types of motors, characteristics and applications. Necessity of starters, three point starter (excluding design). 7+1* hrs

PART B

5. SINGLE PHASE TRANSFORMER: Principle of operation, Construction, EMF equation, Power losses and efficiency. Definition of Regulation, Open circuit and Short circuit tests. Predetermination of regulation and efficiency from OC and SC test data. All day efficiency. 6+2* hrs

6. THREE PHASE INDUCTION MOTOR: Constructional features, Principle of operation, Production of Torque, Slip, Torque-slip characteristics, losses and efficiency, Star-delta starter and applications. 5+1* hrs
7. a) ALTERNATORS: Constructional features. Principle of operation, EMF equation considering winding factors (Excluding derivation of winding factors).
   b) Different methods of Power Generation. 6+1*hrs
8. a) MEASURING INSTRUMENTS: Moving iron and moving coil meters-extension of ranges Dynamometer type of wattmeter. Induction type energy meter. Megger. 5 hrs + 1* hrs
   b) EARTHING : Necessity, Types of earthing. 3 hrs

50 hrs + 10* hrs Tutorials

Reference Books :

1. Electrical Technology - H. Cotton
2. Electrical Engineering- Hughes
3. Electrical Technology - B. L. Theraja
4. Electrical Sciences - M. V. Rao
5. Electrical Engineering- V. K. Mehta
6. Basic Electrical Sciences- Prof. P. M. Chandrashekaraiah

Question paper pattern :
The question paper consists of 8 questions of 20 marks each.
The students have to answer 5 full questions, selecting at least two questions from each PART.

2K11SP1101 ENGINEERING PHYSICS

PART A

1. Physics of Vibrations: Free oscillations – differential equation and solution; Damped vibrations – differential equation and solution; critical, over and under damping; analogy with electrical circuits; Forced vibrations – differential equation and solution; amplitude and velocity resonance; sharpness of resonance and quality factor; LCR resonance . 6 hrs

2. Elasticity : Statement of Hooke's law; Elastic moduli and Poisson's ratio; Derivation of relation between the elastic moduli; torsion of Cylinder; expression for couple per unit twist; bending of beams; expression for bending moment; theory of single cantilever. 6 hrs

3. Free electron theory of metals: Classical free electron theory for electrical conduction in metals; expression for drift velocity and electrical conductivity; expression for thermal conductivity; Weideman Franz law; limitations of free electron theory. 4 hrs

4. Superconductivity : Temperature dependence of electrical conductivity in metals and superconductors; magnetic effects – Meissner effect; type I and type II superconductors; temperature dependence of critical magnetic field; qualitative ideas of BCS theory of superconductivity; high temperature auperconductors; application of superconductors – cryotron, superconducting magnets. 4 hrs

5. Cryogenics : Idea of throttle expansion of gases; Joule Thomson experiment, Expression for inversion temperature, Method of production of low temperature, Linde's air liquefier, Measurements of low temperature - platinum resistance thermometer (theory and construction). 5 hrs

PART B

6. Lasers : Spontaneous and stimulated emission of radiation; population inversion; necessary condition for laser action; optical resonator; construction and working of Ruby; -Helium-Neon and semi conducting laser; applications of laser (any two). 4 hrs

7. Optical Fiber: Schematic of optical fiber; total internal reflection; derivation of expression for numerical aperture and acceptance angle; types of optical fiber; loss mechanisms in optical fiber; absorption; attenuation and scattering effects; applications in communication; point to point communication. 4 hrs

8. Holography : Fundamentals of holography, difference between photography and holography, Construction of hologram, recording and reproducing of three dimensional image, applications of holography (any two). 4 hrs

9. Dielectric materials: Definitions of dielectric constants and polarization – different types of polarization – electronic, orientation and ionic – Clausius – Mossetti equation – Ferro electric materials – applications of dielectric materials. 4 hrs

10. Magnetic materials : Definition of magnetization and magnetic susceptibility; dia para, ferro and ferri magnetic materials; qualitative ideas of Langevin theory of dia and para magnetism; soft and hard magnetic material - applications. 5 hrs

11. Liquid Crystal : Classification of liquid crystals – Orientational order intramolecular forces – deformation of the director - magnetic effects – optical properties – applications – LCD. 5 hrs

Question paper pattern :
The question paper consists of 8 questions of 20 marks each.
The students have to answer 5 full questions, selecting at least two questions from each PART.

Reference Books :

1. Modern Physics, Kenneth. S. Krane, John Wiely & Sons.
2. Solid State Physics, S. O. Pillai, New Age International
3. Fundamentals of Physics – Halliday and Resnick, Ninth Edition.
4. Material Science, S. L. Kulkarni & K. C. Bhandari, New Age International
5. Laser and Non Linear optics: B B Laud
6. Physic for Scientists and Engineers Serway & Jewett Thomson Book Collections.

2K11SC1101 ENGINEERING CHEMISTRY

1. Solid State Chemistry/ Metallic Solids

Bonding in solids: Ionic, covalent, metallic and molecular solids. Band Theory of solids: Molecular orbital theory, linear combination of atomic orbitals, bonding and anti – bonding orbitals with H and He as examples, extension of band theory to metals, semiconductors and insulators. Semiconductors: Intrinsic and extrinsic – p and n – types, stoichiometric semiconducting compounds, numerical problems. 7 hrs

2. METAL FINISHING

Polarisation, decomposition potential and overvoltage, Technological importance of metal finishing. Effect of plating variables on electrodeposits. Electroplating techniques – methods of electroplating, surface preparation, plating of Cr. Electroless plating of copper for PCB. 6 hrs

3. Battery technology : Battery-their importance, classification. Cell characteristic, cell reactions and performance of primary batteries-Zn-MnO_2, Secondary batteries – working principle, cell reactions and performance of Pb-acid battery, Ni-Cd battery, Modern batteries – Zn – air battery, Li-MnO_2 battery. Fuel cells – definition, classification, advantages and limitations. Construction and cell reactions of H_2-O_2 fuel cell and methanol – oxygen fuel cell. 5 hrs

4. Corrosion Engineering : Metallic corrosion-definition, electrochemical theory of corrosion, Forms of corrosion-differential metal corrosion, differential aeration corrosion – pitting corrosion, waterline corrosion, stress corrosion. Factors affecting the rate of corrosion. Corrosion control – surface coatings, inorganic coatings- phosphating, anodizing, organic coatings – paints and enamels. Metal coatings – anodic metal coatings – galvanizing. Cathodic metal coatings – tinning. Corrosion inhibitors. Cathodic and anodic protection. 7 hrs

5. High Polymers: Definitions – Natural and synthetic polymers, mechanism of addition polymerization (free radical mechanism), degree of polymerization, glass transition temperature. Addition and condensation polymers. Resins and plastics : Differences between resins and plastics, thermoplastics and thermosetting plastics – manufacture, properties and applications of HDPE and LDPE, polystyrene, phenol - formaldehyde, Teflon, polymethyl methacrylates, polyurethanes and polycarbonates. Elastomers : Deficiencies of natural rubber, vulcanizations, advantages of synthetic rubber. Manufacture and uses of Neoprene and Buna-S. Adhesives : Manufacture and applications of epoxy resins. 8 hrs

6. Conducting Polymers and fullerenes: Conducting Polymers: Definition, examples – PA, PPP, PPY and others, differences between conducting polymers and conventional conductors, doping – oxidation reductive, protonic acid doping, mechanism of conduction – formation of soliton, polaron and bipolar mechanisms. Fullerenes: Structure of C60, preparation, reactions; Friedal Crafts reaction, addition halogenations. 4 hrs

7. GREEN CHEMISTRY: Introduction, Principles, Atom economy : Concept, AE in oxidation of benzene & butane, synthesis of aldrin by Diels – Alder reaction; Waste : Production & Prevention, E-factor, synthesis of ibuprofen; Water as a reaction solvent : Concept & Synthesis of indole, reduction reactions; Microwave Irradiation in Organic synthesis : concept, advantages, synthesis of esters, oxidation reactions, amination of ketones; Ionic liquids : examples, concept, synthesis of 2 – phenylacrylic acid; Biocatalysis : concept, advantages, synthesis of 6 - aminopenicillanic acid; Synthesis of vitamin C. 8 hrs

8. Nonomaterials: Introduction and definition of nanoparticles and nanomaterials, electronic structure, electronic band theory. Preparation of nanoscale materials: Precipitation, mechanical milling, chemical vapor deposition and sputtering. Fullerene: Nature of carobn bond, Discovery of C60, Synthesis of C60, Structure of C60, Alkali doped. 7 hrs

9. Tutorials 10 hrs

Question paper pattern for theory: Shall consists of 14 questions of 10 marks each (with sub divisions a and b with 6 and 4 marks) out of which 10 questions have to be answered (5 questions from each PART). While setting the question paper, 7 questions in PART-A and 7 questions in PART B have to be set. For PART A, questions should be drawn from the chapters 1-4 (Electronic structure of solids, metal finishing, Battery technology and corrosion Engineering) and for PART B, questions should be drawn from the Chapters 5-8 (High polymers, conducting polymers and fullerenes, Green Chemistry and Nanomaterials)

Reference Books :

1. Solid State Chemistry and its applications by A. R West, John Wiley , 1987
2. Engineering Chemistry by P C Jain and Monica Jain, Dhanpatrai Publishing Co. Ltd.
3. Chemistry in Engineering and Technology Vol. 1 and Vol. 2 by J. C Kuriacose and J. Rajaram, Tata McGraw-Hill Publishing Company Ltd.
4. Chemistry of Advanced Materials by C.N. R. Rao, Blackwell Scientific Publications.
5. Solid State Chemistry Compounds by A. K. Cheethan and P. Day, Clarendon Press, Oxford, 1992.
6. An introduction to electrochemistry by Glasstone, East-West Press Pvt. Ltd, 1985.
7. Chemical and Electrochemical Energy Systems by R. Narayan and B. Viswanathan, University Press, 1998.
8. Text book of Polymer science by F. W. Billmeyer, Jr., John Wiley and Sons, 1994.
9. Engineering Chemistry by R. Gopalan, D. Venkappayya and Nagarajan, Vikas Publishing House Pvt. Ltd, 1999.
10. Green Chemistry An Introductory Text by Mike Lancaster, Royal Society of Chemistry, 2002.
11. Green Chemistry Environment Friendly Alternatives by Rashmi Sanghi and M. M. Srivastava, Narosa Publishing House, 2003.

2K11SP1102 ENGINEERING PHYSICS LABORATORY

1. Density of Glass tube
2. Volume resonator
3. Sonometer
4. Diffraction grating
5. Air wedge
6. Newton's ring
7. Experiment with laser
8. n by dynamic method
9. y by single cantilever
10. y by bending method
11. Experiment with fiber optics
12. Determination of Currie temperature of a ferromagnetic substance
13. Transistor characteristics
14. Temperature dependence of risibility of semiconductor
15. Measurement of dielectric constant and its temperature dependence

2K11SC1102 ENGINEERING CHEMISTRY LABORATORY

For examination an experiment each from PART – A and PART – B shall be set. Under PART-A, a common experiment shall be set for all the candidates while under PART – B different experiment may be set.

PART – A

1. Preparation of standard EDTA solution and determination of total hardness of water.
2. Preparation of standard EDTA solution and determination of calcium oxide in the given sample of cement solution (rapid EDTA method).
3. Determination of Cu% in brass using standard sodium thiosulphate solution (brass solution to be prepared by weighing the brass sample).
4. Preparation of standard dichromate solution and determination of iron in the given sample solution of haematite ore (external indicator method).
5. Determination of manganous dioxide in the pyrolusite using potassium permanganate solution (pyrolusite is to be weighed).
6. Determination of chemical oxygen demand of the given industrial waste water sample.
7. Estimation of Ca^{2+} ions in the solution of dolomite.

PART – B

1. Determination of pKa value of a week acid using pH meter.
2. Colorimetric determination of iron / copper / any other metal.
3. Estimation of hydrochloric acid using standard sodium hydroxide solution conductometrically.
4. Determination of coefficient of viscosity of a given liquid using Ostwald's viscometer (density of the liquid is to be given).
5. Kinetics of acid hydrolysis of methyl acetate.

PART – C

1. Demonstration of Chemistry software – Viscosity experiment, demonstration of IR spectroscopy.
2. Demonstration of gravimetric estimation of nickel using dimethylglyoxime.
3. Demonstration of synthetic organic compound synthesis using microwave irradiation (synthesis of asprin, glucose pentaacetate, oxidation and reduction reactions).
4. Flamephotometric determination of sodium / potassium.

2K11CI1301 PROGRAMMING WITH C

PART – A

Chapter 1: Computer Fundamentals 6 hrs

Introduction to digital Computer, Input Devices, Output devices, Storage devices, Operating System, Unix Commands: ls, mkdir, rmdir, cp, mv, rm, type, cat, date, who, banner, pwd, chown.

Chapter 2: Fundamentals of C 8 hrs

Introduction, Character Set, Identifier and Keywords, Constants and Variables, Character and Character Strings, Promotion and Typecasting, Labels, Data types, Operators and Expressions, Operator Precedence and Associativity, Basic Input and Output Statements, Library Functions, Programming Examples.

Chapter 3: Control Statements 8 hrs

Introduction, if Statement, if-else statement, Multi-way decisions, Compound statements, Loops, for Loop, while loop, do-while loop, break statement, switch statement, continue statement, goto statement, Programming Examples.

Chapter 4: Functions and Scope 8 hrs

Introduction, Necessity of Functions, Function Declaration and Definition, Classification of Functions, User defined and library functions, Function parameters, Return values, Recursion, Scope and Extent, Programming examples.

PART – B

Chapter 5: Arrays and Strings 8 hrs

Introduction, Necessity of Arrays, Multidimensional arrays, Sorting and Searching of Arrays, Strings, Arrays of strings, Addition and Multiplication of 2 Matrices, Functions in string.h, Programming examples.

Chapter 6: Pointers 8 hrs

Introduction to Pointers, Declaration and Initializing of pointers, Accessing a variable through its pointer, Pointers and Arrays, Passing Arrays to Functions, Pointers and Functions, Accessing arrays inside functions, Programming Examples.

Chapter 7: Structures and Unions 8 hrs

Introduction, Declaring and using Structures, Structure initialization, Operations on structures, Array of structures , Array within structure, Structures and Functions, Pointers to Structure, Pointers with in the Structure, Union, Differences between Structure and Union, Operations on a union, Programming Examples.

Chapter 8: Dynamic Memory Allocation 4 hrs

Introduction, Library functions for dynamic memory allocation, Dynamic multi-dimensional arrays, Self Referential Structures, Singly linked list.

Chapter 9: Files 2 hrs

Introduction, File structure, File-handling functions, File Types, Concatenation of files.

References:

1. Mastering C: Venugopal K.R et al Tata McGraw Hill, 2006. (Chapter: 1 to 7, 8.1 to 8.6, 8.10 to 8.13, 9, 10.1 to 10.4, 14.1 to 14.3, 15)
2. Programming in ANSI C: Balaguruswamy E, Tata McGraw Hill 1992.
3. Programming in C: Yashwanth Kanetkar P, BPB Publications, 1997.
4. The C Programming Language: Kernighan B.W and Ritchei D.M, Prentice Hall, 1971.
5. The C Odessey: Vijay Mukhy, BPB Publications.
6. C – Aptitude: Venugopal K.R, et al, Tata McGraw Hill, 2006.

Question paper pattern : The question paper consists of 8 questions of 20 marks each. The students have to answer 5 full questions, selecting at least two questions from each

C PROGRAMMING LAB

1. a) Write a program to determine the mean, variance and standard deviation of *n numbers*.
   b) Write a Program to convert a given number in binary to decimal.

2. a) Write a program to find the smallest and largest element in an array.
   b) Write a program to concatenate two strings.

3. a) Write a program to find the sum of squares.
   b) Write a program to solve the quadratic equation for all conditions i.e., roots are equal, imaginary and distinct.

4. a) Write a program to print the reverse of an integer.
   b) Input 'n' integers (real, character) & store them in an array.

5. Write a program to sort the elements in ascending and descending order Using
   a) Bubble sort b) Selection Sort

6. a) Write a program to find whether the given string is a Palindrome or not.
   b) Write a program to insert an element into an array.

7. a) Write a program to calculate the grades of n students from three tests.
   b) Write a program to delete an element from an array.

8. a) Write a program to search an element using linear search.
   b) Write a program to find the factorial of a number using Recursion.

9. a) Write a program to search an element using binary search.
   b) Write a program to generate the Fibonacci series using recursion.

10. Input 2 matrices of size M X N and P X Q. Perform
    a) Multiplication if they are compatible.
    b) Transpose of the resultant matrix. Print the result in matrix form with suitable headings.

11. Write a program to read and display details of students using structure.

12. Write a program to concatenate two files

13. Write a program to display Norm and Symmetry of Matrix.

14. Write a program to create and display the linked list.

2K11EM1101 MECHANICAL ENGINEERING SCIENCES

PART - A

1. Energy and its Sources: Energy – renewable and non-renewable, thermal, hydroelectric, solar, wind, tidal, ocean and nuclear energy. 3 hrs

2. Steam Generation

Boilers – Fire tube (Vertical Fire tube Boiler) & Water tube boiler (Babcock & Wilcox Boiler). Concept of wet, dry and superheated stream, Enthalpy, Latent heat, dryness fraction, degree of superheat and Entropy, Related numerical problems. 4 hrs

3. Energy Conversion : Using the following

a) Steam turbines: impulse and reaction turbines. 4 hrs

b) I.C. Engines: Diesel and petrol engines. Four stroke and two stroke engines. Indicated power and brake power, mechanical efficiency and thermal efficiency, Related numerical problems. 6 hrs

4. a) Air Compressor : Use of compressed air. Working of compressor, brief introduction and advantages of multi stage compressors. 3 hrs

b) Refrigeration and Air Conditioning: vapor compression and vapor absorption refrigeration, Principles of air conditioning 3 hrs

PART – B

5. Fasteners: Temporary and permanent fasteners, ISO thread profile, single and multi start threads, lead and pitch Left and right hand threads, Hexagonal and square head bolts and Nuts, Riveted joints- single riveting and double riveting and welded joints. 6 hrs

6. Power Transmission: Belt, rope, chain and gear drives, Velocity ratio, Ratio of Tensions, power transmitted given the relevant formulae (derivation of formulae is Not included) 6 hrs

7. Brakes, dynamometers and clutches: Functions and types of brake, dynamometers and clutches. 3 hrs

8. Bearings & Lubrication: Type of bearing, Journal bearing, & ball bearing. Necessity of lubrication. Types of lubricants, properties of a good lubricant. 4 hrs

PART – C

9. Basic principles, procedures, advantages and limitations. Applications and examples involved in the following processes. 12 hrs

a. Casting b. Forging c. Rolling d. Drawing e. Extrusion f. Welding g. Brazing & Soldering

10. Machining : Lathe : Block diagram of lathe, Basic concepts in turning, taper turning and thread cutting operation. Drilling : classification of Drilling Machines and their operations. 6 hrs

References :

1. Workshop Technology : Raghuwamashi
2. Workshop Technology : Hajra Choudhary
3. Elements of Mechanical Engineering : K.R.Gopalkrishna
4. Theory of Machines : P.L. Ballaney

Note: Question paper shall contain 8 questions, Five questions to be answered choosing at least 2 from Part A and Part B and one from Part C. Part A contains 3 questions and Part B contains 3 questions and Part C contains 2 questions

2K11EM1102 WORKSHOP PRACTICE

Exercises in fitting shop comprising preparation of different joints using files, hacksaw, taps, dies and drills in 50mm by 6mm thick mild steel flats. 3 Models

Exercises in Welding shop comprising welding lap joint, butt joint, and L-Joint in mild steel flats. 3 Models

Exercises in carpentry shop comprising planning and chiseling and preparation of different joints like dove-tail joint Tenon Mortise joint and open bridle-mortise joint in 25mm x 50 mm cross section wood 3 Models

Exercises in sheet metal shop comprising development and soldering of cylinder (base closed), cubical box, simple funnel (made of frustums of cones/Pyramids) and rectangular tray in 22 gauge (1.2 mm thick) G.I. sheet. 3 Models

Use of power tools to make one of the models in each shop Total: 12 Models

Scheme of Examination:- Preparation of one model either at fitting shop or carpentry shop. Preparation of one model in either at welding shop or soldering shop. Viva – Voce.

2K11EE1302 ELECTRICAL LABORATORY

1. Fluorescent lamp connection with and without capacitor.
2. Prove Kirchhoff's laws for DC circuits.
3. Measurement of inductance (3 Voltmeter method and AVW-method).
4. V-I characteristics of semiconductor diode.
5. Open circuit characteristics of DC shunt generator.
6. Speed control of DC motor-flux control and Armature control.
7. Open circuit and Short circuit test on single phase transformer (Calculation of % regulation and % efficiency).
8. Transistor characteristics CE configuration.
9. Star and delta connection, to verify phase and line relationships.
10. Op-Amp applications:- Voltage follower-Inverting, Non-inverting amplifier, Adder, Differentiator and Integrator.

2K11SM1201 ENGINEERING MATHEMATICS –II

PART - A

Unit-1: Solutions of ordinary differential equations of first order and first degree: Homogeneous forms, Linear and Bernoulli equations, Exact and reducible to exact equations, using standard integrating factors – orthogonal trajectories in Cartesian and polar forms. 6 + 1*=7 hrs

Unit-2: Second and higher order differential equations, homogenous linear equations with constant and variable co-efficients, problems. Non-homogeneous linear equations with constant and variable co-efficients, problems, Method of variation of parameters, Method of undertermined co-efficients. 6 + 2*=8 hrs

Unit-3: Vector differential calculus: Vector valued function of a single variable, Differentiation, Geometrical meaning, examples. Scalar and vector fields, gradient of a scalar field, geometrical application, divergence and curl of a vector field, Laplacian, vector identities. 7 + 1*=8 hrs

Unit-4: Vector integration : Line, surface and volume integrals of a vector function, Green's, Stokes and Gauss's theorem (without proof) problems. Orthogonal curvilinear co-ordinates. 6 + 1*=7 hrs

PART - B

Unit-5: Laplace transforms : Definitions and basic properties, Laplace transform of elementary functions and standard results, Laplace transforms of derivatives and integrals, Laplace transforms of periodic function, Unit step functions. 6 + 1*=7 hrs

Unit-6: Inverse Laplace Transforms, Convolution theorem, Applications of Laplace transforms to solve linear ordinary differential equations of first and second order with constant co-efficients. 6 + 2*=8 hrs

Unit-7: Analytical Geometry in three dimensions : Direction cosines and direction ratios, planes, straight lines, Angle between planes / straight lines, coplanar lines, shortest distance between skew line and right circular cone and right circular cylinder. 6 + 1*=7 hrs

Unit-8: Special functions : Series solution of the Bassel differential equation, Recurrence relation orthogonality, Generating function.
Series solution of Legendre differential equation, Recurrence relations, Generating functions, Legendre polynomials. 7 + 1*=8 hrs

Total number of hours is 64 (50 hours of teaching, 10 hours of Tutorials and 4 hours of internal test (* indicates Tutorial hour)

Question paper pattern :
The question paper contains two parts namely, Part A and Part B. Each part contains 4 questions. Five full questions are to be answered in all out of 8 questions, choosing at least two from each part.

Text Books:
1. Thomas G B & R L Finnery, Calculus, Addison Wesley, 9th Edition, 1998.
2. E. Kreyszig, "Advanced Engineering Mathematics" 8th Edition, 2004, John Wiley and sons.
3. P V O Neil, "Advanced Engineering Mathematics", Pearson / Thomson.

2K11CE1201 STRENGTH OF MATERIALS
(Common to all branches except B.Arch)

Hours / Week : 4 Exam : 3 Hours
Total : 60 hours Max Marks : 100

PART A

1. Simple Stresses and Strains : Concept of stress and strain, types of stresses, types of strains, Elasticity, Hooke's law, Elastic Modulus, stress-strain diagrams for ductile and brittle materials, principle of superposition, bars of varying cross section, Saint Venant's principle, tapering bars of circular cross section, tapering bars of rectangular cross section of uniform thickness, compound bars. 10 Hrs

2. Elastic constants : Poisson's ratio, Volumetric strain, Volumetric strain of rectangular block and circular rod, Bulk Modulus, relation between E and K, Rigidity modulus, relation between E and C, relation among E, C and K. Temperature stresses – temperature stresses in composite sections. 8 Hrs

3. Shear force and Bending moment in beams : Shear force, Bending moment, relation among loading, SF and BM, SFDs and BMDs for simply supported beam, cantilever beams and overhanging beams subjected to concentrated, uniformly distributed load, uniformly varying loads, moment and couple. Loading pattern and BMD form SFD. 12 Hrs

PART B

5. Deflection of Beams: Differential equation of deflected beam, slope and deflection of simply supported beam, cantilever beams and overhanging beams by double integration method and Macaulay's method. 8 Hrs

6. Torsion of Shafts : Theory of Torsion, Torsion equation – assumptions and derivation, torsional rigidity, polar modulus transmission of power, strength and stiffness of solid and hollow circular shafts. 8 Hrs

7. Elastic stability of columns : Ideal column, slenderness ratio, short column and long column, critical load, effective length, Euler's formula for different end conditions, Rankine's formula. 8 Hrs

8. Thin and Thick Cylinders : Introduction, stresses and strains in thin cylinders subjected to internal fluid pressure, stresses in thick cylinders. Lame's equation. 6 Hrs

References Books:

1. Strength of Materials – S S Bhavikatti, New Age Intenational (P) Ltd.,
2. Strength of Materials – R K Bansal, Laxmi Publications (P) Ltd.,
3. Strength of Materials – S Ramamrutham, Dhanpat Rai Publishing Company (P) Ltd.,
4. Strength of Materials – M A Jayaram, Sapna Book House.
5. Mechanics of Materials – B C Punmia, Ashok K Jain and A K Jain, Laxmi Publications (P) LTd.,
6. Mechanics of Materials – J B K Das and P L Srinivas Murthy, Sapna Book House.
7. Engineering Mechanics of Solids – Popov E P., Pearson Education Asia.
8. Strength of Materials – Singer F L., Harper International.

Question paper pattern :
The question paper consists of 4 questions from Part A and 4 questions from Part B. The students have to answer Five full questions, selecting at least Two questions from each part.

2K11EC1201 BASIC ELECTRONICS

PART A

1. Introduction to Electronics : What is electronics, Electronic Devices, Evolution of Electronics- Vacuum tubes to Integrated Circuits, Conduction in Semiconductor: Electrons and holes in an intrinsic semiconductor, conductivity of a semiconductor, carrier concentration in an Intrinsic semiconductor, donor and acceptor impurities , charge densities in a semiconductor, Fermi level in a semiconductor having impurities, life time of carriers, Hall effect. Introduction to Solar energy Conversion, Photovoltaics. 7 hrs

2. Semiconductor – Diode Characteristics: Qualitative theory of a PN junction, PN Junction as a diode, Volt – Ampere characteristics , temperature dependence of P-N characteristics, half wave and full wave rectifiers, ripple factor, capacitor filter, Zener Diode- characteristics, Zener and avalanche breakdown, Zener regulated power supply. 7 hrs

3. Transistor Characteristics : Junction transistor, transistor – current components, transistor as an amplifier, common base configuration, common – emitter configuration and Common Collector configuration with input and output characteristics, CE cutoff region, CE saturation region , large signal , DC and small-signal CE values of current gain, operating point, bias stabilization, decibel, Classification of amplifiers, RC coupled amplifier, frequency response, distortion in an amplifier, cascading transistor amplifiers 12 hrs

4. Theory of Sinusoidal oscillators: Concept of feedback, sinusoidal oscillators, working of RC phase shift, Colpitts and Hartley's oscillator using BJT's Expressions for frequency of oscillation (No derivation), crystal oscillator. 4 hrs

PART B

5. Operational Amplifiers (OPAMP): Introduction, ideal OPAMP, need for OPAMP, OPAMP characteristics, OPAMP applications: voltage follower, addition and subtraction using OPAMP circuits, OPAMP integrating and differentiating circuits. 7 hrs

6. Communication systems: Basic block diagram of communication systems: Radio AM & FM, TV, Overview of Mobile communication, Satellite communication, Modulation, Amplitude Modulation , Frequency spectrum, power relations, Phase and Frequency modulation ,comparison of AM and FM, radio telephony, super heterodyne receiver, Transmitters. 10 hrs

7. Digital Electronics: Digital logic – Binary numbers base conversion, Octal and Hexadecimal numbers , binary addition and subtraction using One's and Two's complements, addition and subtraction in Binary, Octal and Hexadecimal Number systems, BCD and EX-3 addition and subtraction, numbers, binary logic symbols, basic theorems & properties of Boolean Algebra, De-Morgan's theorem. AND OR logic gate realizations using Transistor – Transistor Logic (TTL) , MOS, CMOS , NMOS,PMOS . Symbols used for NOT, OR, AND, NAND , NOR, XOR gates and their truth tables, Realization of Boolean functions using basic gates. Realization of basic gates using universal gates. 10 hrs

8. Introduction to Cathode Ray Oscilloscope (CRO) Basic block diagram, use of CRO for measurement of amplitude Frequency and Phase. 3 hrs

Reference Books:

1. Basic Electronics M.V. Rao
2. "Electronics Devices and Circuits" Millman and Halkias, TMH 1991 Reprint 2001
3. Electrical and Electronics Computer Engineering for Scientist and Engineers, 2nd edition K.A. Krishna Murthy and M Raghuveer, New Age International Publishers(Wiley Easter 2001
4. Electronics Communication Systems, George Kennedy (TMH 4th edition
5. Electronics Principles A.P. Malvino, TMH 6th edition
6. Digital Logic and Computer Design, Morris Mano
7. Basic Electronics by Dr. H. N. Shivashankar and B. Basavasraju.
8. Principles of solar energy by D. Yogi Goswami, Frank Kreith, Jan.F. Kreider., Eswar Press, Chennai.
9. Data Communication by William Schweber, Mcgraw Hill.

Note: Question paper shall contain 8 questions, one question from each unit. Five questions to be answered choosing at least 2 from each part.

2K11EM1201 ENGINEERING DRAWING

PART - A

Fundamentals of Engineering Drawing:
B.I.S. Conventions for Engineering Graphics, Dimensioning, Use of instruments, Simple geometrical constructions, construction of polygons, lettering, concept of R.F. (Representative Fraction) in scales. 4+6 hrs
Projection of Points: Concept of Orthographic Projection; Projection of points in different quadrants, emphasizing on First Angle Projection. 2+3 hrs

Projection of Straight Lines: Projection of lines in simple positions, inclined to one plane and parallel to other plane, inclined to both planes. To find true length and true inclinations, Practical problems. 6+12 hrs

PART – B

Projection of Plane Surfaces: Projection of right regular triangle, hexagon and pentagon, square, rectangle & circle without through holes (by change of position method and auxiliary plane method) 6+12 hrs

Projection of Solids: Projection of the following simple and right regular solids: Prisms, Pyramids, Cones and Cylinders (without through holes), inclined to both HP & VP (by change of position method) and Auxiliary Plane Method. 8+15 hrs

PART - C

Isometric Projection : of right regular solids viz, prisms, pyramids, cone, cylinder and their frustums and sphere and combination of any two of these solids. Simple Department of Mechnical Engineering, UVCE, Bangalore (@K10 Scheme of study) machine parts. 6+12 hrs

Scheme of Examination: TWO questions from PART A i.e, ONE on Projection of lines, One on practical problems involving lines, Four questions from PART B, TWO on plane surfaces and Two on solids. TWO questions from PART C. Student to answer ONE from PART A and THREE from PART B and ONE from PART C each of 20 Marks

TEXT BOOKS:

1. Engg Drawing Vol - I & Vol – II in Angle Projection, Gopala Krishna K. R
2. Engg Drawing in I Angle Projection, Bhatt N.D
3. Machine drawing, Gopala Krishna K.R

III SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11SM301 Engineering Mathematics – III

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART – A

UNIT-I

Partial Differential Equations (PDE) Formulation of PDE, Solution of non homogeneous PDE by direct integration, Method of separation of variables. (First and second order equations), Solution of Lagrange's linear PDE of the type Pp + Qq=R , Solution of standard types of non-linear partial differential equations – Charpits method. (6+1*=7) hrs

UNIT-II

Fourier Series Periodic functions, Fourier expansions, Half range expansions, Complex form of Fourier Series, Practical Harmonic analysis. (6+2*=8) hrs

UNIT-III

Fourier Transforms Finite and infinite Fourier Transforms, Fourier sine and cosine Transforms, Properties, inverse transforms. (6+1*=7) hrs

UNIT-IV

Z-Transforms Definition, Standard Z-Transforms, Linearity property, damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms, Application of Z-Transforms to solve differential equations. (7+1*=8) hrs

PART – B

UNIT-V

Statistics and probability : Curve Fitting, Fitting of a straight line, Fitting of a curve of the form $y = ab^x$, Fitting of a Parabola, Correlation, Regression, Basic concepts of probability, Addition theorem, Conditional probability, multiplication theorem, Bayes's theorem. (6+2*=8) hrs

UNIT-VI

Random variables Discrete and continues random variables – FDF – CDF, Binomial , Poisson, Exponential and Normal distributions. (7+1*=8) hrs

UNIT-VII

Joint Probability and Markov Chains : Joint probability distributions, concept of joint probability , joint distributions, discrete and continuous, independent random variables, problems on expectation and variance.

Markov Chains : probability vector, stochastic matrices, Fixed vectors and regular stochastic matrices, higher transition probabilities, stationary distributions and absorbing states. (6+1*=7) hrs

UNIT-VIII

Calculus of variations Variation of a function and a functional, External of a function, variational problems, Euler's equation, standard variational problems, including Geodesics, Minimal surface of revolution, hanging chain, Brahistochrone problems. (6+1*=7) hrs

Total number of hours is 64 (50 hours of teaching, 10 hours of Tutorials and 4 hours of internal test (*indicates Tutorial hour)

PATTERN OF QUESTION PAPER :

The question paper contains two Parts namely PART-A and PART-B each containing 4 questions. Five questions are to be answered in all of 8 questions, choosing atleast two from each PART.

References :

9. Thomas, G B & R L Finney, Calculus, Addison Wesley, 9th Edition, 1998.
10. Kreyszig, E, Advanced Engineering Mathematics, John Wiley, 8th Ed., 1999.
11. P V O Neil Advanced Engineering Mathematics, Pearson Thomson.
12. S C Gupta and V K Kapoor, Fundamentals of Mathematical Statistics, S Chand & Sons publishers.
13. Walpole and Myers, Probability and Statistics for Engineers and Scientists, 2007.

III SEMESTER B.E (ELECTRICAL & ELECTRONICS)

2K11EE301 Analog Electronic Circuits

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. Marks 25.**

PART-A

1. **Wave Shaping circuits:** Diode Clipping and Clamping circuits, Clamping Circuits Theorem, Attenuator. 2 hrs +1* hr
2. **Analysis of BJT and JFET amplifiers:** Different Types of Biasing circuits for BJTs & JFETs Stability of Operating Point in BJT circuits. h-parameter Model of Small Signal, Low Frequency BJT Amplifiers. Analysis of BJT Amplifiers in CE, CB & CC Modes, Small Signal Model of JFET, Analysis of Low Frequency Common Source & Common Drain Amplifiers. Differential Amplifiers.

   12 hrs +3* hrs
3. **High Input resistance BJT Circuits:** Analysis of Emitter follower, Darlington emitter follower & Boot strapped emitter follower circuits. 2 hrs +1* hr
4. **Frequency Response of Amplifiers :** LF & HF response. coupled amplifiers - RC coupled, transformer coupled & direct coupled amplifiers, Multistage amplifiers - Effect of cascading on amplifier response, Gain bandwidth product, Tuned amplifiers - single tuned amplifiers, doubled tuned and stagger turned circuits - frequency response. 5 hrs +1* hr
5. **Large Signal Amplifier :** Classification, AC load line, Class A & AB (Push Pull & Complementary symmetry) amplifiers - efficiency, Linearity, Harmonic distortion. 4 hrs +1* hr

PART-B

6. **Feedback Amplifiers:** Classification, Concept of feedback, Topologies of feedback amplifier, Effect of feedback on different characteristics of feedback amplifier, Analysis of voltage series, current series, current shunt & voltage shunt feedback amplifiers. 6 hrs +2* hrs
7. **Sinusoidal Oscillators :** Barkhausen criteria, Generalized Analysis of BJT oscillators - RC phase shift & Wein bridge oscillator. Hartley, Colpitt's oscillator. Crystal oscillators, Negative resistance – Tunnel diode: characteristics and Tunnel diode oscillator. 8 hrs +2* hrs
8. **Voltage Time Base Generators:** Features of time base signal, Methods of generation Bootstrap time base generator - working & waveforms. 2 hrs +1* hr
9. **DC Power Supplies:** Half wave, Full wave & Bridge rectifiers - ripple factor, efficiency, regulation & transformer utilization factor. Full wave rectifier with filters - Analysis of capacitor, inductor, LC & Pi section filters. Regulators - Zener regulator, Series regulator with & without feedback, shunt regulator & current regulator. Short circuit protection, Voltage multipliers - Half wave & Full wave.

   9 hrs +2* hrs

50 hrs + 14* hrs Tutorials

REFERENCES :

1. Principles of Electronics - Kamal Choudhary.
2. Taxas instrumentation Inc - Transistor Circuit Design.
3. Pulse Digital & Switching wave forms - Millman & Taub.
4. Foundation of Electronics - Chatopadhyay.
5. Pulse, digital & switching waveforms - Millman & Taub, McGraw Hill International Edition.
6. Electronic Devices & Circuits - Millman & Halkias, McGraw Hill International Edition.
7. Electronic Devices & Circuits Theory - Nashelsky & Boylested, PHI -EEE.
8. Electronic Principles - Malvino, TMH Publications.
9. Electronic Principles - Gray & Campbell, Wiley Eastern.
10. Applied Electronics - Gray, Asia Publishing.

Question paper pattern :

The question paper consists of 8 questions of 20 marks each.
The students have to answer 5 full questions, selecting at least two questions from each PART

2K11EE302 Electric Circuits

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART-A

1. **Basic Concepts :** Linear, non-linear, unilateral, Bi-lateral circuits with examples. Independent and dependent sources with examples. Source shifting and Transformation technique. The concept of loop current and node voltage analysis. Solution of Network by loop-current, node-voltage method and star-delta networks. 10 hrs + 3* hrs
2. **Network topology :** Graph of a network, concept of a tree and links, incidence matrix, tie-set and cut-set schedule, solution of networks, Principle of duality in networks. 6 hrs
3. **Network Theorems :** Superposition, reciprocity, Thevenin's, Nortorn's, Maximum power transfer theorems, Millman's theorem. 10 hrs + 3* hrs

PART-B

4. **Resonant Circuits, Locus Diagrams, Coupled Circuits :** Series and parallel resonance, frequency response of series and parallel circuits.**:** Solution of series and parallel networks using Locus diagrams. Mutual Inductance, coefficient of coupling, DOT convention, analysis of coupled circuits, conductivity equivalent coupled circuit. 6 hrs + 2* hrs
5. **Polyphase Circuits :** Analysis of balanced and unbalanced 3-phase circuits. Measurement of active and reactive power with balanced and unbalanced load. 6 hrs + 2* hrs
6. **Transient Behaviour and Initial Conditions in Network :** Behavior of circuit elements under transient condition. Transient response of a circuit for AC & DC excitations. Importance of initial conditions. Evaluation of initial conditions in RL, RC and RLC circuits. 6 hrs + 2* hrs
7. **Two Port networks :** Open Circuit, Impedance parameters, Short circuit Admittance parameters, Transmission and Hybrid parameters. Relation between parameter sets. Calculation of these parameters for a given Network. Network functions of one port and two port Networks, poles and zeros. Time domain response from pole zero diagram. 6 hrs + 2* hrs

50 hrs + 14* hrs Tutorials

REFERENCES BOOKS :

1. Engineering Circuit Analysis - Hayt & Kimmerly.
2. Theory and Problems of Electric Circuits (Schaum's outline Series) – J A Edminister.
3. Networks – Desur & Kuh (KUO).
4. Networks – Roy Chowdhary.
5. Network Analysis – Umesh Sinha.
6. Network Analysis - Bakshi

Question paper pattern :
The question paper consists of 8 questions of 20 marks each.
The students have to answer 5 full questions, selecting at least two questions from each PART.

III SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE303 DC Machines & Transformers

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART-A

1. **D C Generator :** Constructional features, EMF equation. Armature reaction - demagnetising and cross magnetising ampere turns. Commutation. Reactance voltage, Interpoles, compensating windings. 8 hrs + 2* hrs

2. **D C Generator Characteristics :** Types - series, shunt compound and separately excited generators. Magnetisation characteristics. Critical field resistance. Load characteristics and critical load resistance. 5 hrs + 1* hr

3. **D C Motors :** Back emf, speed, torque & Characteristics of DC motors. Types- shunt, series and compound motors, application. 4 hrs + 2* hrs

4. **Speed Control of DC Motors :** Armature voltage and field current control of dc shunt motors. Series - parallel control of series motors. Motor starters. (including design) 4 hrs + 2* hrs

5. **Testing of DC Machines :** Losses, efficiency and condition for maximum efficiency. Direct test and Indirect tests : Hopkinson, Swinburne's & Retardation tests. Load test. 4 hrs + 2* hrs

PART-B

6. **Transformers :** General principle, transformer action, types of transformers. Constructional features, Conservator, Breather, Bushings, Cooling methods, EMF equation, Transformer analysis on no load and load, equivalent circuit, 3 phase transformer connections, Tertiary windings, Scott and open Delta connections, variable frequency transformers.

Losses, separation of core loss into its components. Efficiency and condition for maximum efficiency, All day efficiency and Regulation. Predetermination of efficiency and regulation. Parallel operation of Single phase and Three phase transformers. (only condition)

Current in rush, impact of over voltage and short circuit. No load and on load tap changers. Harmonics.

18 hrs + 4* hrs

7. **Auto Transformer :** Single phase and Three phase Auto transformers, advantages & disadvantages. 2 hrs

8. **Testing of Single phase Transformer :** Polarity test, Short circuit and Open circuit tests, Sumpner's test. 4 hrs + 2* hr

50 hrs + 14* hrs Tutorials

REFERENCES BOOKS :

1. Performance and Design of DC Machines - A E Clayton & N N Hancock.
2. Electrical Technology : H Cotton.
3. Performance & Design of AC Machines : M. G. Say.
4. Theory of AC Machines - Langsdorf.
5. Principles of AC Machines - Lawrence & Richards
6. J & P hand book

Question paper pattern :
The question paper consists of 8 questions of 20 marks each.
The students have to answer 5 full questions, selecting at least two questions from each PART.

III SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE304 Electrical & Electronics Measurements

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART-A

1. **Units, Dimensions :** S-I system of units. Dimensional analysis using S-I system of units. 4 hrs + 3* hrs
2. **Calibration of Measurements & Errors :** Prototype calibration, Standard classification, Systematic errors, Random errors, Cumulative errors, Resolution, accuracy, Precision, Stability of Instruments. 3 hrs
3. **Ammeters, Voltmeters, Wattmeter, Energy meter and Instrument Transformers :** Review of Permanent magnet moving coil, moving iron, Ammeter, Voltmeter, Electrostatic Voltmeter - theory, construction, errors and limitations. Methods of range extension. Dynamometer type wattmeter-errors and compensating devices. LPF watt meters. Three phase wattmeter and reactive power meter. Induction type energy meters -single phase and three phases. Errors, adjustments and calibration. Theory and construction of current transformers-ratio and phase angle error. Theory and construction of potential transformers, errors. Effect of variation of burden, power factor and frequency on the performance of CT and PT. Silsbee's method of CT testing. 10 hrs + 6* hrs
4. **Measurement Of Resistance, Inductance And Capacitance :** Wheatstone bridge and its limitations, Kelvin's double bridge. Loss of charge method, Measurement of Earth Resistance, Factors affecting Earth Resistance, Cable fault location by Murray loop test, Maxwell's bridge. Anderson's bridge. Desauty's Bridge and Schering Bridge. AC and DC detectors. Sources of errors in A.C. bridges-remedial measures. 10 hrs + 3* hrs

PART-B

5. **Potentiometers :** Principle, Crompton's DC potentiometer, Polar and co-ordinate type AC potentiometers. Applications. 4 hrs + 2* hrs
6. **Electronic Meters :** Block schematic description of Electronic Voltmeter, True RMS Voltmeter, Digital Voltmeter (Ramp and SAR), Source of Error in DVM, RF power and voltage measurements, Q meter. 5 hrs
7. **Signal Sources :** Function generators, Frequency synthesized signal generator, Standard signal generators (RF), Sweep frequency generators (Direct). 4 hrs
8. **Signal Analyzing Instruments :** Spectrum Analyzers – Principal of operation, Application of Spectrum Analyzer, quantitative analysis. 4 hrs
9. **Digital Analyzing Instruments :** Electronic Counters, Logic Analyzers. 3 hrs
10. **Input Transducers for instrumentation systems :** Classification, Selection, Strain gauge, LVDT, RTD, Piezoelectric, Thermocouple. 2 hrs

50 hrs + 14* hrs Tutorials

REFERENCES :

1. Electrical & Electronic Measurements & Instrumentation - A K Sawhney.
2. Modern Electronic Instrumentation and Measuring Techniques - Cooper & Helfrick.
3. Electrical Measurements & Measuring Instruments - Golding & Widdies, Pitman.
4. Electrical Measurements - Harris.
5. Principles of Measurement Systems - John P Beately.
6. Electrical Measurements - Stout.
7. Applied Electronics Instrumentation and Measurement – David Buchala and Wayne.
8. Electronics Measurement, New York, McGraw Hill – Terman and Petit.
9. Electronic Instrumentation – K S Kalsi.
10. Electrical & Electronic Measurements and Instruments – Gupta.

Question paper pattern :

The question paper consists of 5 questions in PART A and 3 questions in PART B.
The students have to answer 5 full questions, selecting 3 from PART A and 2 from PART B.

2K11EE305 Object Oriented Programming Using C++

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. Marks 25.**

1. **Introduction:** Characteristics of OOPs, Program statements, declaration statements, constants variables data types, Operators, type conversion, assignment statements, cin and cout statements. **Loops and Decisions :** For, While and Do-while loops, If, If-else, Switch statements, Break, Continue and Goto statements. 5 hrs + 2*hrs
2. **Functions :** Defining a function, function arguments, default arguments, constant arguments, passing by value, passing by reference, inline functions, function overloading, functions and strings, functions and structures, arrays and pointers. 5 hrs + 2*hrs
3. **Classes and Objects :** Specifying a class, member function, private & public, static data members, static member function, array of object, function argument, friend function, returning objects.

   8 hrs + 2*hrs
4. **Constructor & Destructor :** Definition, Constructor with default and multiple arguments, copy constructor, dynamic initialization of objects. 6 hrs + 2*hrs
5. **Operator overloading :** Definition, overloading unary and binary operator, usage of friend function, rules for overloading. 6 hrs + 2*hrs
6. **Inheritance :** Introduction, single, multiple, multilevel, hierarchical hybrid, virtual base class, abstract base class, constructors in derived class, pointers to objects, virtual functions, polymorphism.

   8 hrs + 2*hrs
7. **Files :** Streams, opening & closing of files, File modes, File input and output using fundamental and abstract data types, character and string input/output, templates and exception handling. 8 hrs + 2*hrs
8. **Data Structures :** Stack and Queues. 4 hrs

50 hrs + 14* hrs Tutorials

Reference Books :

1. E. Balaguruswamy : Object Oriented Programming with C++, TMH.
2. Bjranne Strousup : C++ Programming Language, Addison Wesley.
3. K R Venugopal, Ravishankar & Rajkumar : Mastering C++, TMH.
4. Robert Lafore : Object Oriented Programming using C++.

Question paper pattern :
The question paper consists of 8 questions. The students have to answer 5 full questions.

III SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE306 Analog Electronics Circuits Laboratory

3 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

1. Characteristics of semiconductor & Zener diodes.
2. Characteristics of transistor in CE mode: determination of static h - parameters.
3. Diode Clipping & Clamping cicuits.
4. Single stage RC coupled amplifier.
5. Direct Coupled amplifier.
6. Transformer coupled amplifier.
7. Emitter follower.
8. Differential amplifier.
9. Single tuned amplifier.
10. Class AB push pull power amplifier.
11. Voltage series feedback amplifier.
12. Transistor RC phase shift (Phase lead) oscillator using BJT.
13. Transistor Hartley & Colpitt's oscillators.
14. Piezo crystal oscillator.
15. Diode FWR with and without capacitor filter.
16. Series Voltage regulator.

III SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE307 Measurements laboratory

3 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

1. Measurement of Inductance by three Voltmeter, Ammeter method and A,V,W method.
2. Measurement of Capacitance by three Voltmeter, Ammeter method and A,V,W method.
3. Verification of theorems (D.C. Circuits only) Superposition, Reciprocity.
4. Verification of theorems (D.C. Circuits only) Thevenin's theorem, Maximum power transfer theorem.
5. Measurement of Resistance by

   (i) Wheatstone's Bridge (ii) Kelvin's Double Bridge
6. Adjustment and Calibration of Single phase Energy meter.
7. Measurement of Resistance by DC Potentiometer ; Calibration of Ammeter, Voltmeter & Wattmeter by D.C. Potentiometer.
8. Measurement of 3 phase active & reactive power by One Wattmeter method & Two Wattmeter method.
9. Measurement of L and C by A.C. Bridges

   a) Maxwell Bridge b) Desauty Bridge
10. Calibration of current - transformer by Silsbee's Test.
11. Calibration of Dynamometer type Wattmeter by Phantom Loading Method.
12. Measurement of displacement using LVDT.
13. Temperature measurement by Thermocouple/RTD.

IV SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11SM401 Engineering Mathematics – IV

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART-A

UNIT-I
Sets in the Complex plane-Functions of a complex variable-limit, continuity and differentiability (definitions only). Analytic functions,Cauchy-Riemann equations in Cartesian and polar forms. Harmonic functions, Constructions of analytic functions (Cartesian and polar forms). (6+1*=7) hrs

UNIT-II
Line integral, Cauchy theorem – corollaries. Cauchy integral formula for complex functions and for derivatives, Conformal transformations : $1/z$, z^2 , e^2 and $z + a^2/z$ $(z \neq 0)$. Bilinear transformations.
(6+2*=8) hrs

UNIT-III
Power series-Convegrence, Radius of convergence, Taylor's theorem and Laurent's theorem (statement only), Singularities. Poles, Calculations of residues. Residue theorem (without proof)-problems.
(6+1*=7) hrs

UNIT-IV
Evaluation of Contour integrals. (6+1*=7) hrs

PART–B

UNIT-V
Numerical solution of algebraic and transcendental equations – solution by Bisection, Ramanujan method, linear iteration and Newton-Raphson methods, Solution of linear simultaneous equations. Gauss elimination method, Gauss Jordan method, Gauss Seidel methods, LU decomposition method, methods of Crout, Doolittle and Cholesky. (6+1*=7) hrs

UNIT-VI
Finite differences-(Forward and Backward differences), Interpolation, Newton's forward and backward interpolation formulae, Central difference formulae : stirlings and Bessels formula. Interpolation with unequal spaced points : Lagarange interpolation formula and inverse interpolation formulae and Hermite interpolation formula. (6+2*=8) hrs

UNIT-VII
Divided differences and their properties : Newtons general interpolation formula. Interpolation by iteration, Numerical differentiation using Newtons forward and backward interpolation formulae. Numerical integration : Trapezoidal method, Simpson 1/3 rule, Simpsons $3/8^{th}$ rule, Booles and Weddle's rule. (6+1*=7) hrs

UNIT-VIII
Numerical solution of ordinary differential equations : Solution by Taylor's series, Picard's method of successive approximation, modified Euler's method, Runge Kutta methods of second and fourth roder, Predictor and corrector methods – Adams – Bashforth method, Adams – Moultons method.

PATTERN OF QUESTION PAPER :
The question paper contains two parts namely, PART-A and PART-B. Each part contains 4 questions. Five full questions are to be answered in all out of 8 questions, choosing at least two from each part.

References :

1. Kreyszig.E, Advanced Engineering Mathematics, John Wiley, 8^{th} Ed, 1999.
2. O neil Advanced Engineering Mathematics, Pearson/ Thomson.
3. S. S. Sastry, Indtroductory methods of Numerical Analysis, 3^{rd} edition, Prentice – Hall India.
4. M. K. Jain, S. R. K. Iyengar, R. K. Jain, Numerical Methods for scientific and Engineering computation, New Age International Puclishers.

IV SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE401 DATA STRUCTURES

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **Special Features of C:** Register variables, Bitwise operators, Bit fields, Enumerations, Command line parameters, macros, preprocessor statements arrays in 'C'. 5 hrs + 1* hrs

2. **Functions & Recursion in C:** Writing Recursive program: Finding factorial of a given number, GCD, Fibonacci, Binomial coefficients, Tower of Hanoi, Pointer & pointer variables in 'C'. 6 hrs + 2* hrs

3. **Linked lists:** Circular linked lists, doubly linked lists, circular doubly linked lists. 6 hrs + 2* hrs

4. **Stacks & Queues:** Implementation using arrays & linked lists, Conversion from Infix expression to postfix expression and prefix expression evaluation of postfix expression. 8 hrs + 2* hrs

PART B

5. **Application of linked list :** 6 hrs + 2* hrs
   (i) Addition to two long positive numbers.
   (ii) Evaluation of polynomial.
   (iii) Addition of two polynomials.

6. **Trees:** Binary trees, Binary search tree, Threaded binary tree, AVL tree. 6 hrs + 2* hrs

7. **Sorting & Searching :** Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Shell sort, Address calculation sort, Hash sort (or) Radix sort, Heap sort, Binary tree sort, Topological sort, Linear search, Binary search. 13 hrs+ 3* hrs

50 hrs + 14* hrs Tutorials

References:

1) A M Padma Reddy, Data Structures using C.
2) Aaron M Tenenbaum, Moshe. J, Augenstein : Data Structures using C, Prentice Hall.
3) Yeshavant Kanetkar, Data Structures through C.
4) Seymorlipshuz : Data Structure, Tata McGraw Hill.
5) Mark Allen Weiss : Data Structures & Algorithm Analysis Benjamin/ Cumings Publishing company Inc. Redwood city, CA.

Question paper pattern :

The question paper consists of 8 questions of 20 marks each.
The students have to answer 5 full questions, selecting at least two questions from each PART.

IV SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE402 Micro Electronics

4 hrs/ week **Max. marks 125**

Exam marks: 100 **Sess. marks 25**

PART-A

1. **LINEAR ICs:** Introduction to Linear ICs, Operational Amplifiers : Ideal Op-amp, Electrical Characteristics. Op-amp ckts - Inverting and Non-Inverting Amplifiers, Voltage Follower, Summer, Integrator, Differentiator, Comparators, Schmitt Trigger, Instrumentation Amplifier, Precision Rectifier, Peak Detector, Sample & Hold ckt. Voltage to Frequency Converter, Square Wave and Pulse generator. Timer: 555 Timer operation, 555 Timer used as Astable & Mono-Stable Multi vibrators. 13 hrs + 2* hrs
2. **Digital ICs:** Introduction to SSI, MSI, LSI & VLSI, Review of Boolean Algebra, SOP & POS Expressions (Minterms & Maxterms), Canonical SOP and POS forms, Karnaugh Map, Tabular Method, VEM Technique, Logic families: TTL, CMOS, NMOS, PMOS, HMOS, I I L (I^2L) & ECL logic families - Characteristics. 10 hrs + 3* hrs

PART-B

3. **COMBINATIONAL CIRCUITS:** Half adder, Full adder, Full subtractor, Parallel adders, Design of Ex-3 adder/subtractor, BCD adder, Carry Look Ahead adders, Digital Comparators, Multiplexers : Design of Combinational Circuits using MUX, MUX TREE and its design, Demultiplexers : Design of Combinational Circuits, Encoders, Decoders & Priority Encoders, Code Converters: Gray to Binary and Binary to Gray, BCD to Ex-3, Ex-3 to BCD, ASCII Code. Introduction to ALU. 10 hrs + 3* hrs
4. **SEQUENTIAL CIRCUITS:** Flip flops, RS, JK, Master slave JK, D & T FFs. Counters : Asynchronous & Synchronous counters : Design of Ripple/Binary counter, Up-down counter, Binary Up-down counter, Study of 7490, 7493, 74192, 74193 and their applications, Shift Registers : Study of 7495, Ring counter, Johnson counter, Sequence Generators. LED & LCD Display. 9 hrs + 4* hrs
5. **DATA CONVERTERS:** D/A Converters : Binary Weighted and R-2R Ladder Network, A/D Converter : Flash/Simultaneous type, Successive Approximation, Single Slope and Dual Slope, RAM/Stair Step, Accuracy Resolution & Errors in D/A & A/D Converters. 5 hrs + 1* hr
6. **MEMORIES :** RAM, ROM, PROM, EPROM, EEPROM, PLA: Design of Digital Circuits using PLA, PAL. 3 hrs + 1* hr

50 hrs + 14* hrs Tutorials

REFERENCES :

1. OP - Amplifiers and Linear IC's - Gayakwad.
2. OP - Amplifiers and Applications - Coughlin & Driscol.
3. Microelectronics – Millman & Grabel
4. Integrated Circuits - Taub & Schilling.
5. Digital Principles and Applications - Malvino & Leech.
6. Digital Electronics – Anand Kumar
7. Digital Electronic Fundamentals – R.P. Jain
8. Digital Electronic Fundamentals – Floyd

Question paper pattern :
The question paper consists of 8 questions of 20 marks each.
The students have to answer 5 full questions, selecting at least two questions from each PART.

2K11EE403 Signals and Systems

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART-A

1. **Introduction :** Continuous time & Discrete time signals. Transformation of independent variable, exponential & sinusoidal signals. Unit impulse & unit step functions. Discrete time systems & their basic system properties. Basic system properties. Conversion of continuous – time system to discrete time system. Modeling by discrete-time system. 10 hrs + 2* hrs
2. **Linear – Time – Invariant Systems (LTI) :** Discrete time LTI systems, Convolution sum, Continuous-time LTI systems, the convolution integral. Properties of Linear time invariant systems, Causal LTI systems described by differential and difference equations. 10 hrs + 3* hrs
3. **Fourier series Representation of Periodic Signals :** Response of LTI systems to complex exponentials. Fourier series representation of continuous time periodic signals. Fourier series representation of discrete time periodic signals. Fourier Series & LTI systems. Continuous time and discrete-time Filters. 10 hrs + 3* hrs

PART-B

4. **Fourier Transform :** Definition of Fourier transform & its Inverse. Properties of Fourier transform. Fourier transform of periodic signals. Spectral density, Autocorrelation Functions, Cross-correlation functions, and its properties. Discrete time Fourier transform & its properties, frequency Response of discrete time systems. Hilbert Transform : Definition of Hilbert transform, Pre-envelope. Representation of Bandpass signals and band-pass systems. 12 hrs + 4* hrs
5. **Z-transform :** Definition of Z-transform & its inverse, Properties of Z-transform, Region of convergence of Z-transform, Inverse Z-transform - inverse by long division & partial fraction expansion methods – by evaluation of residues. Analysis & characterization of LTI systems using Z-transforms. 8 hrs + 2* hrs

50 hrs + 14* hrs Tutorials

References Books :

1. Kamen, Heck : Fundamentals of Signals & Systems using MATLAB.
2. Oppenheim, Willsky & Nawab : Signals & Systems : PHI.
3. Carlson : Signals & Linear System Analysis : Wiley Engg.,
4. Haykins : Communication Systems : III Edition
5. Haykins : Signals & Systems : John Wiley International.
6. Nagarath et. Al, TMH, 2001.

Question paper pattern :
The question paper consists of 8 questions of 20 marks each.
The students have to answer 5 full questions, selecting at least two questions from each PART.

IV SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE404 AC MACHINES

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART-A

1. **Three-phase Induction Motors :** Types, Construction, Rotating Magnetic Field, Principle of Operation, Equivalent circuit, Phasor diagram, Slip, Torque equation and Maximum Torque, Torque Slip Characteristic. Relation between Slip Rotor Copper Losses, Rotor input and Efficiency. Free Run and Blocked Rotor Tests, Circle Diagram. Methods of starting, Star-delta starter, Auto transformer starter, rotor resistance starter. Different types of speed control of Induction motor. Synchronous cusps, cogging & crawling, Double cage induction motor (Torque slip characteristics only). 16 hrs +3* hrs

2. **Induction Generators :** Negative slip, Generator Vs Motor action. Characteristics & circle diagram. Phasor diagram for induction generator. 4 hrs

3. **Single Phase Motors :** Construction, Double Revolving Field theory and Principle of operation. Starting torque and methods of starting - Split phase, Shaded pole, Capacitor start and Capacitor run, Universal motor. Applications. 5 hrs +1* hr

PART-B

4. **Synchronous Generators :** Construction, Salient and non-salient pole machines, EMF equation, different types of windings, winding factors. Fractional slot windings. Harmonics - reduction and elimination. Armature reaction - leakage reactance and synchronous reactance. Vector diagram of alternator (non-salient type). 8 hrs +2* hrs

5. **Two Reaction Theory :** Direct axis and quadrature axis synchronous reactance, vector diagram. Slip test and regulation. Equation for power in terms of power angle for salient and non-salient pole alternator.

4 hrs +2* hrs

6. **Voltage Regulation :** EMF, MMF, ZPF method. Short circuit ratio of alternators. 3 hrs +2* hrs

7. **Parallel Operation of Alternators :** Effect of change of excitation and input. Conditions for parallel operation. Synchronisation and Synchronising power, operation of alternator on infinite bus. Division of load between two alternators. Operating characteristics of turbo alternator. 4 hrs +2* hrs

8. **Synchronous Motor :** Principle of operation, Rotating magnetic field, vector diagram for salient and non-salient pole motor. Torque and torque angle, Blondel diagram, Effect of change in load, Effect of change in excitation, V and inverted V curves. Synchronous condenser. Maximum power. Hunting and damping. Methods of starting synchronous motors, Power angle curve. 6 hrs +2* hrs

50 hrs + 14* Tutorials

REFERENCES BOOKS :

1. Performance and Design of AC Machines - M G Say.
2. Principles of AC Machinery - Lawrence & Richards.
3. Electrical Technology - H Cotton.
4. Theory of AC Machinery - Langsdorf.
5. Theory of AC Machinery - J B Gupta.

Question paper pattern :
The question paper consists of 8 questions of 20 marks each.
The students have to answer 5 full questions, selecting at least two questions from each PART.

IV SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE405 ELECTRO MAGNETIC FIELD THEORY

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **Electrostatics :** Coulomb's law. Electric field intensity, electrostatic potential and potential difference. Field due to several point charges, principle of linear superposition. Concept of line charge, surface charge and volume charge. Scalar potential and its relation with electric field. Field maps and field cells. Gauss's theorem and applications. Poisson's and Laplace equations-solutions for simple cases. Dipole, polarization and $\in_r$ of dielectric, Capacitance calculations for different configurations. Energy and energy density in an Electrostatic field. Boundary conditions. Displacement current and density. Equation of continuity of currents. 16 hrs +5* hrs
2. **Magnetostatics :** Introduction. Magnetic flux and flux density. Magnetic field intensity. Biot-Savart's law, Ampere's law and applications. Forces and Torque Lorentz force equation. Force acting on a current carrying conductor. Examples on Force Calculation, Torque on a loop in magnetic field. Scalar and vector potentials-applications. Neuman's formula for Inductance. Inductance calculations for simple configurations. Magnetic Dipole and μ_r. Energy stored and energy density in a magnetic field. Boundary conditions. 10 hrs + 4* hrs

PART B

3. **Time varying Electric and Magnetic fields :** Introduction. Faraday's law of electromagnetic induction. Faraday's law in integral and differential forms. Maxwell's equations from different laws in differential and integral forms. Maxwell's equations for free space and harmonic fields. 7 hrs +2* hrs
4. **Relationship between field and circuit theory :** Application of field and circuit theory for series circuit. Maxwell's equations as generalization of circuit equations. 5 hrs
5. **Electromagnetic Waves :** Wave equations IN FREE SPACE. Rectangular plane waves in free space. Sinusoidal plane wave propagation in Free space, Good dielectrics, good conductors and in lossy dielectric media. Skin depth and Skin effect. Relaxation time. 7 hrs +2* hrs
6. **Poynting Vector and flow of power :** Poynting's theorem and Poynting Vector. Instantaneous average and complex Poynting vector. Power loss in a plane conductor. Application of P-vector. 5 hrs +1* hrs

50 hrs + 14* hrs Tutorials

REFERENCES :

1. Electromagnetics (McGraw Hill) - John D. Kraus.
2. Electromagnetic waves and radiating systems - Jordon.
3. Engineering Electromagnetics - W. Hayt. Jr.
4. Electromagnetic fields - S. Seely.
5. Foundation of electromagnetic theory - Reitz & Milford.
6. Electromagnetic field theory – P V Guptha.

IV SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE406 Electrical Machines laboratory

3 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

1. Open circuit characteristic of a D.C. generator.
2. Load characteristics of shunt generator.
3. Load test on shunt motor.
4. Hopkinson's test.
5. Swinburne's test
6. Speed control of D.C. shunt motor by field control and armature control.
7. O.C. and S.C. tests on single phase transformer, predetermination of efficiency regulation, equivalent circuit.
8. Parallel operation of two single phase and 3 phase transformers.
9. Sumpner's test.
10. Separation of losses in a single phase transformer.
11. Polyphase connections : Voltage relation of Y- Y, Y- Δ, Δ – Y and Δ – Δ.
12. Scott connection.

IV SEMESTER B.E (ELECTRICAL & ELECTRONICS)

2K11EE407 IC LABORATORY

3 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

Linear ICs:

1. Op-amp applications (i) Inverting (ii) Non-inverting (iii) Voltage follower (iv) Integrator (v) Differentiator (vi) FW Precision rectifier
2. Wein's Bridge Oscillator using Op-Amp.
3. Op-amp used as Astable & Monostable Multivibrators.
4. 555 Timer used as Astable & Monostable Multivibrators.
5. ZCD and Schmitt trigger using OPAMP.

Digital ICs:

6. Transfer Characteristics of TTL & CMOS Logic Families.
7. Realization of 2's Complement Full Adder/Subtractor - 7483.
8. Realization of MUX & DEMUX using NAND gates, Design of Combinational Circuits using 74153 MUX.
9. Code Converters : Design of Gray to Binary & Vice-Versa.
10. Realization of RS and JK FFs using NAND gates.
11. Modulo-N counter using 7490 & 7493, 74193 IC Chips.
12. Study of 7495 Shift Register - SISO, SIPO, PIPO, PISO & its applications such as Ring Counter, Twisted Ring Counter.
13. D/A Converter: R to 2R type - Staircase Waveform Generator. ADC - Successive Approximation Method.
14. Single Digit Display using 7-Segment Display Device, Counter & a Decoder 7447/7446 IC.

V SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE501 CONTROL SYSTEMS

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART-A

1. **Modeling of Systems:** Definition of Control systems, open loop and closed loop systems, types of feedback, Modeling of Electrical, Mechanical and electromechanical systems, differential equations of physical system. F-I and F-V analogous circuits. Linear and non-linear, continuous, discrete data, time invariant, time variant control systems. 8 hrs+2* hrs
2. **Block diagram and Signal flow graphs:** Transfer function, block diagram representation of control systems, Block diagram reduction techniques, signal flow graphs, Mason's gain formula.

   8 hrs+2* hrs
3. **Time Domain Analysis of control systems:** Standard test signals, Type and order of a system, unit step response of first and second order systems, Time domain specifications and transient response of a prototype second order system, steady state error analysis- Steady state error and static error constants. Generalized or Dynamic error coefficients 8 hrs+2* hrs
4. **Feedback characteristics of control systems –** Sensitivity of control system to parameter variations, Effect of feedback on overall gain, stability, external disturbances and Time constant of a control system, linearizing effect of feedback and Regenerative feedback. 4 hrs + 1* hr

PART-B

5. **Stability analysis:** Concept of stability, Necessary conditions for stability, Methods of determining stability, Routh-Hurwitz stability criterion. 4 hrs + 1* hr

   Stability in Complex Domain: Root locus Technique: Basic properties and construction. Procedure to construct root locus diagrams. Effect of Addition of zeros and poles. Analysis of simple problems using root locus. 6 hrs + 2* hrs

   Stability in Frequency domain: Polar plots, Bode plots, Nyquist stability criterion, relative stability using polar plot Bode plot and Nyquist criterion. 6 hrs + 2* hrs
6. **Frequency domain specifications** – resonant peak, resonant frequency and bandwidth. Correlation between time and frequency response 2 hrs + 1* hr
7. **Compensation Techniques:** Introduction, Cascade compensation networks, Lead compensation, Lag compensation and Lag-lead compensation. 4 hrs + 1* hr

50 hrs + 14 * hrs Tutorials

REFERENCES:

1. Control Systems Engineering (New Age International publishers) - I.J.Nagarath & M.Gopal.
2. Modern Control Systems (Pearson education)– Richard C Dorf and Robert H Bishop.
3. Modern Control Engineering (PHI Publications) – Katsuhiko Ogata.
4. Automatic control systems (John wiley & sons Publications) - Benjamin C Kuo.
5. Modern Control Engineering (PHI Publications) - D. Roy Choudary.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

V SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE502 ELECTRICAL MACHINE DESIGN

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART-A

1. **Design Considerations :** Specification of transformers and rotating machines. Factors to be considered in design and limitations. Temperature rise in Electrical machines, Methods of cooling & quantity of cooling medium, Insulating materials. 4 hrs + 1* hr.

2. **DC Machines :** Main dimensions of the armature, design of armature winding and dimensions of the slots. Design of commutator and brushes. Design of magnetic circuit and estimation of the mmf, Design of shunt and series field windings, Design of interpoles. 12 hrs + 4* hrs

3. **Design of Transformers :** Main dimensions of the core, details of winding, No load current, leakage reactance - estimation in case of simple winding configurations, Determination of the voltage regulation and efficiency. Design of tank, round and rectangular tubes. Design of Current transformers. 12 hrs + 3* hrs.

PART-B

4. **Design of three phase induction motor :** Main dimensions of the stator, details of stator winding, dimension of the slots. Design of cage and slip ring rotor & rotor windings. No load current, leakage reactance and circle diagram. 12 hrs + 4* hrs.

5. **Design of Synchronous machines :** Main dimensions of the stator, details of stator windings, dimensions of the slots. Design of rotor & rotor windings of salient and non-salient pole type alternator. 10 hrs + 2* hrs.

50 hrs + 14* hrs Tutorials

REFERENCES :

1. The performance & Design of Direct Current machines - Albert C Clayton & N N Hancock.
2. Elements of Electrical Machine Design - Still & Siskind.
3. The Performance & Design of Alternating Current Machines - M G Say.
4. A Course in Electrical Machine Design - A K Sawhney.
5. Electrical Machine Design – Agrawal

Question paper Pattern :

Total six questions have to be set, 3 from each Part. Students have to answer 4 questions choosing at least 2 from each Part.

V SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE503 GENERATION, TRANSMISSION & DISTRIBUTION

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART-A

1.GENERATION: Introduction to generation of electrical energy, Sources of energy, Types of generating stations, Thermal, Hydroelectric, Nuclear, Selection of site. Load curves, Load duration Curves. Economics of Power generation. 8 hrs + 2* hrs

2. SUPPLY SYSTEMS: General layout of Power system, effect of transmission voltage on conductor weight, transmission efficiency and line drop. Effect of low Power factor and improvement of Power Factor. 3 hrs + 2* hr

3. OVERHEAD SYSTEMS: Types of supporting structures, comparison of copper, aluminum and ACSR conductors. Sag calculation, Supports at same level and at different levels. Effect of wind, ice, temperature correction. Stringing charts and Sag templates, line vibrations, vibration dampers.

5 hrs + 2* hr

4. INSULATORS : Materials used, types of insulators, potential distribution over a string of insulators, methods of improving string efficiency, grading rings and arcing horns, Testing of insulators (with mention of relevant IS standards) 5 hrs + 1* hr

PART-B

5. UNDERGROUND CABLES : Comparison with overhead lines, different types of Insulating materials used including XLPE and Gas insulation. Types of Cables, Insulation resistance, Electric stress and Capacitance of string core cables, Grading of cables, Intersheath and capacitance grading. Capacitance of Three core cables. 7 hrs + 1* hr

6. CORONA : Phenomena of Corona, Disruptive and visual critical voltage, power loss, advantages and disadvantages of Corona. 3 hrs + 2* hrs

7. LINE PARAMETERS : Inductance of single phase, two wire line, composite conductor lines, self and mutual GMD. Inductance of three phase lines, equilateral spacing, unsymmetrical spacing, transposition, Inductance of transposed line with unsymmetrical spacing, Bundle conductors.
Capacitance of single phase two wire lines, 3 phase lines with symmetrical spacing and unsymmetrical but transposed lines. Ferranti effect, power loss due to charging current. Skin effect and proximity effect.

8 hrs + 2* hrs

8. LINE PERFORNAMCE : Short lines, medium lines, nominal T and PI methods, long lines, ABCD constants. 7 hrs + 1* hr

9. DISTRIBUTION : Feeders, distributors and service mains, AC distribution. 4 hrs + 1* hr

50 hrs + 14* Tutorials

REFERENCES:

1. Transmission and Distribution by H Cotton.
2. Principles of Electrical Power Transmission by Waddicar.
3. A Course in Electrical Power by Sony, Gupta and Bhatnagar.
4. Electrical Power by S L Uppal.
5. Electrical Power Systems by C L Wadhwa.

Question paper Pattern :-
Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

V SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE504 POWER ELECTRONICS

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART-A

1. **Power Semiconductor Devices :** Diodes, SCR, GTO, Triac, BJT, MOSFET, IGBT - their junction structure, ideal & practical Switching characteristics, Rating & specifications, firing and commutation circuits of SCR, RL & RC Snubber circuits.
   11 hrs + 3* hr
2. **Gate drive circuits :** Drive circuits for BJT, MOSFET and IGBT. 5 hrs + 1* hr
3. **Controlled Rectifiers : -** Single phase and Three phase, Half & Fully controlled Bridge rectifier with R, L & DC motor loads; condition for Continuous conduction mode (CCM), and Discontinuous conduction mode (DCM); input current waveform and Harmonic analysis of CCM, Effect of source inductance; Single phase AC voltage controller – Principle of operation with resistive load only.
   14 hrs + 2*hrs

PART-B

4. **Choppers :** Principle, step down and step up chopper, one quadrant & multi quadrant chopper, Chopper fed DC motor drive. 6 hrs + 2* hrs
5. **DC – DC converter :** Buck, Boost, Buck-Boost Regulators, loss calculations an heat sink design for buck converter only. 6 hrs + 2* hrs
6. **Inverters :** 1ϕ and 3ϕ VSI, Bridge, Current source Inverters, Square wave operation, Sine – triangle PWM, Selective Harmonic elimination. 6 hrs + 2* hrs
7. **Applications :** UPS. 2 hrs + 2* hrs

50 hrs + 14* hrs Tutorials

REFERENCES :

1. Power Electronics - Circuits, Devices & Applications by Muhammad. H.Rashid, 3rd Edition, PHI Pub., 2006.
2. Power Electronics by Dr. P. S. Bimbhra, Khanna Publishers, New Delhi, 2006.
3. Power Electronics by M D Singh & Kanchandani, Tata McGraw Hill, 2007.
4. Power Electronics – Essentials & Applications by L. Umanand, John Wiley & Sons.
5. Power Electronics- Devices, Circuits, & MATLAB Simulations by ALOK JAIN, Penram Intl Pub.

Question paper Pattern :-
Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

V SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE505 DIGITAL SIGNAL PROCESSING

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

Discrete Fourier Transform : Introduction, definition of D.F.T & IDFT. Properties of D.F.T, Circular convolution, Linear convolution using D.F.T, Computation of D.F.T - Decimation-in-time F.F.T algorithm, Decimation in frequency F.F.T algorithm, Chirp Z-transform algorithm. 18 hrs +4* hrs

Digital Filter Structures : IIR filter structures : Direct form I & II, cascade, parallel & ladder type realization. FIR filter structures : Direct form & Linear phase FIR structures. 6 hrs + 2* hr

PART B

Analog Filter Design : Butterworth low pass filters, Chebyshev low pass filters. Frequency transformation. 6 hrs + 2* hrs

IIR Filter Design : IIR filter design by approximation of derivatives, IIR filter design by impulse invariance, IIR filter design by Bilinear transformation, Transformation of basic low pass filter. 10 hrs + 3* hrs

FIR Filter Design : Characteristics of FIR digital filters, Different types of windows : Rectangular, Bartlett, Hamming, Blackman & Kaiser windows, Design of FIR filters using windows, Design of FIR filters by Frequency sampling method, Design of Equiripple FIR filters, Design of FIR differentiators, Comparison of IIR & FIR digital filters. 8 hrs +2* hrs

Application of DSP to Speech and Electric Drives signal processing. 2 hrs + 1* hr

50 hrs + 14* hrs Tutorials

References :

1. Terrell & L K Kwan : Digital Signal Processing A Student guide
2. Oppenheim & R W Schafer : Discrete time signal processing, PHI
3. Sanjeev K Mitra : Digital Signal Processing : McGraw Hill
4. Proakis & Monolokis : Digital Signal Processing, PHI
5. Oppenheim & Schafer et.al : Application of DSP, PHI
6. TMS Manual : Texas Instruments
7. Padmanabhan et.al : Digital Signal Processing, New Age Publishers, 2001.
8. Ingle and Proakis : Digital Signal Processing using Matlab, 2001.
9. S. Salivahanan et.al : Digital Signal Processing, TMH, 2001.

Question paper Pattern :-
Total eight questions have to be set 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

V SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE506 COMPUTER ORGANIZATION & ARCHITECTURE

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **General purpose Machine :** General purpose machine views of the computer – user's view, machine / Assembly language programmer's view, stored program concept, computer Architect's view, Logic designer's view, classification of computers, Computer instruction sets, 4– 3– 2- 1-& 0- address machines, addressing modes, informal description of the simple RISC computer (SRC) formal description of SRC using RTN, addressing modes with RTN, different logic circuits for data transfer. 14 hrs

2. **Real machines :** Machine characteristics and performance RISC Vs CISC, A CISC microprocessor : the Motorola MC68000 – CPU and memory architecture, operand and instruction formats and their interpretation MC68000 instruction set, program examples and MC68000 assembler. 12 hrs

PART B

3. **Computer Arithmetic :** Number systems & Radix conversion, Fixed point arithmetic – 2's complement adder / subtractor, look ahead carry generator, unsigned multiplication hardware, Booth algorithm for signed multiplication, Division hardware, Floating point arithmetic, Hardware structure for floating point add & subtract. 14 hrs

4. **Control Unit :** Basic concepts, clocking and timing, Register transfer timing, 1 bus SRC hardware control unit, Block diagram of microcoded control unit, Horizontal & Vertical micro coding, Difference between hardwired control unit & Micro coded control unit. 10 hrs

5. **Memory unit :** Dynamic & static memories, Cache memories, Virtual memory, Memory management and address translation, Virtual address translation in a paged MMU, Input and Output organization. 10 hrs

60 hrs

Reference Books:

1. Vincent .P. Heuring & Harry. F. Jordan, Computer systems design & architecture, Addison-Wesley, 1997.
2. Computer Organization : V C Hamacher, Z G Vraneric & S. G. Zaly, 4th Edition, 1996.
3. I P Hayer, Computer Architecture & Organization.
4. M.Raffiquazzaman & Rajan Chandra, Modern Computer Architecture, Galgotia 1990.
5. Computer Organization & Design, David A Patterion & John L Hennery, Morgan Karyman 1997.

Question paper Pattern :-
Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

V SEMESTER B.E (ELECTRICAL & ELECTRONICS)

2K11EE507 SIMULATION LAB USING LABVIEW

3 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

1. Logic gate realization :-
   (a) Basic gates : AND, OR, NOT
   (b) NAND, XOR (using basic gates)
2. Realization of adders and subtractors
   (a) Half adder (b) Full adder (c) Parallel adder & (d) Subtractor.
3. Conversion of 4-bit Gray code to Binary code & vice-versa.
4. Realization of 7 segment display using case structure.
5. Generation of signals (a) sinusoidal, square & triangular signal using formula node (b) three phase sinusoidal signal.
6. Realization of half wave rectifier and full wave rectifier using formula node.
7. Realization of Multiplexer (MUX) and De-multiplexer (DEMUX).
8. Continuous monitoring of temperature using random number, every 2 seconds.
9. Invert the state of Boolean indicator twice until program is stopped by the user.
10. Generate random numbers, multiply by 10 and display them in 3 waveform channels.
11. Generate random numbers, multiply by 100 and display them on waveform chart.
12. Evaluate the algebraic equations (2 nos) using Formula node.
13. To find square root of a given number. If the number is negative, display -99999 using following methods.
    a.Case structure (b) Select function (c) Formula node
14. Indicate using a LED, the deviation of the temperature from a user defined value. Use while loop, let the tolerance be $\pm 5^0$C from the set point.
15. Convert a given number into – Decimal, Hexadecimal and Binary.
16. Generate 5000 random numbers and display them in a continuous fashion display.
17. Generate random numbers between 0 and 10. Calculate their 5 point moving average. Display generated numbers and their moving average separately.
18. Program to indicate the Matching of 2 Numbers.
19. Evaluate y=sin(x) and display the result. Use formula node.
20. Generate 5 Random numbers and display them in an ARRAY. Also display the reversed array.
21. Develop a simple CALCULATOR.
22. Generate 2-D array (3x10) containing random numbers. Plot each row on its own graph.
23. Convert any Array into Cluster and Cluster into an Array.
24. Convert a Random Number into different forms of STRING.
25. Program that takes 1-D array (10x1) as an input, multiply pair of elements and show the resulting array (5x1).
26. Measure temperature approximately every 0.25s, for 10s, during the Data Acquisition. Display the continuous temperature variation, temperature for first 10s, Average temperature over the 10s, maximum and minimum temperature. Temperature values during first 10s using an array.

V SEMESTER B.E (ELECTRICAL & ELECTRONICS)

2K11EE508 POWER ELECTRONICS & DRIVES LABORATORY

3 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

Power Electronics & Drives laboratory :-

1. Static characteristics of SCR, Diac, Triac & MOSFET.
2. Single phase half controlled bridge rectifier with R & RL loads.
3. Single phase fully controlled bridge rectifier with R load.
4. DC motor speed control using single phase converter.
5. Speed control of DC motor using four quadrant chopper.
6. Stator voltage control of Single phase Induction motor.
7. Three phase inverter fed induction motor drive.
8. Stepper motor drive.

Circuit simulation :-

9. Series RLC circuit – Study of damping.
10. Design of chopper circuit & its simulation using P-spice.
11. Simulation of single phase, three phase voltage source inverter and observe load voltage and current using P-spice / Simulink.

VI SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE601 MICRO PROCESSOR & MICRO CONTROLLER (8086 / 8051)

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **Architecture of 8086 :** Architecture of Intel 8086 processor, Signals, Internal Operation, Memory Decoding, 8086 configurations: Minimum mode and Maximum mode, Instruction execution, system bus timing, Timing diagrams, Interrupts: Interrupt mechanism, Types and priority, Interrupt vector table, Software interrupts, Non maskable interrupts. Direct memory access. 10 hrs
2. **Assembly Language Programming :** 8086 Addressing modes, Instruction set: Data transfer Instructions, String Instructions, Logical Instructions, Arithmetic Instructions, transfer control Instructions, Processor control instructions. Basic Concepts of modular programming: Assembler directives, Memory organization, Macros. Assembly language programming examples: block transfer, multi precision arithmetic operations, Code conversion, searching, sorting, subroutine calls, stack operations, Time delay loops, simple programs using DOS and BIOS interrupts. Concepts of executing assembly language programs using MASM. 18 hrs

PART-B

3. **Interfacing with 8086 :** Programmable Peripheral interface (8255) – Mode 0,1,2 operations, programming examples. Serial Communication Interfaces – Asynchronous communication, Synchronous communication, Programmable communication Interface (8251), Programmable interval timer (8253) – Operating modes & Interfacing. DMA Controller, Organization of Intel 8257- different modes of operation, Interrupt Controller - Organization of programmable interrupt controller 8259. Keyboard and Display interface 8279–block diagram, interfacing of matrix key board and seven segment LED display using 8279. 16 hrs

PART - C

4. **Microcontroller 8051 :** Overview of microcontrollers, 8051 Architecture, Addressing modes, Instruction Set - Arithmetic and Logic instructions, loop and Jump instructions, call instructions, Assembly programming - simple programs, programming timer, and interrupts. 12 hrs

56 hrs + * 8 hrs Tutorials

Text Books

1. Microprocessor and Interfacing by Douglas. V. Hall, Tata McGraw Hill,
2. Microcomputer systems: 8086/ 8088 family Architecture, Programming and Design by Liu, Gibson, Prentice Hall India 2004.
3. The 8088 and 8086 Microprocessors Programming, interfacing Software and Hardware Applications by Walter A.Triebel, Avathar Singh, Pearson Education 2008.
4. The 8051 Microcontroller and Embedded Systems by Mohamed Ali Mazidi, Janice Gillispie Mazidi, Pearson Education 2007.
5. Microcontroller (8051) by Kenneth Ayala, 3rd Edition, 2010.
6. The 8086 / 8088 Family Design, Programming and Interfacing by John Uffen buck, Prentice Hall of India, 2002.
7. The Intel Microprocessor system – Architecture, programming and Interfacing by Brey B.B.

Question paper Pattern :-

Total 8 questions have to be set, with each question carrying 20 marks.
(3 questions from PART-A, 3 questions from PART-B and 2 questions from PART-C). Students should answer 2 questions from PART-A, 2 questions from PART-B and 1 question from PART-C.

VI SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE602 POWER SYSTEM ANALYSIS

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **Representation of a Power system components :** Circuit models of Transmission line, Synchronous Machines, Transformer and load, one line diagram, impedance and reactance diagram. Per unit system, Per unit impedance diagram of Power System Networks. 8 hrs.
2. **Symmetrical 3-phase faults :** Transients on transmission lines – Short circuit currents – Reactance of Synchronous machines on load and on no load. 4 hrs.
3. **Symmetrical Components :** Analysis of unbalanced load against balanced 3-phase supply, Neutral shift resolution of unbalanced of phasors into their symmetrical components, phase shift of symmetrical components in star-delta transformer bank. Power in terms of symmetrical components. Analysis of Balanced and unbalanced loads against unbalanced 3-phase supplies. Sequence impedances and sequence networks. Sequence impedance of power system elements (Alternator, transformer and transmission line), +ve, -ve and zero sequence networks of Power System elements. 14 hrs.

PART B

4. **Unbalanced faults :** LG, LL, LLG faults on an unbalanced alternator with and without fault impedance. Unsymmetrical faults on a power system with and without fault impedance, open conductor faults in power systems. 12 hrs.
5. **Stability studies :** Steady state and transient stability. Rotor dynamics and the swing equation. Power Angle equation. Equal area criterion of stability and its application. 6 hrs.
6. **Load frequency control :** Modelling of Isolated power system & problems. 6 hrs.

52 hrs + 12 * hrs Tutorials

REFERENCES:

1. “Elements of Power System analysis” by W D Stevenson Jr, 4th Edition, McGraw Hill International Edition, 1982.
2. “Symmetrical components and Short circuit studies” by P Narayana Reddy .
3. “Modern Power System Analysis” by I.J. Nagrath & D.P. Kothari, 3rd Edition, Tata McGraw Hill.
4. “Power System Analysis” by R Begen and Vijay Vittal.

Question paper Pattern :-
Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VI SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE603 ELECTRIC DRIVES

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **Introduction :** Classification of drives, Basic elements of an electric drive. Dynamic conditions & Stability considerations. 8 hrs + 1* hr
2. **DC drives :** Introduction, Basic characteristics of DC drives, operating modes, Single phase drives, 3 phase drives, DC – DC converter drives, Closed loop control of DC Drives (Open loop transfer function, closed loop transfer function, Micro computer control of DC drives). 12 hrs + 2* hrs
3. **Induction motor drives :** Stator voltage control, rotor voltage control, v/f control, Slip regulation method of speed control of Induction motor. 10 hrs + 3* hrs

PART B

4. **Permanent magnet motor drives :** Brushless DC motor (BLDC), Permanent Magnet Synchronous motor (PMSM). 4 hrs + 1 hr
5. **Synchronous motor drives :** Voltage source inverter, Current source inverter fed synchronous motor drives. 4 hrs + 1* hr
6. **Variable Reluctance motor drives** : Stepper motor drives, Switched Reluctance motor drives (SRM). 4 hrs + 2* hrs
7. **Rating and Heating of motors :** Requirements of a drive motor, Power losses and heating of electric motors, Cooling of electric motors, Classes of duty and selection of motor. 4 hrs + 2* hrs
8. **Applications** : Drive Considerations for Textile mills, Steel rolling mills, Cranes and hoist drives, Cement mills, Sugar mills, Machine tools, Paper mills. 4 hrs + 2* hrs

50 hrs + 14* hrs Tutorials

REFERENCES :

1. Electric Drives-Concepts and Applications by Vedam Subrahmanyam, 2nd Edition, Tata McGraw Hill, 2010.
2. Fundamentals of Electric Drives by G. K. Dubey, 2nd Edition, Narosa Publishing house, New Delhi, 2007.
3. Fundamentals of Electrical Drives- A.Veltman, D.W.J.Pulle, R.W.De Doncker, Springer Pub., 2011.
4. Power Electronics – Devices, Circuits & Applications by Muhammad H Rashid, 3rd Edition, PHI Pub., 2006.

Question paper Pattern :-
Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VI SEMESTER B.E (ELECTRICAL & ELECTRONICS)

2K11EE604 SWITCH GEAR & PROTECTION

4 hrs/ week **Max. marks 125.**
Exam marks: 100 **Sess. marks 25.**

PART A

1. **Representation of Power System :** Single line diagram of Generating Station, Substation & Distribution System. 3 hrs + 1* hr
2. **Switches** : Isolating switches, Load break switches, Earthing switches. HRC fuses and their applications. 3 hrs + 1* hr
3. **Theory of Circuit interruption** : Introduction. Physics of arc phenomenon. Essential properties of the arc. Maintenance of the arc. Arc interruption theories. 5 hrs +1*hr
4. **Circuit Breakers** : DC Circuit breaking, AC circuit breaking. Methods of arc extinction. Restriking voltage, rate of rise of restriking voltage. Resistance switching, current chopping, capacitive and inductive current breaking. Principle's of arc quenching. Arc controlled devices. Requirement of an ideal circuit breaker. Rating of circuit breakers. Types of circuit breakers, plain break, self generated pressure oil circuit breakers. Externally generated pressure oil circuit breakers. Air circuit breakers - low voltage air break type, arc chutes, axial blast and cross blast air circuit breakers. Advantages and disadvantages OCB and ACB, SF6 circuit breakers. Vacuum circuit breakers, HVDC Breakers. Testing of circuit breakers. 14 hrs + 2* hrs
5. **Switchgear** : HT, LT, indoor, outdoor cubicle drawout, metal clad, SF6 switchgear. 4 hrs + 1* hr

PART B

6. **Protective Relays** : Purpose of protective relaying. Requirement of relays, sensitivity, selectivity, reliability and speed of operation. Glossary of terms used in protective relaying like pick-up level, reset level, zone of protection - over reach and under reach. Classification of relays. universal relay-torque equation. 4 hrs + 1* hr
7. **Electromagnetic Relays:** Operating principles of attracted armature, solenoid and induction type relays, over current relays, Directional over current relays. Differential relays. Distance relays. Negative sequence relays. 4 hrs + 1 * hr
8. **Protection of apparatus**: Introduction. Transformer protection. Generator protection. Motor protection and Bus-zone protection. 3 hrs + 1* hr
9. **Feeder Protection** : Introduction – over current protection. Determination of TMS and PSM setting. Protection of radial feeders. Parallel feeders and ring main. Distance protection. Pilot protection. Carrier current protection. 4 hrs + 2* hr
10. **Solid State Relays :** Advantages. Application of semiconductor devices to power system protection. Comparators. Level detectors. Logic circuit for fault detection and protection. Static over current relays. IDMT relays. Distance relays. Two input and multi input relays. Relay with quadrilateral and elliptic characteristics. Microprocessor based Relays 4 hrs + 2* hr
11. Computer Based integrated protection system. 2 hrs + 1* hr

50 hrs + 14* hrs Tutorials

REFERENCE :

1. Power protection and switchgear - Ravindranath & Chander.
2. Switchgear and protection - Despande.
3. Electrical Power - Soni, Bhatnagar & Gupta.
4. Switchgear & Protection - Sunil S Rao.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VI SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE605 COMMUNICATION ENGINEERING

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **INTRODUCTION** : Block diagram of communication system, sources of information, channel, Noise: Types – internal & external noise sources, white noise, noise calculations - SNR, Noise equivalent bandwidth, noise figure, noise temperature. 4 hrs
2. **MODULATION – Amplitude modulation:** Full AM, time domain and frequency domain representation of AM signal, power in AM wave; Generation of AM wave – square law modulator, switching modulator; Detection of AM wave – Square law detector, envelope detector; DSBSC system – Generation of DSBSC wave – balanced modulator; Detection of DSBSC – coherent detection; SSB system – Spectrum of SSB wave, SSB generation – phase shift method, coherent detection of SSB. 12 hrs
3. **ANGLE MODULATION:** FM, PM, Mathematical representation of FM, Spectrum of FM, Relation between FM and PM, bandwidth determination of FM, FM generation – direct and indirect method; FM detection – Slope detector, Foster Seely discriminator. 9 hrs
4. **AM/FM SYSTEMS:** AM transmitter/receiver, FM transmitter/receiver (Block diagram description). 3 hrs

PART B

5. **INFORMATION THEORY & CODING:** Information, measure of information, Entropy & its properties, information rate, Markov sources, Source coding – Properties, construction of instantaneous codes, Shannon's theorem, Shannon Fano and Huffman coding; Error control coding – Classification, block codes, Hamming code; binary cyclic codes – properties, CRC code. 16 hrs
6. **DIGITAL COMMUNICATION**: Sampling theorem, sampling of low pass/bandpass signals, signal reconstruction from samples – interpolation formula, distortion in sampling; PAM – generation/detection of PAM; PCM systems – sampling, quantization, quantization noise and SNR, robust quantization, companding, DPCM/DM/ADM systems. 10 hrs
7. **DIGITAL MODULATION**: Principle of ASK, FSK & PSK modulation/demodulation. 3 hrs

50 hrs + 14 * hrs Tutorials

REFERENCES :

1. Electronics Communication Systems – John & Kennedy.
2. Analog & Digital Communications – Simon Haykin.
3. Digital Communications – Simon Haykin.
4. Information Theory & Coding – P.S. Sathyanarayan.
5. Communications – Ropbem Schoenbeck.
6. Electronics Communication – Roddy & Collen.

Question paper Pattern :-
Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VI SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE606 MODERN CONTROL THEORY

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **State variable analysis and Design**: Introduction, Concept of State, State variables and State model of linear systems, Linearization of state equations. State space Representation using physical variables, phase variables and canonical variables. State space representation of simple Electrical circuits. 10 hrs + 2* hrs

Derivation of Transfer function from state model, Diagonalisation, Eigen values and Eigen vectors, Generalized Eigen values. 5 hrs + 2* hrs

Solution of state equation, State transition matrix and its properties, computation using Laplace transformation, Power series method, Cayley-Hamilton method, concept of controllability and observability, methods of determining the same. 10 hrs + 2* hrs

PART B

2. **Non-Linear systems:** Introduction, Behavior of Non-linear systems, Common physical Non linearities-saturation, friction, backlash, dead zone, relay, multi variable non-linearity. Phase plane method, Singular points, stability of non-linear systems, limit cycles, construction of phase trajectories- Isocline method. 10 hrs + 2* hrs

3. Controllers: Design of P, PI and PID Controllers (Frequency domain approach). 6 hrs + 2* hrs

4. **Pole placement Design and state observers:** Introduction, Stability improvements by State feedback, Necessary and sufficient conditions for arbitrary pole placement, State regulator design, design of state Observers. 4 hrs + 2* hrs

5. **Liapunov stability criterion** : Introduction, Liapunov functions, direct method of Liapunov and the non-linear system. 5 hrs + 2* hrs

50 hrs + 14* hrs Tutorials

References:

1. Digital Control and State variable methods (TMH Publications) by M. Gopal.
2. State Space Analysis of Control Systems (PHI Publications) by Katsuhiko Ogata.
3. Automatic Control systems (John wiley & sons Publications) by B.C. Kuo.
4. Advanced Control Systems (RBA Publications) by Nagoor Kani.
5. Control systems (New Age International publishers) by Naresh K. Sinha.
6. Modern control Engineering (Sanguine Technical Publishers) by K.P.MohanDas.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VI SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE607 AC MACHINES & PROTECTION LABORATORY

3 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

1. No-load and blocked-rotor tests on 3 phase induction motor-Predetermination of performance curves-by drawing circle diagram using Equivalent circuit.
2. Load Test on three phase induction motor.
3. Load Test on single phase induction motor.
4. Load test on induction generator.
5. Open circuit & short circuit tests on alternators-regulation by EMF & MMF methods.
6. Regulation of alternators by ZPF method.
7. Determination of X_d & X_q of a salient pole alternator & predetermination of regulation.
8. V & inverted V curves and Power angle characteristics of synchronous motor.
9. Characteristics of over current : a) directional, b) non-directional.
10. Characteristics of Overvoltage and Undervoltage relay.
11. Study of Microprocessor based Relays.
12. Study of Differential relay.
13. Study of Static over current relay.

VI SEMESTER B.E (ELECTRICAL & ELECTRONICS)

2K11EE608 MICROPROCESSOR & MICROCONTROLLER LAB (8086 / 8051)

3 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

1. Programs for 8 / 16 bit Arithmetic operations.
2. Programs for sorting and searching.
3. Programs for string manipulation operations.
4. Programs for Digital clock and Stop watch.
5. Interfacing ADC and DAC.
6. Parallel communication between Two Microprocessor Kits using Mode 1 and Mode 2 of 8255.
7. Interfacing and programming 8279 - Keyboard and display interface
8. Square wave generation using 8253 timer.
9. Interfacing and programming of Stepper motor.
10. Programming using Arithmetic, Logical and Bit Manipulation instructions of 8051 Microcontroller.
11. Programming and verifying Timer and Interrupts operation of 8051 Microcontroller.

VII SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE701 HIGH VOLTAGE ENGINEERING

4 hrs/ week **Max. marks 125.**
Exam marks: 100 **Sess. marks 25.**

PART A

1. **Introduction**: Advantages of high voltage for power transmission-prospective voltage levels. 1 hr
2. **Generation of high voltages :**

A C Voltages : Transformers in cascade. Resonant transformers – parallel and series resonant transformers. Tesla coil.

D C Voltages : voltage doubler circuit, cockroft - Walton cascaded D C generators – Voltage regulation, ripple, optimum number of stages. Electrostatic DC generators.

Impulse Voltages: Standard Lighting and switching voltages. Single stage impulse generators. Multistage impulse generators. Controlled tripping - three - electrode and trigatron gap methods. Impulse current generator. Generation of switching surge voltages. 12 hrs + 3* hrs

3. **High Voltage & Current Measurements** : R-dividers for AC and DC voltages. Generating voltmeter. Electrostatic voltmeter, sphere gaps - Method of measurement of AC, DC and impulse voltages. Effects of temperature, pressure, humidity and radiation. Potential dividers for impulse voltages-R, C and RC mixed dividers. Measurement of high DC, AC and Impulse currents. Diode peak voltmeter. 12 hrs + 2* hrs

PART B

4. **Breakdown Theory :** Ionization phenomena, Breakdown in Gases - Townsend's theory, Paschen's law, streamer's theory of break down. Time lags of breakdown, Breakdown in Electronegative gases, Corana discharges and breakdown in non-uniform field. Breakdown in solid and liquid dielectrics. 4 hrs + 1* hr
5. **Over Voltage Phenomena on Transmission lines** : Causes of over voltages including lightning, switching, faults etc. Origin of travelling waves. Partial differential equations for loss less lines and their solution. Behavior of rectangular travelling wave at transition points - open ended line, short circuit line, line terminated with a resistance, capacitance and inductance (R-L-C). Bewley - Lattice diagram. Protection of transmission lines against over voltages - Horn gap, surge absorber. Ground wires, Lightning arrestors - Silicon carbide and Zinc oxide arrestors - comparison between them with regard to construction and characteristics. Insulation co-ordination. 11 hrs + 4* hrs
6. **High Voltage testing of electrical apparatus :**
Layout of HV Testing laboratory. Clearances, earthing and shielding. 2 hrs + 1* hr
7. **Non destructive HV tests on materials and apparatus**: Introduction, Measurements of capacitance and loss factor using Scherings bridge at low and high frequencies. Partial discharge measurements. Straight and balanced methods of detection. Measurement of PD in cables and transformers. 5 hrs + 1* hr
8. **High voltage Testing of Electrical apparatus :** HV testing of Bushings, testing of cables, transformers and surge diverters (to be discussed with testing circuits and procedure for important tests as per Indian Standards). 3 hrs + 2* hrs

50 hrs + 14* hrs Tutorials

REFERENCES:

1. High Voltage Engineering (Pargamon Oxford) - Kuffel and Zangel.
2. High Voltage Engzzzzineering (TMH New Delhi) - Naidu and Kamaraju.
3. A Course in electrical Power - Soni, Gupta and Bhatnagar.
4. T & D Hand Book - Westinghouse.
5. High Voltage Engineering ,C.L.Wadhwa, New Age International Private limited, 1995.
6. High Voltage Engineering Theory and Practice, Mazen Abdel-Salam, Hussein Anis, Ahdab El-Morshedy, Roshdy Radwan, 2nd Edn (Revised & Expanded) Marcel-Dekker Publishers(Special Indian Edn.).
7. Partial discharge Measurements - IEC Specification No 270(1968) SI 6209(1971).
8. Methods of HV testing - IS 2071 - (1976).
9. Methods impulse testing - IS 2070 - (1962).
10. Insulators testing - IS 2099 - (1986), IS-731.
11. Impulse testing of transformers - IS 2026 - (1981).

12. Testing of Circuit Brakers and Isolators - IS 2516 - (1980).
13. Testing of Power cables (Part I and Part II) - IS 5959 - (1970).
14. Lightning Arrestors - IS 4004 - (1967) and IS 4850 - (1968) and IS 3070 - (1982).
15. RIV Measurements - B S 5049 (1973).

Question paper Pattern :-
Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VII SEMESTER B.E (ELECTRICAL & ELECTRONICS)

2K11EE702 ESTIMATION, SPECIFICATION AND ENGINEERING MANAGEMENT

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **General Principles of Estimation :** Introduction to estimation, Electrical Schedule, Catalogues, Market Survey and source selection, Recording of estimates, Determination of required quantity of material, Labor conditions, Determination of cost material and labour, Contingencies, Overhead charges, Profit, Purchase system, Purchase enquiry and selection of appropriate purchase mode, Comparative statement, Purchase orders, Payment of bills, Tender form, General idea about IE rule, Indian Electricity Act and major applicable I.E rules. 4 hrs + 2*hrs

2. **Specification :** Importance of specification, ISI specifications of Alternators, Power Transformers, AC Motors, Circuit Breakers, Overhead line Conductors, Insulated HT underground cables, porcelain insulators, Insulating wire, Power line carrier Communication (PLCC) equipment. 2 hrs

3. **Service connection, Inspection and Testing of Installation :** Concept of service connection, Types of service connection and their features, Method of installation of service connection, Inspection of internal wiring installations, Inspection of new installations, Testing of installations, Testing of wiring installations, Reason of excess recording of energy consumption by energy meter. 4 hrs + 1*hr

4. Electrical Installation for Power Circuits : Introduction, Important considerations regarding motor installation, wiring, Determination of input power, Determination of input current to motors, Determination of rating of cables, determination of rating of fuse, Determination of size of Condit, distribution, Board main switch and starter. 6 hrs + 2* hrs

5. **Residential Building Electrification :** General rules guidelines for wiring of residential installation and positioning of equipments, Principles of circuit design in lighting and power circuits, Procedures for designing the circuits and deciding the number of circuits, Method of drawing single line diagram, Selection of type of wiring and rating of wires and cables, Load calculations and selection of size of conductor, Selection of rating of main switch, distribution board, protective switch gear ELCB and MCB and wiring accessories, Earthing of residential Installation, Sequence to be followed for preparing estimate, Preparation of detailed estimates and costing of residential installation. 4 hrs

6. **Electrification of Commercial Installation :** Concept of commercial installation, differentiate between electrification of residential and commercial installation, fundamental considerations for planning of an electrical installation system for commercial building, design considerations of electrical installation system for commercial building, Load calculation and selection of size of service connection and nature of supply, Deciding the size of the cables, bus bar and bus bar chambers, Mounting arrangements and positioning of switchboards, distribution boards main switch etc., Earthing of the electrical installation, Selection of type wire, wiring system and layout, sequence to be followed to prepare estimate, Preparation of detailed estimate and costing of commercial installation.

5 hrs + 2* hrs

PART B

7. **Estimation :**

Estimation of 400KV, 66KV Transmission lines & Distribution lines (400/230V, 11kV) : Introduction, Typical AC electrical power system, Main components of overhead lines, Line supports, Factors governing height of pole, Conductor materials, Determination of size of conductor for overhead transmission line, Cross arms, pole brackets and clamps, Guys and Stays, Conductors configuration spacing and clearances, Span lengths, Overhead line insulators, Insulator materials, Types of insulators, Lightning Arrestors, Phase plates, Danger plates, Anti climbing devices, Bird guards, Beads of jumpers, Muffs, Points to be considered at the time of erection of overhead lines, Erection of supports, Setting of stays, Fixing of cross arms, Fixing of insulators, Conductor erection, Repairing and jointing of conductor, Dead end clamps, Positioning of conductors and attachment to insulators, Jumpers, Tee-offs, Earthing of transmission lines, Guarding of overhead lines, Clearances of conductor from ground, Spacing between conductors, Testing and commissioning of overhead distribution lines, Some important specifications. 10 hrs + 3* hrs

8. **Design and Estimation of Substations**: Introduction, Classification of substation, Indoor substations, Outdoor substations, Selection and location of site for substation, Main Electrical Connections, Graphical symbols for various types of apparatus and circuit elements on substation main connection diagram. Key diagram of typical substations, Equipment for substation and switchgear installations, Substation auxiliaries supply, Substation Earthing. 5 hrs + 2* hr

9. **Growth and concept of Industry :** Types of ownership, principles of management, principles of Taylor, Henny l. Gantt and Henry Fayol in modern Industry, functions and process of management. 2 hrs

10. **Organization :** Types of organizations, Line type, Line and staff, Functional, Line-functional and Matrix types. Authorities and responsibilities, managerial controls 2 hrs

11. **Production Management :** Plant location, layout of plants, production planning and control, routine, scheduling, inspection, Line balancing, automation characteristics, impact of automation - advantages and disadvantages of automation, quality control - scope, organization, standards and specifications (Tolerances). Statistical quality control, control charts, techniques of Time and Motion study. 4 hrs + 1* hr

12. **Personnel Management & Human Relations :** Introduction, qualification of personnel recruitment and selection of personnel. Training of personnel - Craftsmen, supervisors (TWI scheme), managers. Employer and Employee relations, Employees morale, health and welfare of workers, effect of noise, lighting, ventilation on production. Fatigue and reduction of fatigue, accidents and their reduction, settlement of individual disputes, ILO, workers participation in management. 2 hrs + 1* hr

50 hrs + 14* hrs Tutorials

REFERENCES :

1. Industrial organization and management - Bethel.
2. Introduction to Management - S.S Chatterjee.
3. Engineering Economics and Management - N.Narasimhaswamy.
4. Industrial Organization and Engineering Economics - T.R. Banga & S.C. Sharma.
5. Electrical Installation Estimating & Costing, J B Gypta, VIII Edition S K Katria & Sons, New Delhi
6. Electrical Design Estimating and Costing , K B Raina S K Bhattacharya, New Age International
7. Electrical Wiring Estimating and Costing, Uppal, Khanna Publishers Delhi.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VII SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE703 NON-CONVENTIONAL ENERGY SOURCES

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **AN INTRODUCTION TO ENERGY SOURCES :** Introduction, Energy Sources, Energy Sources and their availability, World Energy Futures, New Energy Technologies, Renewable energy sources, Prospects of renewable Energy Sources 6 hrs.
2. **SOLAR ENERGY :** Introduction, Solar radiation and measurement, Different Solar energy collectors, Energy Balance equation and Collector efficiency (Problems on Efficiency equation), Solar energy storage systems, Solar Pond, Extraction of Thermal Energy, Application of Solar energy – Solar water heating, Solar thermal Electric conversion, Solar electric power generation, Solar cooking. **PHOTO VOLTAICS :** Introduction to solar energy conversion, PV cells, characteristics, cell efficiency, stand alone and integrated operation 16 hrs.
3. **GEOTHERMAL ENERGY** 4 hrs
4. **WIND ENERGY :** Introduction, Basic Principles of Wind energy conversion, Basic components of Wind energy conversion systems (WECS), Classification of WECS, Advantages and Disadvantages of WECS, Types of Wind machines (Wind Energy collection), Performance of Wind machines, Generating Systems, Applications of Wind Energy. 10 hrs.

PART B

5. **ENERGY FROM BIO-MASS :** Introduction, Bio-mass Conversion technology, Generation, Types of Bio-gas plants, Community bio-gas plant, Utilization of Bio-gas. 4 hrs.
6. **HYDROGEN ENERGY & FUEL CELLS** : Introduction, Utilization of Hydrogen gas, Hydrogen as an Alternate fuel for motor vehicles, Hydrogen Technology development in India. 8 hrs.
7. **MAGNETO HYDRO DYNAMICS (MHD) :** Introduction, Principle of MHD Power Generation, MHD systems, Advantages of MHD systems. 4 hrs.
8. **ENERGY FROM THE OCEANS** : Introduction, Ocean Thermal Electric conversion, Energy from tides, Wave energy conversion devices. 4 hrs.

56 hrs

REFERENCES :

1. Non-Conventional Sources of Energy by G D RAI, Khanna.
2. Non-Conventional Energy Sources by Khan, Tata McGraw Hill, New Delhi.
3. Solar Energy by Sukhatme.
4. Solar Energy hand book - edited by William C Dikkinson, ASISES, Newyork.

Question paper Pattern :-
Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VII SEMESTER B.E (ELECTRICAL & ELECTRONICS)

2K11EE704 COMPUTER TECHNIQUES IN POWER SYSTEM ANALYSIS

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **Network Topology & Matrices :** Oriented Graphs, Primitive Impedance and Admittance matrices, Formation of Y-Bus, formation of Bus impedance Matrix - Z Bus building algorithm. 8 hrs
2. **Load flow studies :** Introduction, Power flow equations, classification of Buses, Gauss-Seidal method-Algorithm, Flow chart, Acceleration factor, Newton-Raphson method in polar co-ordinates-Algorithm, flow chart, FDLF method- Algorithm, Flow chart, Problems on all load flow methods, Representation of Transformer tap settings, Comparison of load flow studies. 18 hrs

PART B

3. **Economic operation of Power system:** Introduction, performance curves, Economic generation scheduling, Neglecting losses and generator limits – Economic generation scheduling including generator limits and neglecting losses-Iterative techniques-Economic dispatch including transmission losses-penalty factor. Iterative technique for solution of economic dispatch with losses-Derivation of transmission loss formula-optimal scheduling of hydrothermal plants-problem formulation solution procedure and algorithm. 12 hrs
4. **Transient Stability studies:** Numerical solution of swing equation-point-by point method, Modified Euler's method, Range-Kutta method, Representation of power system for transient stability studies, load representation, Factors and methods of improving Transient stability. 14 hrs.

52 hrs

Reference books :

1. Stages G W and E I Abiad "Computer methods in Power System Analysis", McGraw hill, 1968.
2. "Computer Techniques in Power System Analysis", M A Pai, TMH, 2nd Edition, 2006.
3. "Modern Power System Analysis", TMH, 2003, I. J.Nagrath and D P Kothari.
4. "Power System Analysis", TMH, 2nd Edition, Haadi Sadat, 2007.
5. "Advanced Power System Analysis and Dynamics", L P Singh, 2008.
6. "Power System Analysis", Nag Sarkar, 2009
7. "Power System Analysis", Wadhwa, 2010.
8. "Computer Techniques in Power Systems", Uma Rao.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VII SEMESTER B.E (ELECTRICAL & ELECTRONICS)

2K11EE705 TESTING & COMMISSIONING OF ELECTRICAL EQUIPMENT

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. Transformers
   a) Specifications
   b) Installation : Location and Site selection. Design of Foundation details, code of practice for terminal plates, polarity and phase sequence, oil tanks, drying of windings with and without oil. General inspection. 6 hrs
   c) Commissioning tests : National and international standards, volt-ratio test, earth resistance oil strength. Bucholz and other relays, tap changing gear, fans and pumps, insulation test, impulse test, load and temperature test. 5 hrs
   d) Specific tests : Determination of performance curves like efficiency, regulation etc. and determination of mechanical stress under normal and abnormal conditions. 6 hrs

2. Synchronous machines
   a) Specifications
   b) Installation : Physical inspection, name plate details, foundation details, alignments excitation systems, cooling and control gear and drying out. 4 hrs
   c) Commissioning tests : Insulation, Resistance measurement of armature and field windings, waveform, telephone interference factors, line charging capacity. 4 hrs
   d) Performance tests : Tests to estimate the performance for generator operations, maximum reactance tests, Sudden short circuit tests, transient and sub-transient parameters, measurements of sequence impedance, capacitive reactance and separation of losses, temperature raise test and retardation tests. 5 hrs
   e) Factory tests : Gap length, magnetic centrity, balancing, vibrations and bearing performance. 2 hrs

PART B

3. Induction Machines
   a) Specifications : For different types of motors both for single phase and 3-phase. 2 hrs
   b) Installation : Location of motors, Foundation details, Apparatus, Shaft and alignment, Fitting of pulleys and coupling. Drying of windings. 4 hrs
   c) Commissioning tests : Mechanical tests, Air gap symmetry, Tests for bearings, Vibrations and balancing. 4 hrs
   d) Electrical tests : Insulation test, earth resistance, high voltage test, starting up failures, Routine test, factory test and site test according to ISI code. 2 hrs

4. Switch and protective devices : Standards, Types, specification, installation, commissioning tests, maintenance, schedule, type and routine tests. 6 hrs

50 hrs

Text Books :

1. Relevant Bureau of Indian standards.
2. Transformers – BHEL, J and P transformer, Handbook, J and P Switch Gear Hand book.
3. Testing and Commissioning of Electrical equipment – B V S Rao.
4. Testing and commissioning of Electrical equipment – S. Rao.
5. A Hand book on operation and Maintenance of Transformers – H N S Gowda.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VII SEMESTER B.E (ELECTRICAL & ELECTRONICS)

ELECTIVE I 2K11EE706.1 TRANSDUCERS AND SIGNAL CONDITIONING

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. Introduction, Classification, Active / Passive, Mechanical / Electrical, Basic requirements of Transducer, Electrical Transducers, Variable resistance transducers – Strain gauges, Variable Capacitance transducers, Variable Inductance transducers-LVDT, Hall-effect, Semiconductor, Opto-electric, piezo-electric transducers. 20 hrs

2. **Instrumentation Amplifier :** Basic characteristics, Three-amplifier configuration, Amplifiers for signal conditioning. 8 hrs

PART B

3. **Signal Processing :** Stair case generator comparator V/f – I/f comparator, filters, Data acquaintance and conversion, Multiplexer, Sample and hold click, ADC, DAC. 12 hrs

Digital signal transmission and processing, Modulation and Demodulation digital data transmission, telemetry 8 hrs

Input devices and display, Analog devices & receivers, digital input output devices, semi signal, dot matrix display LED, LCD. 8 hrs

Digital fuzzy meter, time period and time interval. 4 hrs

Reference books :

1. Electrical & Electronics Measurements by A K Sawheny.
2. Opamp and LIC by Ramakanth Gayakwad.
3. Transducers by Ranjan Sharma and Mani.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VII SEMESTER B.E (ELECTRICAL & ELECTRONICS)

ELECTIVE I 2K11EE706.2 ENERGY MANAGEMENT & AUDITING

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

INTRODUCTION : Energy scenario – world and India, energy consumption, Demand patterns, Codes, standards and Indian electricity policy / regulations, power sector reforms. 6 hrs

ENERGY ECONOMIC ANALYSIS: The time value of money concept, developing cash flow models, payback analysis, depreciation, taxes and tax credit – numerical problems, Electricity billing, Tariff. 10 hrs

ENERGY AUDITING : Introduction, Types of Audit, Methods of conducting, Elements of energy audits, energy use profiles, measurements in energy audits, presentation of energy audit results, Energy Audit Report format. (Case study) 8 hrs

PART B

ELECTRICAL EQUIPMENT AND POWER FACTOR : Correction and location of capacitor, Advantages of Pf correction, energy efficient motors, light, Fan, Concept of ABT. 10 hrs

DEMAND SIDE MANAGEMENT : Introduction to DSM, concept of DSM, benefits of DSM, different techniques of DSM – time of day pricing, multi-utility power exchange model, time of day models for planning, load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment. Management and organization of Energy Conservation, Methods of conservation (Case study), Awareness programs, Congestion management, open access. 16 hrs

50 hrs

References :

1. D P SenGupta, K R Padiyar, Indraned Sen, M A Pai (Ed) : Recent advances in Control & Management of Energy Systems. Interline Publishers. Bangalore (1993).
3. Ashok V Desai (Ed) : Energy Demand - Analysis, Management and Conservation Wiely Eastern Ltd. New Delhi.
4. H U D S Hand Book of Industrial Energy conservation. Van Nostrand Reinhold Company. New York (1983).
5. Paul O'Callanghan - Energy Management. McGraw Hill Book Company, London (1993).
6. Industrial Energy Management Systems, Arry C White, Philip S Schmidt, David R Brown, Hemisphere Publishing Corporation, New York.
7. TERI Reports.
8. Current Literature.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VII SEMESTER B.E (ELECTRICAL & ELECTRONICS)

ELECTIVE I 2K11EE706.3 VLSI DESIGN

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. Introduction: Moore's Law, VLSI design flow, design philosophy – full-custom, semi-custom design; VLSI trends - ITRS roadmap, CMOS and bipolar technologies. 4 hrs
2. MOS transistor: MOS structure, MOS system under external bias; structure and operation of MOSFET, I-V and C-V characteristics of MOSFET, threshold voltage; MOS Scaling and small geometry effects, MOS capacitances. 12 hrs
3. VLSI fabrication: Processes – photolithography, ion implantation, diffusion, oxidation, thin film deposition – CVD, PVD (Sputtering); etching; epitaxy; n-well, p-well and twin tub processes, LOCOS and STI isolation; Standard CMOS process flow for fabrication. 12 hrs

PART B

4. MOS Inverters: Static characteristics – R-load inverter, NMOS load inverter, CMOS inverter, Switching characteristics - Calculation of delay times, inverter design with delay constraints, power dissipation of CMOS inverters. 8 hrs
5. Combinational MOS logic circuits: CMOS logic circuits – NAND2, NOR2 gates, complex logic circuits, CMOS transmission gates. 6 hrs
6. Sequential MOS logic circuits: Bistable elements, SR latch, clocked latch and flip flop circuits; CMOS D-Latch. 5 hrs
7. High performance CMOS logic: Dynamic logic, Domino logic. 3 hrs
8. Semiconductor Memory: Classification, Architecture, Dynamic RAM – 1T DRAM cell, Static RAM - 6T SRAM cell. 5 hrs
9. VLSI Testing: Fault types and Models, Controllability and observability, Scan based and BIST techniques, IDDQ testing. 3 hrs

References books :

1. Kang & Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", Tata McGraw-Hill Edition.
2. Rabaey, Chandrakasan and Nikolic, "Digital Integrated Circuits: A Design Perspective", Pearson Education Publishers.
3. J.D. Plummer, Deal and Griffin, "Silicon VLSI Technology: Fundamentals, Practice & Modeling", Prentice Hall Publishers.
4. Weste and Eshraghian, "Principles of CMOS VLSI Design: A Systems Perspective", Pearson Education Publishers.
5. S.K. Gandhi, "VLSI Fabrication Principles", Wiley Publishers.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VII SEMESTER B.E (ELECTRICAL & ELECTRONICS)

ELECTIVE I 2K11EE706.4 PROGRAMMABLE LOGIC CONTROLLERS

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

Introduction to PLC : Programmable logic controller (PLC) basics, definition overview of PLC systems – ON–OFF control concept using relay logic– Input & Output modules– Power Supplies– Isolators– PLC installation – Trouble Shooting And Maintenance of PLC – General PLC Programming Procedures – Programming ON–OFF Outputs. 15 hrs

PLC – Auxiliary Commands and Functions : Creating ladder diagram from process descriptions – PLC basic functions – Register basics – Timer functions – Counter functions – Design of Interlocks & Alarms using PLC – PLC advanced functions – Alternate Programming Languages – Analog PLC operation. 15 hrs

Automation : Introduction & Historical background – Traditional & Computer based control system developments – Resulting System Architectures – Local Control Unit (LCU) Introduction – Basic Elements of A Microprocessor Based Controller – Function blocks – Example of continuous control, Logic control and Batch Reactor – Security design issues for LCU – manual back–up designs – Redundant controller designs. 15 hrs

Communication system requirements : Architectural issues – Channel structure – Operator interface requirements – Low Level Operator Interface – High Level Operator Interface, Introduction to Field Bus – Architecture Topology – Bus standards – Interoperability – Interchangeability. 15 hrs

Text Books

1. John. W. Webb and Ronald.A. Reis, “Programmable Logic Controllers Principles and Applications”,

Prentice Hall Inc, New Jersey, 3rd edition, 1995.

2. Lukas M. P, “Distributed Control Systems”, Van Nostrand Reinhold Co, New York, 1986

References

1. Deshpande .P .B & Ash .R .H, “Elements of Computer Process Control”, Instrument Society of America,1981.
2. Hughes .T .A, “Programmable Controllers”, ISA, 1989.

VII SEMESTER BE (ELECTRICAL & ELECTRONICS)

2K11EE707 CONTROL SYSTEMS AND DSP LABORATORY

3 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART – A
CONTROL SYSTEMS

1. Time Response Analysis: Transient response of 1st, 2nd & higher order / type systems.
2. Complex domain analysis: To Draw the Root locus plot.
3. Frequency Domain Analysis i. To Draw the Bode plot
   ii. To Draw Nyquist plot.
4. Determine the state model representation in different (controllable, observable and Jordan) Canonical forms.
5. Determine the Eigen values and transfer functions for a given state space model and Check for complete controllability and observability.
6. Design of full order observer.
7. Design of Lag - Lead Compensator.
8. Controllers ----- P and PI

PART – B
DSP

1. Discrete Time Signals & Systems : Find Impulse response,
   Step response &
   Frequency response of a given system.
2. For the LTI systems described by the difference equations, generate its impulse response, and unit step response. Comment on the properties of the system
3. Compute the Auto and Cross correlation of two given sequences.
4. Time and Frequency domain responses.
   a) Linear convolution.
   b) Circular convolution.
   c) Verification of Linear convolution using DFT.
   d) Finding DFT using FFT algorithms.
   e) Finding the Inverse FFT.
5. Design a low pass FIR FILTER using Kaiser window and hamming window techniques.
6. Design a low pass Butterworth and type-1 Chebyshev IIR FILTERS.

VIII SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE801 HVDC & FACTS

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **D.C. Power transmission technology :** Comparison of A.C. and D.C transmission, application of D.C transmission, different types of D.C links, description of D.C transmission systems, planning and modern trends in H.V.D.C transmission. Economic considerations 7 hrs + 1* hr
2. **Analysis of HVDC Converters :** Thyristor valve, valve protection, tests and recent trends. Choice of Converter configuration. Analysis of 6 pulse bridge type converter (Graetz circuit), effect of source inductance, equivalent circuit (without filters) converter bridge characteristics. Valve voltage wave forms with and without overlap. Line commutated inverter with source inductance. 12 hrs + 3* hrs
3. **Harmonics and Filters :** Generation of Harmonics, types of filters, carrier frequency and RI noise. 3 hrs + 1* hr

PART B

1. **Converter and HVDC System Control :** Principles of D.C link control, converter control characteristics, Firing angle control current and extinction angle control, power control, higher level controllers. 5 hrs + 1* hr
2. **Converter faults and protection :** Converter faults, protection against over currents and over voltages, over voltages in a Converter station. Reactive power control during transients. 5 hrs + 1* hr
3. **Multiterminal HVDC Systems :** Types of MTDC Systems, Control and protection of MTDC Systems, applications of MTDC Systems. 3 hrs + 2* hr
4. **Stability of A.C.** -D.C interconnected system. 2 hrs + 2* hr
5. **Simulation of HVDC Systems :** Modelling of HVDC Systems for digital dynamic Simulation. 3 hrs + 1* hr

PART C

1. Principles of Reactive power compensation, Load and Line compensation, Concepts of Flexible AC Transmission system (FACTS). 4 hrs + 1* hr
2. Shunt and Series compensation, Static variable compensations, Thyristor controlled reactor, Thyristor switched capacitor. 6 hrs + 1* hr

50 hrs + 14* hrs Tutorials

References :

1. HVDC Power transmission systems - Wiley eastern ltd. - K.R.Padiyar.
2. Direct current transmission Vol I, Wiley Newyork 1960 - E.W.Kimbark.
3. Computer modelling of Electrical Power Systems - Wiley InterScience, Newyork 1983 - Arrillaga.T, Arnold, C.P. and Harker.B.J.
4. High voltage Direct current transmission - Garraway Limited, London 1960 - Hingorani, N.G and Adamson.C.
5. Power System Stability, Operation and Control - Prabhakundur.

Question paper Pattern :-
Total eight questions have to be set, 3 from each Part, 3 from PART B, and 2 from PART C. Students have to answer 5 questions choosing 2 from PART A, 2 from PART B and 1 from PART C.

VIII SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE802 UTILIZATION OF ELECTRIC POWER

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **Heating and Welding :** Advantage and method of electric heating, resistance ovens, induction heating, dielectric heating, the arc furnace, electric welding, resistance and arc welding, control device and welding equipment. 12 hrs
2. **Electrolytic process:** Fundamental principles extraction refining of metals electroplating, Factors affecting electro deposition process. 6 hrs
3. **Refrigeration & Air conditioning :** C.O.P, Air refrigeration system, Simple vapour compression, Regrigeration system, Domestic refrigerator, Water coolers, Air conditioning systems, Load estimation, applications. 12 hrs

PARTB

4. **Electric traction:** Traction systems, power supply, A.C. locomotive, Diesel electric traction, overhead equipment, power factor & harmonics, Speed time curves, mechanism of train movement, Tractive effort for propulsion of trains, Specific energy consumption, control of traction motors DC, Induction motors using PWM strategies, inverter design, speed control strategies v/f control, vector control, field weakening control, Electric braking, Energy savings in Regenerative breaking. 20 hrs
5. **Electric vehicles and systems :**
   Road load characteristics, city drive cycle, Power estimation, Torque estimation, Acceleration profiling, Auxiliary loads.
   Electric propulsion: Electric vehicles, hybrid electric vehicles, series hybrid, parallel hybrid, combination hybrid, energy management, power flow strategies, regenerative breaking, gear train, differential gear.
   Batteries for electric vehicles: Power density, energy density, choice of batteries, DOD for EV batteries, Alternate energy storage mechanism (fuel cells). 10 hrs

60 hrs

Reference Books :

1. Utilization of Electric Power by R. K. Rajput, Laxmi Publications, New Delhi, 2012.
2. A course in Electrical power by Chakraborthy, Soni, Gupta & bhatnager, , Dhanpat Rai and Sons
3. Openshaw taylor, Utilization of Electric energy (Chapter 1,2,3,6)
4. Modern Electric, Hybrid Electric & Fuel cell vehicles, CRC Press, Mehrdod, Ehshani, Yimin Gao.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VIII SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE803 ILLUMINATION ENGINEERING

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **Light & Vision:** Electromagnetic spectrum, visible spectrum, Photopic, Scotopic & Mesopic Visions – Visual functions, Accommodation, Adaptation & Convergence. 4 hrs
2. **Propagation of light:** Light propagation, Reflection, Specular, diffuse, spread, compound, scattered & selective reflections, Absorption, Transmission, Refraction, Polarization. 4 hrs
3. **Photometric quantities &Units:** Basic quantities – Laws of illumination from point law, surface, photometry, spectrometry & photocells - Inter relation between the various photometric quantities, Luminous efficacy, Spectral eye sensitivity curve, Light watt, Brightness, Luminous exitance, Radiometric quantities & units, Point by point method of illuminance Calculations – Horizontal and Vertical illuminance calculations. 10 hrs
4. **Artificial light sources:** Construction – principle of operation - Luminous efficiency, Lamp life & Colour characteristics of incandescent, Tungsten halogen, fluorescent, High pressure mercury vapour, High pressure sodium vapour and metal halide lamps, CFL lamps – Electro luminescence & LED-LCD Displays. 8 hrs

PART B

5. **Luminaire:** Definition – optical characteristics of light control elements – classification, Symmetrical and asymmetrical , diffuse and focussed & C.I.E. classification - Applications of various light control elements (Reflectors, Refractors, diffusers & screening devices), Luminous intensity distribution measurements using GONIO photometer, L.I.D. diagrams in rectangular & polar co-ordinates. 8 hrs
6. **Artificial illumination design techniques:** Utilization factor – Maintenance factor – Light output ratio – D.L.O.R & U.L.O.R - L.D.L of various lamps – Glare – Direct & Indirect types - Designing for average uniform illumination – Room index – space to mounting height ratio – Lumen method of calculations – Numerical examples – IES glare index computation method – simple examples using ceiling mounted luminaires (Calculation of initial glare index only) – Evaluation of total luminous flux output from photometric test data. 10 hrs
7. **Flood lighting of buildings:** design aspects – Location of the equipment – Flood lighting of monuments & sports grounds – Numerical examples. Flood light calculation. 8 hrs
8. **Road lighting:** Road lighting criteria – Luminance & Luminance ratio – Overall & Longitudinal uniformity ratio – Zebra effect – Convectional lighting schemes – Factors affecting cost & quality of road lighting – Lighting of curves. Energy conservation measures in illumination systems – Introduction to optical fibers & Lasers. 8 hrs

60 hrs

REFERENCES :

1. Cayless M. A. & A.M. Marsden , Lamps and Lighting (3e), O & IBH Pub., 1983.
2. Ronald N. Helms, Illumination Engg. for Energy efficient luminous Environment, PH, 1980
3. Cotton H., Principles of Illumination, Chapman & Hall Ltd, London 1960.
4. Durrant D.W, Interior lighting design (5e), Lighting industry federation Ltd., 1977.
5. W. J. M Van Bommel and J. B. Boer, Road lighting, Kluwer Technical Lib, 1981.
6. Boer J. B. and D. Fischer, Interior lighting(5e), Kluwer Technical Lib, 1981.
7. I. E. S. N. A New York, Lighting Handbook (8e), 1993.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VIII SEMESTER B.E (ELECTRICAL & ELECTRONICS)

ELECTIVE II 2K11EE804.1 ARTIFICIAL INTELLIGENCE TECHNIQUES FOR POWER SYSTEMS

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **Introduction** : Approaches to Intelligence control, Architecture of Intelligent control. Symbolic reasoning system, Rule based systems, AI approach. Knowledge representation, Expert systems. 9 hrs

2. **Artificial Neutral Networks**: Concept of ANN and its Basic Mathematical model – Mcculloch-pitts, Neuron model, Simple perceptron. Adaline and Madaline, Feed-forward, Multi layer perceptron. Learning and Training the neural network. Data processing, Scaling, Fourier transformation, principal-component, analysis and wavelet transformations, Hopfield network, Self organizing network and Recurrent network, Neural network based controller. Application of ANN to power systems. 12 hrs

PART B

3. **Fuzzy logic system :** Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to Fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification, Fuzzy knowledge and Rule based. Fuzzy modeling and Control schemes for non-linear systems. Self organizing fuzzy logic control, Fuzzy logic control for non-linear time delay system. 9 hrs

4. **Genetic algorithm :** Basic concept of GA and detail algorithm steps. Adjustment of parameters. Solution of typical control problems using GA. Evolutionary techniques and Tabular search. Economic dispatch problem using these techniques. 12 hrs

5. **Applications :** GA application to Power System optimization problems, case studies. Identification and control of linear and non-linear dynamic systems using Matlab, Neural Network tool box. Stability analysis of Neural network interconnection systems. Implementation of Fuzzy logic controller. Stability Analysis of Fuzzy control systems Power system problems Optimal power flow, economic dispatch and stability studies. 12 hrs

54 hrs

References books :

1. Power System Optimization – Kothari and Dhillon (2009)
2. Artificial Intelligence and Intelligent Systems – N P Padhy, Oxford University Press (2009)
3. Introduction to ANN – J M Zurada (1999) Jaica Publishing House
4. Neural Networks and Fuzzy Systems – Kosko. B (1994), PHI, Ltd
5. Fuzzy set theory and its applications – (1994) – Zimmerman H J, Kluwer publications.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VIII SEMESTER B.E (ELECTRICAL & ELECTRONICS)

ELECTIVE II 2K11EE804.2 ANALOG & MIXED MODE VLSI

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

1. Introduction: CMOS Analog design, levels of abstraction, robust analog design – analog design tradeoffs. 2 Hours
2. MOS device physics for analog design: MOS small signal model, device parameters – g_m and r_o, Implications of scaling and MOS second order effects for analog design – subthreshold conduction, body bias effect, channel length modulation. 6 Hours
3. Single stage amplifiers: CS stage – R-load, diode-connected load, current source load, triode load, source degeneration, Source follower, CG stage, Cascode amplifier, folded cascade. 8 Hours
4. Differential amplifiers: Single ended and differential operation, basic differential pair, common mode response, differential pair with MOS loads, VGA, Gilbert cell; Current mirrors – basic current mirror, cascode current mirrors- accuracy voltage headroom tradeoff, low voltage operation, Wilson current mirrors. 10 Hours
5. Operational amplifiers: General considerations, 1-stage, 2-stage op amps, performance issues – input range, power supply rejection and slewing in simple op amp; frequency compensation – first principles. 8 Hours
6. Switched capacitor circuits: Sampling switches – MOS as switch - mathematical analysis, speed-precision considerations. 5 Hours
7. Oscillators and PLLs: Ring oscillators, Voltage controlled oscillators, Simple PLL- basic PLL topology, Non-idealities & applications of PLLs. 5 Hours
8. Digital-to-Analog and Analog-to-Digital Converters: DAC - characterization, Parallel DAC – current scaling DAC; ADC - characterization, Serial ADC- single slope and dual slope ADC. 8 Hours

52 hrs + 14* hrs Tutorials

References:

1. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, Tata McGraw-Hill Edition.
2. Allen and Holberg, “CMOS Analog Circuit Design”, Oxford University Press, 2004
3. Gray, Hurst, Lewis and Meyer, “Analysis and Design of Analog Integrated Circuits”, Wiley Editions.

Question paper Pattern :-

Students have to answer any 5 full questions out of 8 questions.

VIII SEMESTER B.E (ELECTRICAL & ELECTRONICS)

Elective II 2K11EE804.3 MICRO ELECTROMECHANICAL SYSTEMS (MEMS)

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **Introduction :** Microsystems and microelectronics- Block diagram, components, multidisciplinary nature of microsystem design & fabrication, classification of MEMS : Mechanical, thermal, Magnetic, RF, Bio & chemo MEMS, MFS, MOEMS, Typical MEMS products and application. 6 hrs
2. **Working principles of MEMS :** Principles of sensing & actuation; structures : beam and cantilever, microplates; Microsensors – pressure sensors, thermal sensors, chemical sensors, optical sensors, bio & biomedical sensors, flow sensors, gas sensors; Microactuation – thermal forces, shape memory alloys, piezoelectric crystals, electrostatic forces; Microactuators - microgrippers, micromotors, microvalves, micropumps, MEMS relay, thermovessels. 14 hrs
3. **Scaling laws in miniaturization**: Scaling in geometry, rigid body dynamics, electrostatic forces, electromagnetic forces, electricity. 6 hrs

PART B

4. **Engineering mechanics for Microsystems design**: Static bending of thin plates – circular, rectangular & square plates, mechanical vibration: microaccelerometers – design theory; resonant vibration; thermo mechanics – thermal stresses, creep deformation. 12 hrs
5. **Materials for MEMS** : Substrates and wafers, Si as substrate material, Si compounds – SiO_2, Silicon carbide, Silicon nitride, Poly Si, Polymers, packaging materials. 4 hrs
6. **Micromanufacturing:** Fabrication of MEMS devices - Bulk micromachining, surface micromachining, LIGA process. 6 hrs
7. **MEMS packaging:** General considerations, 3 levels of packaging – die level, device level and system level; interfaces and technologies for packaging 4 hrs

52 hrs

REFERENCES:

1. Tai-Ran Hsu, “MEMS and Microsystems – Design and Manufacture”, Tata McGraw-Hill Edition.
2. N.P. Mahalik, “MEMS”, Tata McGraw-Hill Edition.
3. Min_Hang Bao, “Micro Mechanical Transducers – Pressure sensors, Accelerometers and Gyroscopes”, Elsevier Publishers.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VIII SEMESTER B.E (ELECTRICAL & ELECTRONICS)

ELECTIVE II 2K11EE804.4 PROCESS INSTRUMENTATION

4 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

PART A

1. **Process Modelling and Response :** Heat exchanger, Mixing process, Stirred tank reactor-First order systems-Response of thermometer, RC circuit, Mixing Process, Liquid level process-Second order systems-Transportation lag-Response of simple closed loop systems. **15 hrs**
2. **Controller Tuning and Process identification :** Controller tuning – Zeigier Nichois tuning method-Cohen and Coon turning method-Electronic PID controllers – Process identification-Open loop identification method-First order and second order model-Closed loop identification method. **15 hrs**

PART B

3. **Control Schemes :** Ratio control systems – Split range control – Cascade control – Selective control – Internal model control – Dead time compensation – Feedforward control – Adaptive control – Inferential control **15 hrs**
4. **Control Valves :** Construction – Valve sizing – Characteristics – Types- transfer function – valve positioner. **5 hrs**
5. **Programmable Logic Controllers :** Introduction – PLC Architecture – PLC programming and programming languages – Ladder diagrams – Basic functions – Advanced functions – PID control of continuous process, Networking of PLC's. **10 hrs**

60 hrs

References :

1. Donald R Coughanowr, "Process System Analysis and Control", Tata McGraw Hill Publishing Company Ltd., 1995.
2. Stephanopoulos G., "Chemical Process Control-An Introduction to Theory and Practice", Prentice Hall of India, 1995.
3. John W Webb, Ronald A Reis, "Programmable logic Controllers – Principles and Applications", Prentice Hall of India, 5th edition, 2003.
4. Frank D, Petruzella, Programming logic Controllers", McGraw Hill Publishing Company Ltd, 1998.

Question paper Pattern :-

Total eight questions have to be set, 4 from each Part. Students have to answer 5 questions choosing at least 2 from each Part.

VIII SEMESTER B.E (ELECTRICAL & ELECTRONICS)
2K11EE806 POWER SYSTEMS SIMULATION LABORATORY
(USING MATLAB)

3 hrs/ week **Max. marks 125.**

Exam marks: 100 **Sess. marks 25.**

1. Formation of Y-Bus.
2. Formation of Z-Bus.
3. Load flow study using Newton-Raphson method.
4. Load flow study using Fast-decoupled load flow method.
5. Short circuit analysis using Z-Bus for 3 phase fault.
6. Solution of swing equation of a single machine connected to infinite bus.
   (a) Runge-Kutta method (b) step by step method
7. Calculation of penalty factors and solution of co-ordination equation for economic operation of power systems.
8. Calculation of ABCD parameters and Reactive power compensation.