Curriculum and Scheme for combined First and Second Semesters B. TECH
(Effective from 2006 admissions)

Code	Subject	Hrs / week			Sessional Marks	University Exam	
		L	T	P		Hrs	Marks
2K6 EN101	Engineering Mathematics I	2	1		50	3	100
2K6 EN102	Engineering Physics	2			50	3	100
2K6 EN103	Engineering Chemistry	2			50	3	100
2K6 EN104	Engineering Mechanics	2	1		50	3	100
2K6 EN105	Engineering Graphics	1		3	50	3	100
2K6 EN106	Basic Civil Engineering	2	1		50	3	100
2K6 EN107	Basic Mechanical Engineering	2	1		50	3	100
2K6 EN108	Basic Electrical Engineering	2	1		50	3	100
2K6 EN109	Basic Electronics and Computer Engineering	2	1		50	3	100
2K6 EN110 P	Basic Engineering Laboratory (Surveying, Fitting, Carpentry, Foundry, Smithy, Welding & Sheet metal)			2	50		
2K6 EN111 P	Basic Electrical & Electronics Work shop (Wiring, Soldering & Study of Basic Computer Hardware)			2	50		
		17	6	7	550		900

2K6 EN101: ENGINEERING MATHEMATICS I
(3 hrs/week)

Module I: Ordinary differential equations (16 hours)
A brief review of the method of solutions first order equations - Separable, homogeneous and linear types – Exact equations - Orthogonal trajectories – General linear second order equations - homogeneous linear equation of the second order with constant coefficients – Fundamental system of solutions – Method of variation of parameters – Cauchy's equation.
Module II: Laplace transforms (17 hours)
Gamma and Beta functions – Definition and simple properties – Laplace transform - Inverse transform – Laplace transform of derivatives and integrals – Shifting theorems – Differentiation and integration of transforms - Transforms of unit step function and impulse function – Transforms of periodic functions – Solutions of ordinary differential equations using Laplace transforms.
Module III: Vector differential calculus (18 hours)
Functions of more than one variable – Idea of partial differentiation – Euler's theorem for homogeneous functions – Chain rule of partial differentiation – Application in errors and approximations. Vector function of single variable – Differentiation of vector functions – Scalar and vector fields – Gradient of a scalar field – Divergence and curl of vector fields – Their physical meanings – Relation between the vector differential operators.
Module IV: Fourier series and harmonic analysis (15 hours)
Periodic functions – Trigonometric series – Euler formulae – Even and odd functions - Functions having arbitrary period – Half range expansions – Numerical method for determining Fourier coefficients - Harmonic analysis

Reference Books:

1. Piskunov N. , *Differential and Integral calculus*, MIR Publishers
2. Wylie C. R. , *Advanced Engineering Mathematics*, McGraw - Hill
3. B. S Grewal. , *Higher Engineering Mathematics*, Khanna publishers
4. Kreyszig E. , *Advanced Engineering Mathematics*, Wiley Eastern
5. Thomas G,B. , *Calculus and Analytic Geometry*, Addison Wesley
6. Spigel. , *Vector analysis*, Schume series, Mc Grawhill
7. Sastry S. S. Engineering Mathematics, Prentice Hall of India

University Examination Pattern
Q I – 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions (covering entire module) of 15 marks each from module I with choice to answer any one.
Q III - 2 questions (covering entire module) of 15 marks each from module II with choice to answer any one.
Q IV - 2 questions (covering entire module) of 15 marks each from module III with choice to answer any one.
Q V - 2 questions (covering entire module) of 15 marks each from module IV with choice to answer any one.

Marks Distribution

Tests (min: 2)	– 30 marks
Assignment (min: 2)	– 15 marks
Attendance	– 5 marks
Total	– 50 marks

2K6 EN102: ENGINEERING PHYSICS

(2 hrs/week)

Module I (11 hours)

Interference of light: Interference from plane parallel thin films - Colours of thin films by reflected light - Newton's rings Measurement of wave length – Thin wedge shaped air film - Air wedge – Testing of optical planes of surfaces. **Diffraction of light** – Introduction to Fresnel and Fraunhofer diffraction – Distinction between the two diffractions – Simple theory of plane transmission grating. **Polarization of light** – Double refraction – Nicol prism – Quarter and half wave plates – Production and detection of elliptically and circularly polarized light – Rotatory polarization – Laurent's half shade polarimeter – Applications of polarized light.

Module II (11 hours)

Quantum Mechanics - Newtonian Mechanics and quantum mechanics – Uncertainty principle - The wave functions – Shrodinger wave equation for free particle – Potentials in Shrodinger equation – Time independent Shrodinger equation - Time dependent Shrodinger equation - Expectation values – Derivation of Shrodinger equation - Application – Particle in a box (motion in one dimension)**NMR and ESR** – Basic principles of Nuclear Magnetic Resonance (NMR) and Electron Spin Resonance (ESR) – Experimental Method for detection of NMR and ESR – Applications

Module III (11 hours)

Laser Physics – Basic concepts of Laser – Spontaneous and stimulated emission – Absorption – Population inversion – Optical Pumping – Construction and components of Laser – Ruby Laser, Helium - Neon Laser and semiconductor laser – Applications – Basic principle of Holography and its application **Fibre Optics** – Basic Principles – Fiber Construction – Fiber Dimensions – Light propagation in fiber – Signal Distortion in optical fibers and transmission losses (Brief ideas only) – Light Wave communication using optical fibers and its advantages – Fiber Amplifiers and EDFAs –Applications of optical fibers. **Non Destructive Testing** –X - rays –Properties and production - X - ray radiography - Stereo radiography - CT scan - Ultrasonics - properties - NDT using ultrasonics - Electrical method - Magnetic method - ultrasound scanning - MRI scan

Module IV (13 hours)

Electron theory of solids. Classical free electron theory - drift velocity - conductivity – relaxation time – mean free path – temperature dependence of resistivity – relation between thermal and electrical conductivities (Weidman – Frenz law) – Quantum free electron theory - density of states - Fermi distribution function - Fermi energy Band theory of solids **(**Qualitative only) - Band structure of metals, semiconductors and insulators – Classifications of semiconductors on the basis of Fermi level and Fermi energy – Impurity levels in N - type and P - type semi conductors. **Hall Effect -** introduction – Measurement of Hall voltage and Hall coefficient – Importance of Hall effect. **Super conductivity** – Properties of superconductors – Josephson Effect and tunneling (qualitative) – B. C. S Theory of superconductivity (qualitative) – Applications of super - conductivity.

Reference Books:

1. Brijlal & Subrahmanyam. N. "Text Book of Optics", S. Chand
2. Rajendran and Marikani: Applied Physics for Engineers 3rd edition - TMH
3. A. S. Vasudeva S " Modern Engineering Physics", S. Chand
4. Jenkins F. A & White H. E. "Fundamentals of Optics", Mc Graw Hill.
5. M. Arumugam: Material science: Anuradha Publications
6. S. O. Pillai "Solid State Physics" New Age International.
7. Srivastva. C. M & Sreenivasan . C. "Science of Engineering Materials", New Age International

University Examination Pattern

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

Marks Distribution

Tests (min: 2)	– 30 marks
Assignment (min: 2)	– 15 marks
Attendance	– 5 marks
Total	– 50 marks

2K6 EN 103: ENGINEERING CHEMISTRY

(2 hrs/week)

Module I High Polymers & Lubricants (13 hours)

Classification of polymers. Polymerization - chain polymerization, condensation polymerization, copolymerization, coordination polymerization, electrochemical polymerization, metathetical polymerization, group transfer polymerization. Mechanism of polymerization. Polymerization technique - bulk polymerization, solution polymerization, suspension polymerization, emulsion polymerization, melt polymerization, solution polycondensation, interfacial condensation, solid and gas phase condensation. Structure – property relationship of polymers. Compounding and moulding of polymers. Important plastics – their production, properties and uses. Thermoplastic resins (PE, PP, PVC, PVA, PMMA, PS), thermosetting resins (Bakelite, Urea formaldehyde, Silicones), fibers (nylon 6, nylon 66, cellulose fibers, Dacron, Kevlar) Elastomers - Natural rubber - production, structure, properties, compounding & vulcanization. Synthetic rubbers - (buna, neoprene, thiokols, polyurethane, silicon rubber) Lubricants: Theory of friction, mechanism of lubrication, classification of lubricants - liquid, semisolid, solid and synthetic lubricants. Properties of lubricants(viscosity index, cloud point, pour point, flash point, fire point, corrosion stability, emulsification, aniline point). Additives and their functions.

Module II Electrochemistry (11 hours)

Electrode potential and electromotive force. Nernst equation for electrode potential. Measurement of EMF and electrode potential. Types of electrodes. Primary and secondary reference electrodes. Electrochemical series. Galvanic cells and concentration cells. Determination of pH using glass electrode. Secondary cells - lead acid cells, Ni – Cd cell, Edisson cell. Fuel cell - hydrogen – oxygen fuel cell. Acid and bases. Lowry - Bronsted and Lewis concepts. Concept of pH – pH measurements. (Instrumental details required) Dissociation constants - potentiometric titrations. Buffer solutions. Henderson equation for calculation of pH.

Module III Corrosion (11 hours)

Corrosion and its control – Theories of corrosion. Different types of corrosion. Factors affecting corrosion. Protective coatings. Self protecting corrosion products. Pretreatment of surfaces. Coating - organic, inorganic coatings - galvanizing, tinning, electroplating, electroless plating, anodisation, passivation by chemical treatment, cathodic protection. Properties and functions of ingredients in paints, varnishes and enamels.

Module IV Fuels & Environmental Pollution: (11 hours)

Classification of fuels - solids, liquid & gaseous fuels, Determination of calorific value. Solid fuels - wood, peat, lignite, coal, Proximate analysis, Petroleum and its refining, fractions and their uses. Cracking and reforming. Petrol knock and octane number. Gaseous fuels - Natural gas, coal gas, acetylene. Combustion calculation. Air - fuel ratio. Pollution - Classification (global, regional and local with examples). Air pollution - Primary and Secondary pollutants. Source, effects and control of air pollution. Water pollution - Pollutant classification - organic, inorganic, suspended, metals and their monitoring. Domestic sewage and industrial wastes. Control of water pollution. Hazardous wastes. Hard and soft water. Analysis of hardness. Quality of water for domestic use and boiler feed. Problem with hard water in boilers. Softening of water - internal and external conditioning of water.

Reference Books

1. V. Raghavan (2000) Material Science and Engineering - A first course, Prentice Hall of India Pvt. Ltd. New Delhi.
2. J. C. Kuriakose & J. Rajaram. Chemistry of Engineering & Technology. Vol. I & II Tata McGraw Hill, New Delhi.
3. A K De (1996) Environmental Chemistry. NewAge International Pvt. Ltd. New Delhi.
4. B R Gowariker etal (2000) Polymer science. New Age international Pvt. Ltd. New Delhi

5. S. Glasstone (1997) Text book of Physical Chemistry. MacMillian, New Delhi.
6. Shashi chawla A text book of Engineering Chemistry. Dhanpath Rai & Co. Pvt. Ltd. New Delhi

University Examination Pattern

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

Marks Distribution

Tests (min: 2)	– 30 marks
Assignment (min: 2)	– 15 marks
Attendance	– 5 marks
Total	– 50 marks

2K6EN104: ENGINEERING MECHANICS

(3 hrs/week)

Module I (15 hours)

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

Module II (17 hours)

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

Module III (17 hours)

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

Module IV (17 hours)

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

Text Books

1. Timoshenko and Young, "Engineering Mechanics", McGraw Hill Publishers
2. Hibbeler, Engineering Mechanics, Vol. I statics, Vol II Dynamics, Pearson

Reference Books

1. Beer, F. P. and Johnson, E. R. , "Mechanics for Engineers - Statics and Dynamics", McGraw Hill Publishers.
2. Shames, I. H. , "Engineering Mechanics - Statics and Dynamics", Prentice Hall of India.
3. Merriam J. L and Kraige L. G. , *Engineering Mechanics - Vols. 1 and 2*, John Wiley.

University Examination Pattern

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

Q II - 2 questions (covering entire module) of 15 marks each from module I with choice to answer any one.

Q III - 2 questions (covering entire module) of 15 marks each from module II with choice to answer any one.

Q IV - 2 questions (covering entire module) of 15 marks each from module III with choice to answer any one.

Q V - 2 questions (covering entire module) of 15 marks each from module IV with choice to answer any one.

Marks Distribution

Tests (min: 2)	– 30 marks
Assignment (min: 2)	– 15 marks
Attendance	– 5 marks
Total	– 50 marks

2K6 EN105 ENGINEERING GRAPHICS

(1 hour lecture & 3 hours drawing practice)

Module 0 (12 hours - 2 drawing exercise) (No questions in the university exam; questions should be included in the class test)

Introduction to engineering graphics - drawing instruments and their uses - types of lines - lettering - dimensioning - BIS code of practice for engineering drawing - construction of conics, spirals, cycloids, involutes and helix.

Module I (14 hours - 2 drawing exercises)

Introduction to orthographic projection. Projection of points - projection of lines - parallel to one plane and inclined to the other - lines inclined to both the planes - true length and inclination with reference planes - traces. Trapezoidal and rotating line method. Projections of planes.

Module II (14 hours - 2 drawing exercises)

Orthographic projection of solids in simple position - projections of frustum and truncated solids - projection of solids with axis inclined to one or both the planes - projections on auxiliary planes - primary and secondary auxiliary projections - projections of solids in combination.

Module III (18 hours - 3 drawing exercises)

Sections of solids by horizontal, vertical or inclined planes - true shape of section. Development of surface of solids, sectional solids, solids having hole. Intersection of surfaces - intersection of prism in prism, cylinder in cylinder and cylinder in cone.

Module IV (14 hours - 2 drawing exercises)

Introduction to isometric projection - isometric scale - isometric view - isometric projections of solids, frustums & truncated solids and their combinations. Conversion of pictorial projection to orthographic projection.

Module V (16 hours - 3 drawing exercises)

Introduction to machine drawing - screwed fastening - bolts and nuts - cap screw - machine screw - set screw - locking arrangements - foundation bolts. Graphic symbols used in engineering. Simple and Sectional views of Knuckle joint - protected type flanged coupling, bushed bearing - socket & spigot pipe joint.

Note: All drawing exercises mentioned above are for class work. Additional exercises wherever necessary may be given as home assignments.

Reference Books:

1. John K C, *Engineering Graphics,* JET Publishers.
2. Varghese P I, *Engineering Graphics*, VIP Publishers.
3. Bhatt N D, *Elementary Engineering Drawing*, Charotar Publishing house.
4. Narayana K L & Kannaiah P *Engineering Graphics*, Tata McGraw Hill
5. Luzadder W J, *Fundamentals of Engineering Drawing*, Prentice Hall of India
6. K Venugopal, *Engineering Graphics*, New Age International (P) Ltd
7. K N Anilkumar, *Engineering Graphics*, Adhyuth Publishers Kottayam
8. Varghese P I, *Machine Drawing,* VIP Publishers
9. Bhatt N D ,*Machine Drawing,* Charotar Publishing house
10. S. B Mathur, *A Text Book of Engineering Graphics*, Vikas Publishing house.

Sessional Marks:

Drawing exercises - 20 marks
Class tests (min: 2) - 25 marks
Attendance - 5 marks
Total marks - 50 marks

University examination pattern

Q1 - Two questions from Module I with choice to answer any one.
Q2 - Two questions from Module II with choice to answer any one
Q3 - Two questions from Module III with choice to answer any one
Q4 - Two questions from Module IV with choice to answer any one
Q5 - Two questions from Module V with choice to answer any one

Each question carries 20 marks.

2K6 EN106: BASIC CIVIL ENGINEERING

(3hrs/week)

MODULE I (16 hours)

Measurement of distance - Direct measurement – tape & chain only - Ranging out survey lines - Taking measurement of a sloping ground - Errors - Tape correction problems. Leveling instruments (Dumpy level, Tilting level and Auto levels). Leveling staff(folding type only) - How to make measurements - temporary adjustment, holding the staff, reading the staff, principles of levelling - recording measurements in the field book - deduction of level - height of collimation method only, examples. Introduction to Total station. (Description only) - Linear and angular measurements using total station, Brief description of contour maps.

MODULE II (14 hours)

Selection of site for buildings - types of buildings - Components of buildings. Exposure to various building byelaws. Fire resistance characteristics of buildings - General classification as per National Building Code - Earth quake Zoning - Disaster mitigation methods

MODULE III (18 hours)

FOUNDATION: different types (description only). Spread footing, Isolated - Footing, Combined footing - Mat foundation - Pile foundation. Safe bearing capacity of soil, Importance of the safe bearing capacity of soil. SUPER STRUCTURE: Masonry - stone masonry, brick masonry. Partition - Materials used for making partition - plywood, particle boards and glass. Doors, windows - materials used for the construction of doors and windows - wood, Steel, Aluminium. Flooring - using mosaic, ceramic tiles, marble, granite and synthetic materials. Roofing - Selection of type of roof, sloping roof - Concrete roof, tiled roof, timber roof ,GI sheet, AC sheet, PVC sheet. Selection of roof covering materials.

MODULE IV (18 hours)

CONCRETE: Ingredients - cement, aggregates and water. Qualities of ingredients. Test for determining the qualities of fine aggregate - fineness modulus and grading curves. IS specifications. Cement - mortar - IS Specification for preparation and determination of mortar strength. Plain Cement Concrete(PCC) preparation - Test on fresh concrete - Test on Hardened Concrete. IS specification for the compressive strength of concrete. Steel - common types used in construction - Mild steel, HYSD steel and their properties. Reinforced Cement Concrete (RCC) –advantages of RCC over PCC. Elementary ideas on pre - cast and pre - stressed concrete constructions.

Reference Books:

1. T. P. Kenetker& S. V Kulkarny, “Surveying & levelling Vol. - 1”, Vidyarthi Griha rakashen
2. Rangwala, “Building Materials”, Charotar Publishing House
3. Rangwala, “Building Construction”, Charoter Publishing House
4. B. C Punmia, “Building Consrtuction” , Lakshmi Publication (p) Ltd.
5. S. K. Roy, “Fundamentals of Surveying” Prentice - Hall of India, New Delhi.
6. National Building Code
7. A M Chandra , “Higher Surveying”, New age International (p)Ltd. Publishers

University Examination Pattern

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

Q II - 2 questions (covering entire module) of 15 marks each from module I with choice to answer any one.

Q III - 2 questions (covering entire module) of 15 marks each from module II with choice to answer any one.

Q IV - 2 questions (covering entire module) of 15 marks each from module III with choice to answer any one.

Q V - 2 questions (covering entire module) of 15 marks each from module IV with choice to answer any one.

Marks Distribution

Tests (min: 2)	– 30 marks
Assignment (min: 2)	– 15 marks
Attendance	– 5 marks
Total	– 50 marks

2K6 EN107: BASIC MECHANICAL ENGINEERING

(3 hrs/week)

Module I (18 hours)

Thermodynamics: Definitions and basic concepts - systems, properties, state, process and cycle - work and heat - thermodynamic equilibrium, Zeroth law of thermodynamics, concepts of temperature and temperature scales, first law of thermodynamics, concepts of internal energy and enthalpy, second law of thermodynamics - Clausius and Kelvin - Planck statements, concept of entropy, thermodynamic processes - constant volume, constant pressure, adiabatic, isentropic, polytropic processes - P - V and T - S diagrams. (Simple problems only)

Module II (18 hours)

Air cycles: Carnot, Otto and Diesel cycles - air standard efficiency. (Simple problems only). I C Engines: Working and comparison of two stroke and four stroke petrol and diesel engines. Pumps and Turbines: Working principles of reciprocating , centrifugal and rotary pumps. Principles of operation of Pelton, Francis and Kaplan turbines. (Elementary ideas with simple sketches only.)

Module III (16 hours)

Properties of steam - saturation temperature, dryness fraction, degree of superheat, specific volume, enthalpy and entropy - T - S diagram. Steam Boilers: Classification - Cochran boiler, Babcock and Wilcox boiler, list of boiler mountings and accessories - applications. Refrigeration and Air conditioning: Refrigerants, properties of refrigerants, working principles of vapour compression refrigeration & vapour absorption refrigeration systems. Psychrometry - definition of terms - Principles of air conditioning - comfort and industrial air conditioning.

Module IV (14 hours)

Classification of manufacturing processes –elementary ideas with simple sketches of moulding, sand casting, die casting, forging, rolling, extrusion, wire drawing, punching and blanking, stamping, coining, surfacing, welding, soldering and brazing. Production machines - elementary ideas with simple sketches of centre lathe, milling machine, drilling machine, grinding machine and shaper - basic machining operations - Concepts of CNC machining systems.

Reference Books:

1. S. K. Hajra Choudhury, Elements *of Mechanical Engineering*, Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. P. K. Nag , *Engineering Thermodynamics*,Tata McGraw - Hill Publishing Company.
3. Dr. R. K. Bansal,*Fluid mechanics and Hydraulic machines*, Lakxmi Publications (P) Ltd. New Delhi.
4. M. L. Mathur and F. S. Mehta ,*Thermal Engineering* , Jain Brothers, New Delhi.
5. K. Venugopal, Basic Mechanical Engineering, New Age International (P) Ltd.

Text Books:

1. S. Tryambaka Murthy, *Elements of Mechanical Engineering*, Vikas Publishing House Private Ltd. New Delhi.
2. S. Benjamin ,*A Text Book of Basic Mechanical Engineering* , Pentex Publishers and Distributers, Kollam - 5.

University Examination Pattern

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

Q II - 2 questions (covering entire module) of 15 marks each from module I with choice to answer any one.

Q III - 2 questions (covering entire module) of 15 marks each from module II with choice to answer any one.

Q IV - 2 questions (covering entire module) of 15 marks each from module III with choice to answer any one.
Q V - 2 questions (covering entire module) of 15 marks each from module IV with choice to answer any one.

Marks Distribution

Tests (min: 2)	– 30 marks
Assignment (min: 2)	– 15 marks
Attendance	– 5 marks
Total	– 50 marks

2K6 EN108: BASIC ELECTRICAL ENGINEERING

(3 hrs/week)

Module I(16 hours)

Generation ,Transmission and Distribution of electric power

Conventional methods of generation of electric power –thermal – hydro – nuclear. Non - conventional energy sources - solar - wind - tidal - geothermal –photovoltaic - fuel cells. General outline of power transmission & distribution system - substation equipment - circuit breakers - isolators, lightning arrestors - wave traps. (Functions only). Electrical wiring - different types - switchboards - earthing - protective devices - relays - MCB's , ELCB's.

Module II(17 hours)

Transformers and Electrical machines

AC fundamentals - 1 - Φ and 3 - Φ - Power factor – economics of power factor improvement. (Derivation not required). Tariff - Types of tariff. Transformer - Construction - different types - 1 - Φ and 3 - Φ - theory –emf equation - methods of cooling. DC machines – Construction - generators and motors - types - characteristics & applications. AC machines - Alternators - Construction - voltage regulation (definition only). Synchronous motors - Applications - Induction motors - 1 - Φ and 3 - Φ - Construction - characteristics & applications. Special machines – stepper motor - universal motor.

Module III (17hours)

Utilization of Electric power

Electric heating - resistance heating - Induction heating - dielectric heating - arc furnaces - principle & applications. Electric welding - resistance welding - arc welding – ultrasonic welding - electron beam welding - laser beam welding. Illumination - different types of lamps - fluorescent, incandescent, sodium vapour, mercury vapour, halogen - energy efficient lamps Traction - traction equipment and functions. Batteries - Different types - Charging methods - Applications. Electrolysis - Basic principles - Extraction of metals - Electro deposition - Electroplating.

Module IV(16 hours)

Instrumentation

Measuring instruments – Ammeter, Voltmeter, Wattmeter, Energy meter, Meggar - basic principle of operation, measurement of power by 2 - wattmeter method. Transducers – measurement of strain, acceleration, altitude, flow, force, torque, humidity and moisture.

Text Books

1. Jain & Jain, " ABC of Electrical Engineering(Electrical Science)", Dhanapat Rai & Son's publishing Company, New Delhi

Reference Books

1. M. L. Soni, PV Gupta, U. S. Bhatnagar and A. Chakrabarthy - A textbook of Power System Engineering - Dhanpath Rai & Sons, New Delhi.
2. Nagrath I. J. & Kothari D. P. – Electric Machines – Tata Mc. graw hill.
3. J. B. Gupta - Utilization of electric power & Electric traction –S. K. Kataria & sons , New Delhi.
4. Sawhney A. K. A Course in Electrical & Electronic Measurement and Instrumentation, Dhanpath Rai & Sons, New Delhi

University Examination Pattern

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

Q II - 2 questions (covering entire module) of 15 marks each from module I with choice to answer any one.

Q III - 2 questions (covering entire module) of 15 marks each from module II with choice to answer any one.

Q IV - 2 questions (covering entire module) of 15 marks each from module III with choice to answer any one.
Q V - 2 questions (covering entire module) of 15 marks each from module IV with choice to answer any one.

Marks Distribution

Tests (min: 2)	– 30 marks
Assignment (min: 2)	– 15 marks
Attendance	– 5 marks
Total	– 50 marks

2K6 EN109: BASIC ELECTRONICS AND COMPUTER ENGINEERING

(3 hrs/week)

PART A - ELECTRONICS & COMMUNICATION ENGINEERING

Module I: INTRODUCTION TO ELECTRONIC COMPONENTS AND DEVICES (16 hours)

Electronic Devices: Passive components, Active components. PN Junction Diodes: Characteristics and applications. Types of Diodes: Zener Diode, LED, LCD, Photodiode, varactor diode – principles of operation and applications. Bipolar Junction Transistors – construction – npn, pnp – working – configuration – characteristics – properties – applications. Amplifiers : RC Coupled amplifier – working. JFET : Construction – characteristics, parameters – applications. Oscillators: principle, RC Phase shift oscillator, crystal oscillator. Integrated circuits : classification – advantages – analog and digital I C's. Microprocessors - 8085: Internal architecture (block diagram only) – applications. Electronic Instruments: Strain gauge, Thermistor, Condensor microphone, Moving coil Loud - speaker, principles of CRT, CRO block diagram and working. Signal generators, regulated power supplies.

Module II: PRICIPLES OF ELECTRONIC COMMUNICATION ENGINEERING (17 hours)

Analog modulation - Different types - AM,FM,PM – principles and comparison. Block diagram of AM and FM Transmitters and superhetrodyne receiver (brief explanation only). Principle of TV systems: interlaced scanning, general simplified block diagram of TV Transmitter and receiver, Yagi antenna, Basic principles of cable TV.

Principles of pulsed RADAR: Block diagram, application. Satellite communication - Concept of Geostationary satellites - simplified block diagram of earth station, Transmitter, Receiver. Block diagram of optical communication systems, Concept of optical fibre, source (LED), detector (phototransistor), advantage of optical communication.

Frequency bands in microwave communication and their uses, simplified block diagram of microwave link.

Basic principles of cellular communication, concepts of cells - Frequency reusage, advantage of cellular communication.

PART B – COMPUTER ENGINEERING

Module III: INTRODUCTION TO COMPUTERS, TROUBLESHOOTING AND MAINTANANCE (16 hours)

Introduction – Characteristics of Computers –Classifications of Computers – Basic computer organizations - Computer software – Types of software. *Components of Standard PC*: Familiarization of motherboard, Processor & Memory, Graphics adapters & Monitors, Drive controllers & Drives, Buses, Network Adapters, Power supply - *Boot Process* : BIOS , POST – Installation of operating systems - *Troubleshooting and Maintenance*: Common problems in Motherboard, Memory, Monitor, Plug & Play Devices and their Troubleshooting.

Module IV: COMPUTER PROGRAMMING & NETWORK FUNDAMENTALS (17 hours)

Computer Programming - - High level and low level languages - steps involved in computer programming - Developing algorithms and flow charts - Efficiency of algorithms - Running, debugging and testing of programs - . *Computer Network*: Topologies – Types, Basic Components, Media: Wireless & Wired, - *Internet Basics*: Applications & Impact on Society, WWW, Email, Search Engine, Web server, Web browser - Future Internet Applications. *Application software packages* – Word Processing – Spread Sheet – Graphics – Personal Assistance.

Reference Books:

1. N. N. Bhargava, "Basic Electronic and Linear Circuits ", TMH Publications.
2. Kumar, "Communication Engineering" mesh Publication New Delhi
3. Peter Norton, "Introduction to Computer", 6th Ed. , Tata McGraw Hill, 2006
4. Pradeep K Sinha and Priti Sinha, "Computer Fundamentals: Concepts, Systems and Application", BPB Publicatios , 2003
5. T F . Bogart, " Electronic Devices and Circuits" Universal Bookstall New Delhi .

6. Santi ram Kal, " Basic Electronics " PHI Publications.
7. George Kennedy, "Electronic Communication Systems", Mc Graw Hill
8. V. Rajaraman, "Fundamentals of Computers" Prentice Hall of India, 2002.
9. Hans - Peter Messmer, "The Indispensable PC hardware book" 3rd Ed., Addison Wesley.
10. Allen B. Tucker, " Fundamentals of Computing ",Tata Mc Graw Hill New Delhi, 1998
11. Stephen J Bigelow " Troubleshooting Maintaining & Repairing PCs", 5th Ed. Tata McGraw Hill
12. Andrew S Tanenbaum, "Computer Network", 3rd Ed. , Pearson Education, 2003

University Examination Pattern

(PART A and PART B to be answered in separate answer books)

PART A

Q I – 4 short answer type questions of 5 marks, 2 from each module.

Q II - 2 questions (covering entire module) of 15 marks each from module I with choice to answer any one.

Q III - 2 questions (covering entire module) of 15 marks each from module II with choice to answer any one.

PART B

Q IV– 4 short answer type questions of 5 marks, 2 from each module.

Q V - 2 questions (covering entire module) of 15 marks each from module III with choice to answer any one.

Q VI - 2 questions (covering entire module) of 15 marks each from module IV with choice to answer any one.

Marks Distribution

Tests (min: 2)	– 30 marks
Assignment (min: 2)	– 15 marks
Attendance	– 5 marks
Total	– 50 marks

2K6 EN110 P: BASIC ENGINEERING LABORATORY

(2 hrs/week)

Part – A. Mechanical Engineering Workshops

Fitting Practice (10 Hours)

Study of metal cutting and measuring tools. Fabrication Exercises involving cutting and chiseling.

Welding (5 Hours)

Study of arc and gas welding equipments. Exercises involving preparation of lap and butt joints.

Carpentry (10 Hours)

Wood and its processing - measuring and marking tools. Wood working hand tools - Wood working machinery. Preparation of joints like dove tail, mortise & tenon.

Sheet metal practice (5 Hours)

Study of machines and tools used in sheet metal work.

Development and fabrication of simple sheet metal components like cylindrical dish, rectangular duct.

Foundry (5 Hours)

Study of foundry tool appliances. Preparation of sand for sand molding, making green sand molds for simple objects. Demonstration of melting, pouring and production of casting.

Smithy (5 Hours)

Study of hand forging tools. Hand forging exercises to make components of simple Geometry.

Part – B Civil Engineering Workshop

Surveying (10 Hours)

Chain survey - Traversing and plotting of details. Plane Table Surveying - method of radiation, intersection and traversing. Leveling – Fly leveling.

Sessional Requirements

Total Attendance	:5 marks
Part - A Mechanical Engineering Workshops	
Workshop Practical and Record	:25 marks
Test	:10 marks
Part – B Civil Engineering Workshop	
Workshop Practical and Record	: 5 marks
Test	: 5 marks
Total	: 50 marks

2K6 EN111P BASIC ELECTRICAL AND ELECTRONICS WORKSHOP

(2 Hrs / week)

A. Electrical Wiring (total 15 hours)

a) Familiarization of various types of service mains - wiring and installations – accessories and household electrical appliances.
b) Earthing – measurements of earth resistances – testing of Electrical installations – precautions and care from Electrical shocks.
c) Wiring practices of a circuit to control :
    i. one lamp by SPST switch
    ii. two lamps by SPST switch.
    iii. two lamps in series and parallel
    iv. stair case wiring
d) Familiarization of various parts and assembling of Electrical Motors and wiring practices of connecting a 3 phase – 1 phase motor with starter.

B. Electronics Workshop (total 15 hours)

1. Familiarization of various Electronic components such as resistors, capacitors, transformers, inductors, diodes, transistors and IC's
2. Assembling and soldering practice of a single phase full wave rectifier circuit with capacitor filter.
3. Assembling and soldering practice of common emitter amplifier circuits.
4. Assembling a timer circuit using IC555, phase shift oscillator using transistor and op - amp and JK flip - flop using NAND gates on the bread board.

C. Computer hardware Lab (total 20 hours)

1. Identification of components / cards – PC assembling from components.
2. Installation of motherboard, processor, memory and child hard disk.
3. Installation of peripherals such as FDD and a CD drive.
4. BIOS setup.
5. Preparation of HDD for installation – formatting partitioning and basics of file system.
6. Installation of different operating systems and managing application software.
7. Troubleshooting of standard PC.

Sessional Requirements

Total Attendance	: 5 marks
Workshop Practical and Record	: 10 marks each for A, B and C
Test	: 5 marks each for A, B and C
Total	: 50 marks

SCHEME AND SYLLABUS OF PHYSICAL EDUCATION, HEALTH AND FITNESS

Introductory Lectures

Unit 1. Health and Fitness: Modern concept of health and fitness, meaning, scope, need and importance of health, fitness and wellness
Unit II. Exercise and Fitness: Means and methods of developing fitness. Importance of physical activities and exercises in developing and maintaining good health, Physical fitness and well being.
Unit III. Sports and Physical education: Meaning and scope, role and importance of sports and games in the development of physical fitness and personality. Social values of sports. Rules of major games.

Practical Sessions

(All classes will be conducted after the normal working hours of the college)

50 sessions of minimum 1hour duration each are envisaged (including Theory and Practical). The student can opt for one of the following activities in line with the specific programme/ schedule announced by the faculty.
Athletics, Badminton, Basketball, Cricket, Football, General Fitness, Hockey, Kabaddi,
Table Tennis, Ball Badminton, Archery, Volley ball, Yoga (not all activities may be offered in a particular semester. More disciplines will be offered based on the availability of infrastructure and expertise.)
In addition, health and fitness assessment such as Height, Weight, Resting Pulse Rate and Blood Pressure will be carried out.

Objective

a) Basically to inculcate awareness of health, general fitness and attitude to voluntary physical involvement.

b) To promote learning of basic skills in sports activities and secondarily to pave the way for mastering some of the skills through continued future involvement.

Scheme of assessment

The student will be continuously assessed on his performance on the field of play. There will not be minimum mark for pass or fail. Total 50 marks will be given assessing their attendance, regularity, punctuality and performance for 50 hours of activity from1st semester to 7^{th} semester.

KANNUR UNIVERSITY
FACULTY OF ENGINEERING

Curricula, Scheme of Examinations & Syllabi for B.Tech Degree Programme (III-IV Semesters) in ELECTRICAL AND ELECTRONICS ENGINERING With effect from 2007 Admissions

THIRD SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/D		Hrs	Marks
2K6EE 301	Engineering Mathematics II	3	1	-	50	3	100
2K6EE 302	Humanities	3	1	-	50	3	100
2K6EE 303	Mechanical Engineering	3	1	-	50	3	100
2K6EE 304	Electronic Circuits and Systems	3	1	-	50	3	100
2K6EE 305	Network Analysis	3	1	-	50	3	100
2K6EE 306	Electrical Measurements and Measuring Instruments	3	1	-	50	3	100
2K6EE 307(P)	**Mechanical Engineering Lab**	-	-	3	50	3	100
2K6EE 308(P)	**Basic Electronics Lab**	-	-	3	50	3	100
TOTAL		**18**	**6**	**6**	**400**	**-**	**800**

FOURTH SEMSTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/D		Hrs	Marks
2K6EE 401	Engineering Mathematics III	3	1	-	50	3	100
2K6EE 402	Computer Programming	3	1	-	50	3	100
2K6EE 403	Microprocessors & Microcontrollers	3	1	-	50	3	100
2K6EE 404	Pulse and Digital Electronics	3	1	-	50	3	100
2K6EE 405	Electrical Machines I	3	1	-	50	3	100
2K6EE 406	Electrical Engineering Materials	3	1	-	50	3	100
2K6EE 407(P)	**Digital Electronics Lab**	-	-	3	50	3	100
2K6EE 408(P)	**Electrical Measurements Lab**	-	-	3	50	3	100
TOTAL		**18**	**6**	**6**	**400**	**-**	**800**

2K6 EE 301 : ENGINEERING MATHEMATICS II

3 hours lecture and 1 hour tutorial per week

Module I:

Infinite Series: Convergence and divergence of infinite series – Ratio test – Comparison test – Raabe's test – Root test – Series of positive and negative terms- absolute convergence – Test for alternating series. ***Power Series***: Interval of convergence – Taylors and Maclaurins series representation of functions – Leibnitz formula for the derivative of the product of two functions – use of Leibnitz formula in the Taylor and Maclaurin expansions

Module II:

Matrices: Concept of rank of a matrix –echelon and normal forms – System of linear equation - consistency – Gauss elimination– Homogeneous liner equations-Fundamental system of solutions- Inverse of a matrix – solution of a system of equations using matrix inversion – eigen values and eigen vectors - Cayley- Hamilton Theorem.

Module III:

Vector Integral Calculus: Evaluation of line integral, surface integral and volume integrals – Line integrals independent of the path, conservative force fields, scalar potential- Green's theorem- Gauss' divergence theorem- Stoke's theorem (proof of these not required).

Module IV:

Vector Spaces: subspaces–linear dependence and independence–bases and dimension-linear transformations -sums, products and inverse of linear transformations.

References:

1. Kreyszing E. Advanced Engineering Mathematics, Wiley Eastern
2. Sastri. S. S. Engineering Mathematics, Prentice Hall of India.
3. Wylie .C. R. Advanced Engineering Mathematics, Mc Grawhill.
4. B .S. Grewal. Higher Engineering Mathematics, Khanna Publishers.
5. Greenberg. M.D. Advanced Engineering Mathematics, Pearson Education Asia.
6. Narayanan .S. Manickavachagom Pella and Ramaiah. Advanced Mathematics for Engineering Students, S. Viswanathan Publishers

Sessional work assessment

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

University examination pattern

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

2K6 EE 302 : HUMANITIES

3 hours lecture and 1 hour tutorial per week

Module I (20 hours)

Functional English Grammar: Sentence Analysis -Basic Patterns -Noun Group, Verbal Group, and Adverbial Group- Tenses – Conditionals - Active and Passive Voice - Reported Speech

Module II (14 hours)

Technical Communication

1. Nature, Growing need, and importance of technical communication – technical communication skills – listening, speaking, reading, and writing.
2. Barriers to effective communication – improper encoding, bypassing inter- cultural differences etc.
3. Organization in technical communication – spatial, chronological etc.
4. Style in technical communication - objectivity, accuracy, brevity, clarity etc.
5. Technical reports – types and format

Professional Ethics: 1. Ethics in Engineering, copyright – IPR- patents

Module III (10 hours)

Humanities, Science and Technology

1. Importance of humanities to technology, Education and Society
2. Relevance of a scientific temper
3. Relation between science, society and culture – the views of modern thinkers
4. The development of science and technology in society – science and technology in ancient Greece and India – the contribution of the Arabs to science and technology – recent advances in Indian science.

Reference books

1. Huddleston R, English Grammar – An outline, Cambridge University Press
2. Pennyor, Grammar Practice Activities, Cambridge University Press
3. Murphy, Intermediate English Grammar, Cambridge University Press
4. Hashemi, Intermediate English Grammar, Supplementary Exercises with answers, Cambridge University Press
5. Vesilind; Engineering, Ethics and the Environment, Cambridge University Press
6. Larson E; History of Inventions, Thompson Press India Ltd.
7. Bernal J. D., Science in History, Penguin Books Ltd.
8. Dampier W. C., History of Science, Cambridge University Press
9. Encyclopedia Britannica, History of Science, History of Technology
10. Subrayappa; History of Science in India, National Academy of Science, India
11. Brownoski J, Science and Human Values, Harper and Row
12. Schrödinger, Nature and Greeks and Science and Humanism, Cambridge University Press
13. Bossel. H., Earth at a Crossroads – paths to a sustainable future, Cambridge University Press
14. McCarthy, English Vocabulary in Use, Cambridge University Press
15. M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill, New Delhi, 2005

Sessional work assessment

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

University examination pattern

Q I - 10 short type questions of 2 marks, from Module 1

Q II - 10 questions of 5 marks, from module II and III for writing short notes with choice to answer any **seven**

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

Q IV - 2 questions A and B of 15 marks from module II for writing essay with choice to answer any one

Q V - 2 questions A and B of 15 marks from module III for writing essay with choice to answer any one

2K6 EE 303 : MECHANICAL ENGINEERING

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)
Fluids and continuum-Fluid properties-Ideal and real fluids-Fluid statistics-Fluid Pressure-Manometer-Centre Of pressure-Buoyancy-Metacentric height Fluid dynamics -Equation of continuity, momentum and energy Laminar and turbulent flow-Friction factor

Module II (13 hours)
Heat transfer-basic modes: conduction, convection and radiation. Fourier law-general conduction equation-one dimensional conduction in single geometries-critical insulation thickness-extended surface heat transfer-Fins, Free and forced convection-Empirical relation Laws of radiation-black body –grey body-radiation shape factor-basic idea of solar radiation.

Module III (13 hours)
Steam turbine-basic cycle of operation-Impulse and reaction turbine compounding –efficiency –governing. Gas turbine-Basic cycle of operation-application-single stage and multi stage turbines .Air compressor: Classification, working principle of reciprocating and rotary compressors.

Module IV (13 hours)
Conventional and Non-conventional energy sources. Steam power plant-IC engine power plant-Gas power plant-Hydel power plant –Layouts components and their functions. Mechanical Transmission of power: Elementary ideas of belt, rope, chain and gear drives-comparison and field of application.

Text books
1. White F.M. : Fluid Mechanics, McGrawHill
2. Jagadishlal: Hydraulic Machines and its applications,
3. M.L.Mathur & F.S.Metha, Thermal Engineering, Jain brothers, New Delhi

Reference books
1. Gupta V. & Gupta S. Fluid Mechanics and its applications, Wiley Eastern
2. Dr. R.K. Bansal, Fluid Mechanics & Hydraulic Machine, Lakshmi Publishers
3. Holman J.P. Heat transfer, McGraw Hill
4. Mathur & Metha, Thermodynamics & heat power Engineering

Sessional work assessment

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

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

2K6 EE 304 : ELECTRONIC CIRCUITS AND SYSTEMS

3 hours lecture and 1 hour tutorial per week

Module I (14 hours)

Diode basics & Circuits-PN Junction - Minority carrier storage - diffusion capacitance - transition capacitance- Schottky diode - Diode circuits - load line - piecewise linear model - single phase half wave and full wave rectifier circuits - voltage regulation - ripple factor - rectifier efficiency - transformer utilization factor - bridge rectifier- rectifier filters - LC and RC filters and comparison - diode clipping circuits - single level and two level clippers - clamping circuits - clamping circuit theorem. Tunnel diode Construction and Characteristics. UJT- Construction – Characteristics-Relaxation Oscillator

Module II(12 hours)

Transistor Amplifier Basics-Operating point of a BJT - bias stability - thermal runaway –Different Types of Biasing- h parameter model of a BJT- CE, CB and Emitter follower analysis- biasing a JFET - CS and CD amplifiers.

Module III (13 hours)

Frequency response of amplifiers - Low frequency response of BJT and FET amplifiers - hybrid π equivalent circuit of BJT - high frequency response of CE amplifier- current gain - cut off frequencies - gain bandwidth product - miller effect-Power amplifiers:-Class A, Class B and Class AB - power amplifiers using BJT.

Module IV (13 hours)

Feedback Amplifiers & Oscillators- negative and positive feedback – Different topologies and properties-oscillators -Barkhausen's criterion for stability of feedback amplifiers - transistor phase shift oscillator - Wein's bridge oscillator.

Linear Op-amp Circuits- ideal and practical op-amps - CMRR-slew rate –inverting and non inverting amplifier - voltage follower - summing amplifier - subtracting circuits - voltage to current converter-op-amp integrator-op-amp differentiator.

Reference books:

1. Millman & Halkies.: Integrated Electronics, McGraw Hill
2. Schilling & Belove: Electronic Circuits, McGraw Hill
3. Sedra & Smith: Microelectronic Circuits, Oxford University Press
4. Boylested & Nashesky: Electronic Devices & Circuit Theory, Prentice Hall of India
5. Gayakwad R.A: OPAMPS & Linear Integrated Circuits, Prentice Hall of India,2002
6. Clayton G.B: Operational Amplifiers, ELBS,2002
7. Frederiksen T.M: Intuitive Operational Amplifiers, McGraw Hill,1988

Sessional work assessment

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

University examination pattern

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

2K6 EE 305 : NETWORK ANALYSIS

3 hours lecture and 1 hour tutorial per week

Module I (15 Hours)
Network theorems & Laplace Transforms
Mesh analysis- Nodal analysis – superposition theorem- Reciprocity theorem- Thevenin's and Norton's theorem-Maximum power transfer theorem for ac and dc circuits. Review of Laplace Transform-Transform pairs-gate functions-shifting theorem – Iinitial and final value theorem- Laplace transform of periodic signals- inversion of transform by partial fraction -Convolution theorem and Convolution integral-Transformation of circuit into s-domain- impedance and admittance matrix in the s domain

Module II (13 hrs)
Application of Laplace Transforms - Transient analysis of RL, RC and RLC series circuits with DC applied - RL and RC circuits with impressed sinusoidal voltage-
Magnetic Circuits –MMF-Magnetic Flux- Reluctance- Comparison of Electric & Magnetic circuits-self and mutual inductances – coefficient of coupling-dot convention – cumulative and differential connection of coupled coils – steady state solutions of coupled circuits.
Introduction to network topology: -Definition of graph, trees, incidence matrix, cut sets-Fundamental cut sets-Cut set schedule-Tie sets-Fundamental tie sets-tie set schedule-Applications of graph-theoretical methods to formation of network equations-Current Variable and Voltage Variable Methods.

Module III(12 Hours)
Fourier Series and Fourier transforms
Fourier Series representation of non-sinusoidal periodic waveforms- Fourier coefficients-Determination of coefficients- Waveform symmetry- Exponential Fourier Series-Discrete amplitude and phase spectra-Steady state solution of circuits with non-sinusoidal periodic inputs by Fourier series.
Fourier representation of aperiodic signals - Fourier transform and inverse transform -Transform pairs - Properties of Fourier transforms - Continuous amplitude and phase spectra - Relation between Laplace transforms and Fourier transforms-power spectral density-energy spectral density – Parseval's theorem

Module IV (12 hrs)
Two port networks: -Characterisation in terms of impedances and admittances -Hybrid and transmission parameters- Inter relationships among parameter sets-Reciprocal and symmetrical two port networks - Interconnection of two port networks- Series, parallel, and cascade- T and Π equivalent of a two port network- Image impedances.
Filter fundamentals- pass and stop bands- passive filters- different types (Basic Concepts only).

Reference Books :

1. Siskand C.S : Electrical Circuits ,McGraw Hill
2. Valkenberg : Network Analysis ,Prentice Hall of India
3. Hayt and Kemmerly :Engineering Circuit Analysis, McGraw Hill
4. David K. Cheng :Analysis of Linear Systems ,Narosa Publishing House
5. A . Chakrabarti : Circuit Theory (Analysis and Synthesis),Dhanpat Rai &Co
6. B.R. Gupta: Network Systems and Analysis, S.Chand & Company ltd
7. Joseph. A. Edminister: Theory and problems of Electric circuits, TMH
8. Gopal G Bhise et al : Engg Network Analysis & Filter Design. Umesh Publications , New Delhi.

Sessional work assessment

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

University examination pattern

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

2K6 EE 306 : ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS

3 hours lecture and 1 hour tutorial per week

Module 1(13 hrs)

General Principles of Measurements: Absolute and Working Standards- Calibration of Meters- Qualities of Measurements - Characteristics - Errors in Measurement - Essentials of indicating instruments- deflecting, damping, controlling torques- Moving Coil, Moving Iron, Dynamo Meter, Induction, Thermal, Electrostatic and Rectifier Type meter; Shunts and Multipliers-Various Types of Galvanometers- Accuracy class

Module II (13 hrs)

Measurement of Resistance, Power and Energy: Measurement of Insulation Resistance, Earth Resistance - Earth Tester-Dynamometer Type Wattmeter - Error and Compensation – Three phase power measurement using one wattmeter and two wattmeter method- Ampere Hour Meter - Single and Three Phase Energy Meters (Induction and Electronic Type) – Calibration- Trivector & TOD Meters - Frequency Meters - Power Factor Meters - Energy / Harmonic Analyzer- Current Transformers and Potential Transformers- ratio & phase angle errors – Clamp on meters. Thermal Imagers for Machinery & Switch Gear. (Concepts Only).

Module III (13 hrs)

Potentiometers: General Principle- Direct Current Potentiometer- AC potentiometer- Application of DC and AC potentiometers

Bridges: Wheatstone's Bridge – Kelvin's Double Bridge - Carry Foster Slide Wire Bridge - Bridge Current Limitations - Maxwell's bridge- Schering bridge- Anderson's bridge and Wein's bridge

Module IV (13 hrs)

Digital Measurements: Oscilloscope – Basic principle of Signal display - Triggered Sweep CRO- Trigger pulse circuit- Delay Line in triggered Sweep - Sync Selector for Continuous Sweep CRO- Dual Beam CRO- Dual Trace Oscilloscope- Applications- Digital storage oscilloscope - Digital Cable fault locators (Concepts Only). **Magnetic Measurements:** Classification - Measurement of Flux and Permeability - Flux Meter - Hall effect Gaussmeter -. B.H. Curve and Permeability measurement - Hysteresis measurement.

Reference Books:

1. Golding E.W: Electrical Measurements & Measuring Instruments, Wheeler Pub.
2. Sawhney AK: A course in Electrical and Electronic Measurements & instrumentation, Dhanpat Rai .
3. Cooper W.D: Modern Electronics Instrumentation, Prentice Hall of India.
4. Stout M.B: Basic Electrical Measurements, Prentice Hall.
5. Oliver & Cage: Electronic Measurements & Instrumentation, McGraw Hill.
6. Harris FK: Electrical Measurements , John Wiley.
7. J B Gupta : A course in Electrical & Electronic Measurement & Instrumentation., S K Kataria & Sons.

Sessional work assessment

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

University examination pattern

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

2K6 EE 307(P) : MECHANICAL ENGINEERING LAB

3 hours practicals per week

Set 1

Fluid Mechanics Lab: - calibration of Venturimeter, Orifice Meter, Notches, Pipe Friction

Set 2

Hydraulic Machinery Lab: - Characteristics of Turbines & Pumps – Pelton Turbine & Francis Turbine – Centrifugal, Gear & Reciprocating Pumps

Set 3

Heat Engine Lab: - Constant Speed Characteristics of SI & CI Engines.

Sessional work assessment	
Lab practicals & record	= 30
Test	=20
Total marks	= 50

University evaluation will be for 100 marks of which 70 marks are allotted for writing the procedure/formulae/sample calculation details, preparing the circuit diagram/algorithm/flow chart, conduct of experiment, tabulation, plotting of required graphs, results, inference etc., as per the requirement of the lab experiments, 20 marks for the viva-voce and 10 marks for the lab record.
Note: Duly certified lab record must be submitted at the time of examination

2K6 EE 308(P) : BASIC ELECTRONICS LAB

3 hours practicals per week

1. Use of CRO : a) Measurement of Voltage , Frequency and Phase shift.
   b) Z-Modulation of frequency Measurement.
2. Semiconductor diodes : V-I characteristics, static and dynamic resistance of Si ,Ge and Zener diodes.
3. Transistor characteristics in CB and CE configuration, Identification of cut off, active and saturation regions.
4. JFET characteristics in the common source configuration , determination of equivalent circuit parameter.
5. RC coupled CE amplifier -Measurement of Gain, input & output impedance and Frequency response.
6. FET Amplifier – Measurement of voltage gain, current gain, input & output impedance.
7. UJT Relaxation Oscillator – Design for a particular frequency.
8. Rectifiers & Filters -characteristics of Half wave, Full wave &Bridge Rectifiers –
   Ripple factor, rectification efficiency & % Regulation.
9. BJT Emitter follower- measurement of voltage gain, current gain input and output impedance & Load characteristics.
10. Characteristics of Clipping and Clamping circuit using Diodes and Zener Diodes.
11. Characteristics of voltage regulators-
    a)simple Zener voltage regulator. b)Zener regulator with emitter follower output.
12. Power Amplifiers – class AB (complementary symmetry).
13. RC phase shift & Wien's bridge oscillator using transistor

Reference books

1. Bhargava et.al., *Basic Electronic Circuits and Linear Circuits,* Tata McGraw Hill
2. Boylestead & Nashelski, *Electronic Devices and Circuit Theory*, 9th Ed, Pearson/PHI
3. Nagarath J., *Electronics Analog & Digital*, Prentice Hall India
4. Millman & Halkias, *Integrated Electronics*, Tata McGraw Hill

Sessional work assessment

Lab practicals & record	= 30
Test	= 20
Total marks	= 50

University evaluation will be for 100 marks of which 70 marks are allotted for writing the procedure/formulae/sample calculation details, preparing the circuit diagram/algorithm/flow chart, conduct of experiment, tabulation, plotting of required graphs, results, inference etc., as per the requirement of the lab experiments, 20 marks for the viva-voce and 10 marks for the lab record.
Note: Duly certified lab record must be submitted at the time of examination

2K6 EE 401 : ENGINEERING MATHEMATICS III

3 hours lecture and 1 hour tutorial per week

Module I: (13 hours)

Complex analytic functions and conformal mapping: Complex functions – limits. derivative, analytic function- Cauchy-Riemann equations- elementary complex functions such as powers, exponential function, logarithmic, trigonometric and hyperbolic functions- Conformal mapping – Linear fractional transformations- mapping by elementary functions

Module II: (13 hours)

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

Module III: (13 hours)

Jointly Distributed Random Variables: Joint distribution functions, independent random variables , covariance and variance of sums of random variables, joint probability distribution functions of random variables, conditional probability and conditional expectations. ***Curve fitting***: Method of least squares, correlation and regression, line of regression.

Module IV: (13 hours)

Vibrating strings: One dimensional wave equation – D' Alembert's solution – solution by method of separation of variables One dimensional heat equation - solution of the equation by the method of separation of variable Solutions of Laplace's equation over a rectangular region and a circular region by the method of separation of variable

Reference books

1. Kreyszig E. Advanced Engineering Mathematics. Wiley Eastern
2. Johnson, Miller and Freud. Probability and Statistics for Engineers, Pearson Education Asia.
3. Wylie .C.R. Advanced Engineering Mathematics, Mc Grawhill.
4. B.S. Grewal. Higher Engineering Mathematics, Khanna Publishers.
5. Freund. J.E. Mathematical Statistics, Prentice hall of India.

Sessional work assessment

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

University examination pattern

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

2K6 EE 402 : COMPUTER PROGRAMMING

3 hours lecture and 1 hour tutorial per week

Module I (15 hours)

Overview of C – Variables, Expressions and assignments, Lexical Elements, Fundamental Data Types, Operators *Control Statements* – if, switch-case, for , while, do, goto, break, switch *Functions*- Parameter passing , scope rules, recursion

Module II (12 hours)

Arrays – One dimensional and Multi Dimensional, *Pointer*-Linked List, Arrays of Pointers, Dynamic Memory Allocations, *Strings* – Operations and functions , *Bitwise Operators and Enumeration Types , Structures and Unions, Files and File Operations*

Module III (13 hours)

Overview of Java Language- Constants, Variables and Data Types, Operators and Expressions *Control Structures* – Decision Making, Branching and Looping, *Object Oriented Programming* – Concept of Classes, Objects and Methods, Benefits Java and OOP- Polymorphism and Overriding of methods, Inheritance

Module IV (12 hours)

Arrays and Strings, Interfaces, Multiple Inheritance, Packages – Putting Classes together – Managing Errors and Exceptions – Applet Programming and Graphics Programming (Basics only) – Managing Input/Output Files in Java

Text books

1. Kelley, Al & Pohl, Ira.,., *A Book on C- Programming in C*, 4th Ed,, Pearson Education (Modules I &II)
2. Balagurusamy E., Programming with Java: A Primer, 3rd Ed., Tata McGraw-Hill (Module III &IV)

Reference books

1. Balagurusamy E., Programming in ANSI C, Tata McGraw Hill
2. Eckel, Bruce., *Thinking in Java*, 2nd Ed, Pearson Education

Sessional work assessment

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

University examination pattern

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

2K6 EE 403 : MICROPROCESSORS & MICROCONTROLLERS

3 hours lecture and 1 hour tutorial per week

MODULE I(16 Hours)

Intel 8085 processors - architecture - pin configuration- memory addressing - addressing modes - instruction set - assembly language programming - interrupts - timing diagrams-data Transfer schemes, Programmed Data Transfer-DMA

Intel 8086 processors- architecture - addressing modes-instruction sets- minimum and maximum mode - multiprocessor configuration – Execution of Assembly Language Programs in PC.

MODULE II (10 Hours)

Interfacing - address decoding - interfacing chips - programmable peripheral interface (8255) - programmable communication interface (8251) - programmable timer (8253) - DMA controller (8257) - programmable interrupt controller (8259) - keyboard display interface (8279)

MODULE III (10 Hours)

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

MODULE IV(16 Hours)

8051 Micro controller- Architecture- Basic Assembly Language programming Concepts- Moving data- Logical Operations- Arithmetic Operations- Jump and Call Instructions- 8051 Micro controller Design- Applications-stepper motor control- Serial data Communication.

Introduction to 80196 microcontroller

Text Books

1. Gaonker R.S., Microprocessor Architecture, Programming and applications
2. Hall D.V., Microprocessors & Interfacing, McGraw Hill
3. Brey B.B., The Intel Microprocessors - Architecture, Programming & Interfacing, Prentice Hall
4. Liu Y.C. & Gibsen G.A., Microcomputer System: The 8086/8088 Family, Prentice Hall of India
5. Uffenbeck J.E., The 8086/8088 Family: Design, Programming & Interfacing, Prentice Hall India Ltd.
6. Ray A.K.& Bhurchandi K.W., Advanced Microprocessors and Peripherals, Tata McGraw Hill
7. Ayala K.J., The 8051 Micro controller, Architecture, Programming and Applications, Penram International Publishing (India).
8. A Nagoor Kani : Microprocessors & Micro Controllers
9. Adithya P Mathur : Introduction to Microprocessors., TMH

Reference Books

1. Intel Data Book Vol.1, Embedded Microcontrollers and Processors
2. Tribel W.A. & Singh A., The 8088 and 8086 Microprocessors, McGraw Hill
3. Mohammed R., Microprocessors & Microcomputer Based System Design, Universal Bookstall
4. Intel Data Book, EBK 6496 16-bit Embedded Controller Handbook
5. Intel Data Book, EBK 6485 Embedded Microcontrollers Data Book
6. B Ram : Introduction to Microprocessors., Dhanpath Rai

Sessional work assessment

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

University examination pattern

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

2K6 EE 404 : PULSE AND DIGITAL ELECTRONICS

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Pulse circuits - forward recovery and reverse recovery of diodes - switching times of diode - switching behaviour of transistors - switch-on time components - resistive switching and clamped inductive switching of BJTs and switching times - storage time and Schottky BJTs - Bistable circuit - symmetrical and asymmetrical triggering of bistable - collector coupled monostable - collector coupled astable - transistor Schmitt trigger circuit - voltage Sweep errors - constant current sweep circuit - miller sweep using op-amps - current sweep generator.

Module II (14hours)

Regenerative comparator circuits using op-amps (741) - comparator IC LM311 and its applications - square, triangle and ramp generator circuits using op-amps and comparator ICs - effect of slew rate on waveform generation - principles of VCO circuits - precision half wave and full wave rectification using op-amps - log and anti-log amplifiers and applications - phase locked loops - principles - lock and capture ranges - capture process - loop filter - PLL dynamics under locked condition - study of NE564 and CD4046 - applications of PLL in signal reconstruction – 555 applications- Three terminal regulators.

Module III (14 hours)

Logic families - ideal logic gates - truth tables of basic gates - logic levels - noise margin - basic Boolean algebra - De Morgan's theorems - DTL gates - HTL gates - TTL gates - standard TTL - schottky TTL - ECL logic - MOS logic - NMOS logic gates - CMOS logic - tristate logic - comparison of logic families
Combinational circuits - number systems - signed and unsigned numbers - one's complement and two.s complement- Boolean functions - canonical and standard forms - simplification of Boolean functions by Karnaugh.s map up to five variable map - NAND, NOR, EX-OR & EX-NOR implementation - codes and code converters - multi level NAND circuits - multi level NOR circuits - adders - subtractors - BCD adder - magnitude comparator - BCD multiplier - decoders and encoders - multiplexers and demultiplexers - implementation of combinational logic by using multiplexers - ROM, PLA and PAL.

Module IV (12 hours)

Sequential circuits and memories - flip flops - RS, JK, T and D flip flops - triggering of flip flops - registers - shift registers - ripple counters - synchronous counters - ring counter - Johnson counter - memories - ROM, static and dynamic RAM - read/write memory, EPROM, EEPROM, memory decoding - analysis of clocked sequential circuits - state tables and state diagrams - state reduction and assignment - flip flop excitation tables - algorithmic state machine design procedure - design of modulo-m counters - introduction to ASM charts-High intensity LEDs-basics of organic LEDs.

Reference books:

1. Millman & Taub: Pulse, Digital and Switching Waveforms, TMH,1999
2. Jaeger R.C.: Microelectronic Circuit Design, McGraw Hill,1997
3. Morris Mano M.: Digital Design, Prentice Hall of India,2001
4. Taub & Schilling: Digital Integrated Electronics, McGraw Hill,1997
5. Morris & Miller: Designing with TTL Integrated Circuits, McGraw Hill,1971
6. Gayakwad R.A: OPAMPS & Linear Integrated Circuits, Prentice Hall of India,2002

Sessional work assessment

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

University examination pattern

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

2K6 EE 405 : ELECTRICAL MACHINES-I

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)
DC machines Fundamentals:- Armature windings –lap winding and wave winding-single layer winding and double layer winding - Commutators- - MMF - torque developed in a winding - EMF developed in a winding -Armature reaction - demagnetising and cross magnetising ampere turns - commutation -

Module II(12hours)
DC generators: EMF Equation- Types of Excitation, Power flow diagram - circuit model - magnetization characteristics - process of voltage build up - terminal characteristics - control of terminal voltage - parallel operation – applications.

Module III (14hours)
DC Motors: Back EMF- Torque and speed equations - Power flow diagram - circuit model- performance characteristics - applications - starting methods - design of starters - methods of speed control – Solid State Speed Control (Block Diagram)-Testing - Swinburne's test - Hopkinson's test - separation of losses - retardation test - permanent magnet DC motor.

Module IV(14hours)
Transformers: - EMF Equation - Magnetising current - harmonics - ideal and real transformer - dot convention - current and voltage ratio - equivalent circuit - phasor diagram - per unit impedance - OC and SC tests - losses - efficiency and regulation - all day efficiency - Sumpner's test - Parallel operation - tap changing - switching transients - auto transformers - voltage and current relationships - saving of copper - different connections of three phase transformers - notations - Scott connection - Transformer with tertiary winding- cooling methods.

Reference books:

1. Clayton & Hancock: Performance & Design Of DC Machines, ELBS
2. Langsdorf A.S.: Theory of DC Machinery, McGraw Hill
3. Nagarath I.J. & Kothari D.P.: Electric Machines, Tata McGraw Hill
4. Say M. G.: Performance & Design of AC Machines, Pitman, ELBS.
5. Chapman S.J.: Electric Machine Fundamentals, McGraw Hill.
6. Toro V.D.: Electrical Machines & Power Systems, Prentice Hall.
7. J B Gupta: Electrical Machines
8. Ashfaq Hussain: Electrical Machines. Dhanpath Rai

Sessional work assessment

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

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

2K6 EE 406 : ELECTRICAL ENGINEERING MATERIALS

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Conducting Materials: Fermi – Diarc distribution – Variation of conductivity with temperature and composition – contact potential – Materials for electric – electric resistances, brushes of electrical machines, lamp filaments, fuses and solder.

Semiconductor: Compound semiconductors – Basic ideas of amorphous and organic semiconductors

Magnetic Materials: Classification of magnetic materials – Origin of permanent magnetic dipoles – Ferromagnetism – Ferromagnetic domains (qualitative application only) – Curie-Weiss law – Hard and soft magnetic materials and applications – Ferrites – Magnetic materials used in electrical machines, instruments and relays

Module II (13 hours)

Dielectrics: Dielectric polarization in monatomic gases – Expression of electronic, ionic and dipolar polarizations in polyatomic gases – Derivation for expression for polarization in solids and liquids – Clausius – Mosotti relation – Behavior of dielectric in alternating fields – Complex dielectric constant – Dipolar relaxation – Dielectric Loss – Ferro electricity – Domain theory and explanation of hysteresis curve - (qualitative application only)

Module III (13 hours)

Dielectric Breakdown: Mechanism of breakdown in gases, liquids and solids – Factors influencing dielectric strength – capacitor materials- Basics of transformer oil testing

Insulating Materials: Good insulator properties and classification on temperature basis – Properties of insulators in static Electric Field-Common insulating Material used in electrical apparatus - Inorganic materials (Mica, Glass, Porcelain, Asbestos) – Organic materials (Paper, rubber, cotton, silk, fiber, wood, plastics, bakelite) – Resins and varnishes – liquid insulators (Transformer oil) –Gaseous insulators (air, SF_6) – Ageing of insulators

Module IV (13 hours)

Solar Energy Materials: Photo thermal conversion – Use of coatings for enhanced solar thermal energy collection – Solar selective coatings – Thin Film technology – Cold mirror coatings – Heat mirror coatings – Antireflection coatings – Photovoltaic conversion – Solar cells – Silicon, Cadmium sulphide and Gallium arsenic – Organic solar cells.

Modern Techniques for Materials Studies: Optical microscopy – Electron microscopy – Photo electron spectroscopy – Atomic absorption spectroscopy – Magnetic resonance – Nuclear magnetic resonance – Electron spin resonance – Ferromagnetic resonance – Mossbauer spectroscopy

Text Books

1. Dekker A.J Electrical Engineering Materials, Prentice Hall of India
2. Agnihotri O. P and Gupta B. K, Solar selective Surface, John wily
3. Tareev, Electrical Engineerin Materials, Mir Publications
4. Seth. S.P and Gupta P. V, A Course in Electrical Engineering Materials, Ganpathrai
5. G K Mithal : Electrical Engg Material Science. Khanna Publishers.

Reference Books:

1. Indulkar O.S & Thiruvegadam S., An Introduction to electrical Engineering Materials, S. Chand
2. Yu Koritsky, Electrical Engineering Materials, Peace Publications
3. Arumugam M., Material Science, Anuradha Agencies
4. Meinal A.B and Meinal M. P., Applied Solar Energy – An Introduction, Addisos Wesley
5. Kapoor P.L., Electrical Engineering Materials, Khanna Publications
6. Hutchison T.S. and Baird D.C., The physics of Engineering Solids, John Wiley
7. Srivasthava C.M and Srinivasan C., Science of Engineering Materials, Wiley Eastern

Sessional work assessment

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

University examination pattern

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

2K 6EE 407(P) : DIGITAL ELECTRONICS LAB

3 hours practicals per week

List of experiments:

1) Familiarization of Logic Gates
2) Realisation of basic gates using Universal Gates
3) Half adder & Half Subtractor Circuits.
4) Full adder & Full Subtractor Circuits.
5) Code Converters using basic gates.
6) Realisation of Flip-flops using gates
7) Counters a) Ripple counter
   b) Johnson Counter
8) Shift Registers.
9) Sequence Generator
10) Multivibrator using AND gates
11) Combinational Logic Design using Decoders and MUX
12) 4 bit adder subtracter IC & BCD adder Circuits.
13) Interfacing & addressing Memory Chips.
14) ADC Circuits & ICs
15) DAC Circuits & ICs
16) EEPROM Programming experiments

Sessional work assessment

Lab Practicals and Record	= 30
Test	= 20
Total marks	= 50

Reference books

1. Jain R.P., Modern Digital Electronics, Tata McGraw Hill
2. Mano M.M., *Digital Design*, Prentice Hall of India
3. Taub B. & Schilling D., *Digital Integrated Electronics*, McGraw Hill

University evaluation will be for 100 marks of which 70 marks are allotted for writing the procedure/formulae/sample calculation details, preparing the circuit diagram/algorithm/flow chart, conduct of experiment, tabulation, plotting of required graphs, results, inference etc., as per the requirement of the lab experiments, 20 marks for the viva-voce and 10 marks for the lab record.
Note: Duly certified lab record must be submitted at the time of examination

2K6 EE 408(P) : ELECTRICAL MEASUREMENTS LAB

3 hours practical per week

1. Potential divider connection of a rheostat and study of the dependence of output voltage upon the value of load resistance
2. Verification of superposition Theorem in dc circuits.
3. Verification of Thevenin's Theorem in dc circuits.
4. Determination of impedance, admittance, power factor and real/reactive/ apparent power drawn in RLC series/parallel circuits.
5. Single-phase power measurement using a dynamometer type wattmeter.
6. Single-phase power measurement by three ammeters and three-voltmeter method.
7. 3-phase power measurement using one wattmeter and two-wattmeter method.
8. Determination of B-H curve, μ-H curve and μ-B curve of an iron ring specimen.
9. Measurement of resistance using Wheastone's bridge and Kelvin's double bridge and extension of range of voltmeters and ammeters.
10. Measurement of self/ mutual inductance and coupling co-efficient of iron cored coil and air-cored coil.
11. Calibration of meters and measurement of unknown resistance using slide- wire potentiometer.
12. Calibration of single phase energy meter by direct and phantom loading at various power factors.
13. Calibration of 3-phase energy meter using standard wattmeter.
14. Measurement of capacitance using Schering Bridge.
15. Insulation Resistance measurement using digital insulation tester and interfacing with PC
16. Experiment using Digital Earth Resistance Tester

Sessional work assessment	
Laboratory practicals and record	= 30
Test	= 20
Total marks	= 50

University evaluation will be for 100 marks of which 70 marks are allotted for writing the procedure/formulae/sample calculation details, preparing the circuit diagram/algorithm/flow chart, conduct of experiment, tabulation, plotting of required graphs, results, inference etc., as per the requirement of the lab experiments, 20 marks for the viva-voce and 10 marks for the lab record.
Note: Duly certified lab record must be submitted at the time of examination

KANNUR UNIVERSITY

FACULTY OF ENGINEERING

Curricula, Scheme of Examinations & Syllabus for Semesters V & VI of B.Tech. Degree Programme in Electrical & Electronics Engineering with effect from 2007 Admissions

FIFTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/D		Hrs	Marks
2K6 EE 501	Engineering Mathematics IV	3	1	-	50	3	100
2K6 EE 502	Environmental Engg: & Disaster Management	3	1	-	50	3	100
2K6 EE 503	Field Theory	3	1	-	50	3	100
2K6 EE 504	Electrical Machines II	3	1	-	50	3	100
2K6 EE 505	Modern Communication Systems	3	1	-	50	3	100
2K6 EE 506	Power systems – I	3	1	-	50	3	100
2K6 EE 507(P)	Linear Integrated circuits Lab	-	-	3	50	3	100
2K6 EE 508(P)	Electrical Machines Lab- I	-	-	3	50	3	100
TOTAL		**18**	**6**	**6**	**400**	**-**	**800**

SIXTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/ D		Hrs	Marks
2K6 EE 601	Economics & Business Management	3	1	-	50	3	100
2K6 EE 602	Power Electronics	3	1	-	50	3	100
2K6 EE 603	Power Systems-II	3	1	-	50	3	100
2K6 EE 604	Control Systems-I	3	1	-	50	3	100
2K6 EE 605	Electrical Engg. Drawing	1	-	3	50	3	100
2K6 EE 606	Elective - I	3	1	-	50	3	100
2K6 EE 607(P)	Electrical Machines Lab-II	-	-	3	50	3	100
2K6 EE 608(P)	Power Electronics Lab	-	-	3	50	3	100
TOTAL		**16**	**5**	**9**	**400**	**-**	**800**

Elective I

2K6 EE 606 (A) - Electrical System Design & Estimation
2K6 EE 606 (B) - Energy Conservation
2K6 EE 606 (C) - Linear System analysis
2K6 EE 606 (D) - Cellular & Mobile Communication Systems
2K6 EE 606 (E) - Industrial Psychology
2K6 EE 606 (F) - Operations research

2K6 EE 501 ENGINEERING MATHEMATICS IV

3 hours lecture and 1 hour tutorial per week

Module I Probability distributions (13 hours)

Random variables-Probability distributions - binomial distribution –Poisson distribution-normal distribution –Mean, variance and Moment generating function -Poisson process - Chebyshev's theorem- Geometric Distribution-Uniform Distribution, Gamma distribution, Beta Distribution, Exponential Distribution and Hyper-Geometric Distributions.

Module II Statistical inference (13hours)

Population and Sample-Sampling Distributions of Mean and Variance-Point Estimation-Interval Estimation -Null Hypotheses and Significance tests-Hypotheses concerning one mean- Confidence Intervals of mean and variance - Estimation of Variances-Hypotheses concerning one variance-Hypotheses concerning two variance- Chi square test as test of goodness of fit.

Module III (Series solutions of differential equations (13hours)

Power series method of solving ordinary differential equations - series solution of Bessel's equation – Recurrence formula for Jn(x)-expansions for J_0 and J_1 – value of $J_{1/2}$- generating function for Jn(x)- Orthogonality of Bessel functions - Legendre's equation – series solution of Legendre's differential equation -Rodrigues formula-Legendre Polynomials – Generating function for Pn(x)- Recurrence formulae for Pn(x) -Orthogonality of Legendre polynomials

Module IV Quadratic forms and Fourier Transforms (13 hours)

Quadratic forms - Matrix associated with a quadratic form - Technique of Diagonalization using row and column transformations on the matrix - Definite, Semidefinite and Indefinite forms - their identification using the Eigen values of the matrix of the quadratic form.

Fourier Transform-Properties of Fourier Transforms-Linearity property-Change of scale property-shifting properties –Modulation property-Transform of the Derivative-simple problems- Fourier Cosine transform-Fourier Sine Transform.

Text book

Johnson RA, Miller & Freund's Probability and Statistics for Engineers, Prentice Hall of India
(For Module I and II only)

Reference Books

1. Wylie C R & Barrett L. C., Advanced Engineering Mathematics, Mc Graw Hill
2. Kreyszig E., Advanced Engineering Mathematics, John Wiley.
3. Bali N. P. & Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications
4. Grewal B. S, Higher Engineering Mathematics, Khanna Publishers

Sessional work assessment

Two tests	2 x 15 = 30
Two assignments	2 x 10 = 20
Total marks	= 50

University Examination Pattern

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

2K6 EE 502 ENVIRONMENTAL ENGG: & DISASTER MANAGEMENT

3 hours lecture and 1 hour tutorial per week

MODULE I (12 HOURS)

Multidisciplinary nature of Environmental studies – Definition – scope and importance – need for public awareness Natural resources – renewable and non-renewable resources – natural resources – forest resources - water resources Mineral resources – food resources – energy resources – Land resources – use, overuse and misuse of these resources with appropriate case studies to substantiate – effect on the environment – role of individual in conservation of natural resources – equitable use of resources for sustainable lifestyle.

MODULE II (12 HOURS)

Ecosystem – concept – structure and function – producers, consumers & decomposers – energy flow in the ecosystem- Ecological successive food chains - food webs (all in brief)

Ecological pyramids – introduction, types and characteristic features, structure and function of forest, grassland, desert and acquatic ecosystems (ponds, lakes, streams, rivers, oceans and estuaries) Biodiversity and its conservation – Introduction – definition : genetic species and ecosystem diversity – Biogeographical classification of India – value of biodiversity – consumptive and productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels –India as a mega-diversity nation – hot spots of biodiversity – threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

MODULE III (13 HOURS)

Environmental Pollution – Definition – causes - effects and control measures of : Air Pollution – water Pollution – soil Pollution – marine Pollution – noise Pollution – thermal Pollution – Nuclear hazards .

Solid waste management – causes, effects and control measures of urban and industrial wastes – Role of an individual in preventing Pollution – Environmental Protection Act – Prevention and control of air and water Pollution – Wildlife Protection Act – Forest Conservation Act – Issues involved in Enforcement of Environmental Legislation – Public awareness.

Disaster Management – Principles of disaster management – nature and extent of disasters – natural disasters , hazards, risks and vulnerabilities – man-made disasters – chemical, industrial, nuclear and fire. – preparedness and mitigation measures for various hazards – financing relief expenditure – legal aspects - post disaster relief – voluntary agencies and community participation at various stages of disaster management – rehabilitation programmes.

MODULE IV (10 HOURS)

Social Issues and the Environment – From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting , watershed management – resettlement and rehabilitation of people ; its problems and concerns, case studies – environmental ethics : Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies – waste land reclamation – consumerism and waste products.

Human population and the environment – Population growth, variations among nations – population explosion – Family welfare programmes – Environment and human health – Pollution hazards, sanitation and health – Human rights for a clean environment – value education – HIV/AIDS – social concern – Women and Child welfare – role of Information Technology in environment and human health – Case studies.

FIELD WORK (5 HOURS)

- Visit to a local area to document environmental assets – river / forest / grassland / hill / mountain
- Visit to local polluted site – urban / rural / industrial / agricultural
- Study of common plants, insects , birds
- Study of simple ecosystems – pond, river, hill slopes, etc.

Text book

1. Clarke. R.S. Marine Pollution. Clanderson Oress Oxford.`
2. Mhaskar A.K. Matter Hazardous. Techno-Science Publications.
3. Townsend. C., Harper. J. and Michael Begon, Essential of Ecology. Blackwell Science.
4. S. Deswal & A . Deswal, A Basic Course in Environmental Studies, Dhanpat Rai & Co
5. Environmental Studies – Dr. B . S. Chauhan, University Science Press.
6. Kurien Joseph & R. Nagendran, Essentials of Environmental Studies, Pearson Education.
7. Trivedi. R.K. and Goel. P.K. Introduction to air pollution. Techno-Science Publications.

Reference Books

1. Agarwal.K.C. Environmental biology. Nidi Publ.Ltd. Bikaner.
2. Bharucha erach, Biodiversity of India, Mapin Publishing Pvt.Ltd.,.
3. Brunner,R.C.. Hazardous Waste Incineration. McGraw Hill Inc..
4. Cunningham W.P. , Cooper T.H., Gorhani E. & Hepworth M.T. Environmental Encyclopedia ,Jaico Publ.House ,.
5. De A.K. Environmental Chemistry.Wiley Eastern Ltd.
6. Hawkins R.E. Encyclopediaof Indian Natural History, Bombay Natural History Society ,.
7. Heywood V.H. & Watson R.T.. Global Biodiversity Assessment. Cambridge Univ. Press.
8. Jadhav H. & Bhosale V.M.. Environmental Protection and Laws. Himalaya Pub. House,
9. Odum E.P. Fundamentals of Ecology W.B. Saunders Co..
10. Rao M.N. & Datta A.K. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd..
11. Sharma B.K.. Environmental Chemistry Goel Publ. House, Meerut
12. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol.I & II.Enviro Media.
13. Wagner K.D. Environmental Management. W.B. Saunders Co.

Sessional work assessment

Two Tests	2 × 15	= 30 marks
Two Assignment	2 × 10	= 20 marks
Total		= 50 marks

University Examination Pattern

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

2K6 EE 503: FIELD THEORY

3 hours lecture and 1 hour tutorial per week

Module I: (16 hours)

Electric field : Co-ordinate System and transformations – Cartesian co-ordinates – circular cylindrical co-ordinates – spherical co-ordinates – relation between Cartesian, cylindrical and spherical co-ordinates

Vector calculus – Del operator – Gradient of a scalar – Divergence of a vector – Curl of a vector – Laplacian of a vector – Divergence theorem – Stoke's theorem.

Electrostatics – Electric field concept – Electric field intensity – Electric field due to continuous charge distributions – Electric flux – Gauss's law – Applications – Electric scalar potential – Electric dipole moment – Electric field polarization – Condition at boundary between dielectrics – Capacitance of an isolated sphere –Spherical capacitor – Capacitance between co-axial cylinder- Capacitance between parallel wires.

Module II: (16 hours)

Magnetic field: Magnetic circuit and electric circuit – Magnetic field intensity – Magnetic flux density – mmf – Flux – reluctance – Comparative study with electric and magnetic circuit – Lorentz force – Biot –Savart's law and Ampere's circuital law – H due to a long wire – H due to a long solenoid – H due to an infinite current sheet – H due to a circular wire loop – Skin effect – Faraday's laws of Electromagnetic induction – inductance and mutual inductance – Self inductance of toroid and toroidal solenoid – Lifting power of an electromagnet – Force and torque in terms of stored energy – Torque on a closed circuit

Magnetic vector potential and magnetic scalar potential – Helmholt's theorem – Magnetic dipole – Magnetic force on a charged particle – Force on a current element – Magnetic boundary conditions.

Module III: (10 hours)

Maxwell's equations: Faraday's law – Displacement current – Maxwell's equations in point form – Maxwell's equations in integral form and differential form – Boundary conditions.

The uniform plane wave – Propagation in free space – Plane wave propagation in loss less dielectrics – Plane wave in good conductor – Poynting theorem and wave power – Complex pointing theorem – Poynting vector.

Module IV: (10 hours)

Waves and transmission lines: Polarization of electromagnetic waves - Wave polarization - Elliptically and circularly polarized waves – Reflection and refraction of plane electromagnetic wave oblique – Law of refraction (Snell's law) - Brewster's law .

Transmission line parameters – Standing wave ratio – Impedance matching - Stub matching – Phase velocity and group velocity – Characteristic impedance – Reflection co-efficient – Reflection and transmission of plane wave at boundaries.

Text books

1. Hayt W.H., Engineering Electromagnetics, McGraw Hill
2. Premlet B., Electromagnetic Theory with Applications, Phasor Books
3. K A Gangadhar, Field Theory, Khanna Publishers
4. V V Sawate, Electromagnetic Fields and Waves, New Age international

Reference books

1. Guru & Hiziroglu, Electromagnetic Field Theory, *Fundamentals*
2. John D. Kraus, Electromagnetics, McGraw Hill
3. S P Seth, Elements of Electromagnetic Fields, Danapath Rai & Co
4. R Meenakumari & Subasri, Electromagnetic fields, New Age International
5. David K. Cheng, Field and Wave Electromagnetics, Addison Wesley

Sessional work assessment

Two tests	2 x 15	= 30
Two assignments	2 x 10	= 20
Total marks		= 50

University examination pattern

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

2K6 EE 504 : ELECTRICAL MACHINES II

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Synchronous generators: Construction - principle of operation - type and selection- EMF developed in a winding - Distribution factor- Chording factor - armature reaction - voltage regulation - automatic voltage regulator - predetermination of voltage regulation - EMF method - MMF method - Potier method – ASA method - phasor diagrams - short circuit ratio- two reaction theory - modified phasor diagram - analysis by two reaction theory - slip test - sudden short circuit - current waveforms - transient and subtransient reactances - DC excitation - static excitation - brush less excitation .

Module II (14 hours)

Analysis of synchronous machines - Power angle characteristics of cylindrical rotor and salient pole machines - active and reactive power control - alternator connected to infinite bus -synchronizing power and torque- effect of armature reactance- load sharing upon parallel operation - power frequency characteristics - locus of generated voltage for constant real power and variable excitation - V curves - inverted V curves

Synchronous motor - Principle of operation - different starting methods -equivalent circuit - phasor diagram- effect of load changes on synchronous motor - mechanical load diagram - torque and power relations- synchronous condenser- hunting - periodicity of hunting – suppression- applications.

Module III (14 hours)

Theory of induction machines: 3 phase induction motors - construction - principle of operation - rotor MMF and production of torque - slip and frequency of rotor current - phasor diagram - equivalent circuit - mechanical power developed - maximum torque - torque slip characteristics - losses and power flow - single phasing - no-load and blocked rotor tests - the circle diagram - double cage rotors - effects of air gap flux harmonics - cogging and crawling - line excited and self excited induction generators - applications of induction motors.

Module IV (12 hours)

Starting and speed control of induction motors: starting methods for three phase induction motors - direct on line starting - auto transformer starting - star delta starting - rotor resistance starting - speed control - basic methods - voltage control - frequency control - rotor resistance control - pole changing - slip power recovery scheme

Single phase induction motor - double field revolving theory - equivalent circuit- starting methods-capacitor based starting and running.

Text book and References

1. Langsdorf A.S., Theory of A.C Machinery, McGraw Hill.
2. Dr PS Bimbhra, Electrical Machinery, Khanna Publishers
3. Nagrath I.J. & Kothari D.P., Electric Machines, Tata McGraw Hill
4. Fitzgerald A.E. & Kingsley, Electrical Machinery, McGraw Hill
5. Say M.G., Performance and Design of AC Machines, Pitman, ELBS.
6. Stephen J Chapman, Electric Machinery Fundamentals, McGraw Hill.
7. Vincent Del Toro, Electrical Machines and Power Systems, Prentice Hall
8. Ashfaq Hussain, Electric machines, Dhanpat Rai & co.
9. Theodore Wildi, Electrical Machines, Drives and Power systems, Pearson
10. Smarajit Ghosh, Electrical Machines, Pearson
11 JB Gupta, Theory and Performance of Electrical Machines, SK Kataria & Sons

Sessional work assessment

Two tests	2 x 15 = 30
Two assignments	2 x 10 = 20
Total marks	= 50

University examination pattern

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

2K6 EE 505 : MODERN COMMUNICATION SYSTEMS

3 hours lecture and 1 hour tutorial per week

Module I (16 hours)

Analog modulation schemes: Super heterodyne receivers-receiver parameters-AM receivers-IF and its selection-AGC, AM demodulator circuits-SSB receivers-demodulation of SSB, receiver types-FM receiver-FM demodulators, FM noise suppression- Pulse modulation, principle of PAM, PWM,PPM modulation and demodulation-circuits.

Digital modulation schemes: Coherent binary schemes: ASK,FSK,PSK,MSK, coherent M-ray schemes, calculation of average probability of error for different modulation schemes, Power spectra of digital modulated signals, performance comparison of different modulation schemes-PCM, DPCM, Delta modulation, generation and demodulation- Multiplexing- TDM, FDM, WDM.

Module II (12 hours)

Principle of TV communication: Theory of interlaced scanning- composite video waveforms-synchronising signal standards as per PAL625 line system-bandwidth-Block diagram of monochrome transmitter and receiver.

Colour TV signal standards-principle of NTSC, PAL and SECAM encoders/ decoders-Block diagram of transmitters and receivers.

Principles of Radar: Radar frequencies-Radar equation-Transmitter and receiver(Block diagram approach), Pulsed, CW, FMCW, MTI, and tracking radars.

Module III (12 hours)

Principles of optical communication system: LED and LASER diode- Principle of operation- optical detectors-pin detector-APD- optical fibres- step index- graded index- single mode and multimode

Principles of mobile communication systems: operation of cellular system- improving capacity in cellular systems-frequency re usage- hand off strategies- cell splitting- sectoring channel assignment strategies- call blocking in cellular networks.

Module IV (12 hours)

Satellite communication: Orbit of communication satellite-satellite constellation- orbital parameters- orbital perturbations- geostationary orbits-low earth and medium orbits- frequency selection- RF links- propagation characteristics- modulation methods- coding- multiple access spacecraft- antennas-transponders-inter satellite link-link power budget- earth station interference- special spectrum communication general concepts- frequency hopping- frequency hopping transmitter- frequency hopping receiver- time hopping- antijam consideration-CDMA.

Text books & References

1. Principles of Communication systems, George Kennedy, TMH.
2 Dennis Roody and john Coolen, Electronic communication, Prentice Hall..
3. Bernard sklar, Digital communications Fundamentals and applications, Pearson
4. Dennis Roddy, Satellite Communication, PHI.
5. TS Rappaport, Wireless digital communications, Principles and Practice, Pearson
6. R. R. Gulati, Monochrome and colour Television, John Wiley.
7. Skolnik, Introduction to Radar Systems
8. John Senior, Optical Fiber Communications, PHI
9. RE Ziemer , WH Tranter, Principles of Communication, 5th edition, John Wiley.
10. BP Lathi, Modern Digital and Analog Communication system, 3rd edition, Oxford.
11. Wayne Tomasi, Modern Electronic Communication system, Pearson
12. Simon, Hindey, Lindsey, Digital Communication Techniques, PHI
13. John G Proakis, Digital Communication, MGH
14. WL Prichard, Satellite Communication system engineering, Pearson

Sessional work assessment

Two tests	2 x 15 = 30
Two assignments	2 x 10 = 20
Total	= 50

University examination pattern

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

2K6 EE 506 : POWER SYSTEMS- I

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Economic considerations in power generation: Classification of generation costs-interest and depreciation-methods of providing depreciation-load curves-terms associated with generation-significance of load and diversity factors-base load and peak load plants. Tariff-types, Power factor-causes of low power factor-disadvantages-methods of power factor improvement-most economical power factor-economical comparison of the two methods of increasing power supplied.

Module II (15 hours)

Design of transmission lines: Main components of overhead lines- Conductors-materials-configuration-spacing and clearances-supports-span length-calculation of sag and tension- effect of wind and ice-supports at unequal heights - sag template-equivalent span -vibration and dampers-Insulators-materials-types-causes of failure of insulators-distribution of potential over a string of insulators-string efficiency-methods of improving string efficiency-formation of corona-disruptive and visual critical voltages-factors affecting corona-advantages and disadvantages-corona power loss-methods of reducing corona effects-underground cables-general construction-classification-insulation resistance-capacitance of 1-core cable-dielectric stress-grading methods-capacitance of 3-core cables-laying of cables-heating of cables.

Module III (13 hours)

Characteristics and performance of transmission lines: Constants of transmission lines-resistance-inductance and capacitance of 1-Φ,2 wire lines-composite conductors-GMD and GMR-inductance and capacitance of 3-Φ lines-transposition-double circuit lines-bundled conductors-classification of lines-short lines-voltage regulation and efficiency-medium lines-nominal T and Π configurations-ABCD constants- long lines- rigorous solution-interpretation of long line equation-Ferranti effect- tuned power lines-power flow through lines-methods of voltage control.

Module IV (12 hours)

Power distribution: -Feeders, distributors and service mains- types of distribution systems -design of feeders-Kelvin's law-current distribution and voltage drop calculations in DC distributors with concentrated loading and uniform loading-AC distributors with concentrated loading-radial and ring systems-AC interconnected systems, Improvement of existing distribution system-LT capacitor installation-size, connection and specifications.

Text books

1. Nagarth J & Kothari D P, Power system Engineering, TMH
2 J B Gupta, A course in electrical power, S K Kataria & Sons

Reference books

1. Stevenson Jr, Elements of power system analysis, TMH
2. Pabla A S, Electric power distribution systems, TMH
3. Wadhwa C L, Electric power systems, Wiley eastern LTD
4. Gupta B R power system analysis and design, Wheeler publishing & co.

Sessional work assessment

Two tests	2 x 15 = 30
Two assignments	2 x 10 = 20
Total	= 50

University examination pattern

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

2K6 EE 507(P) LINEAR INTEGRATED CIRCUITS LAB

3 hours practical per week

1) Study of OP AMPs: Measurement of OP AMP parameters-CMRR, slew rate ,open loop gain ,input and output impedances.
2) Design and set up of inverting and non inverting amplifier, summer, subtractor, scale changer, integrator and differentiator circuits.
3) Inverting and non inverting comparator, Level detector and zero crossing detector circuits using OP AMP.
4) Phase shift and Wein bridge oscillator with amplitude stabilization using OP AMPs.
5) OPAMP comparator –design and set up Schmitt trigger-window comparator.
6) Square, Triangular and Ramp generation using OP AMPS
7) Astable and Monostable Multivibrators using OP AMP s.
8) Precision rectification –absolute value and averaging circuit using OP AMPS.
9) Second order Low pass, High pass and Band pass filters using single OP AMPS.
10) Active notch filter realization using OP AMPs.
11) Experiments on precision OP AMPS.
12) Voltage regulation using IC723or 78xxor 79xx.
13) Design of PLL for given Lock and capture ranges and Frequency Multiplication.
14) Resistance-Temperature characteristics of Thermistors.
15) Characteristics of Optocoupler.
16) Audio Amplifiers- Input impedance. Output impedance, frequency response etc.

A minimum of 12 experiments to be conducted from the above list.

Sessional work assessment	
Laboratory Practicals and Record	= 35
Test	= 15
Total marks	= 50

2K6 EE 508(P) : ELECTRICAL MACHINES LAB I

3 hours practical per week

DC Machines

1. Open circuit characteristics of DC shunt generator at rated speed
   (a) Predetermine the OCC at different speeds and determine resistance required in the field circuit for generating different voltages on no load.
   (b) Find the critical resistance and the critical speed for a given field circuit resistance
2. Load test on DC shunt generator
   (a) Plot the external and internal characteristics by conducting load test
   (b) Deduce the armature reaction curve
3. Brake test on DC shunt and series motor
   Plot the following characteristics
   i) Output Vs Efficiency ii) Output Vs Line current iii) Output Vs Speed
   iv) Speed Vs Torque v) Line current Vs Torque
4. Swinburne's test on a DC shunt motor

   Predetermine the armature current and percentage efficiency when the machine operates as a motor and as a generator delivering 1/4, 1/2, 3/4 and full rated output and plot the characteristics
5. Hopkinson's Test on a pair of DC machines

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

   i). Separate the losses ii) Find the moment of inertia of the rotating system
7. Separation of losses in a DC machine at rated speed

   By conducting no load test at different excitations, separate the losses in the DC shunt motor

Transformers

8. O.C and S.C test on the single-phase transformer - pre-determination of the following
   i). Equivalent circuit referred to HV and LV sides
   ii). Efficiency at 1/4, 1/2, 3/4 and full loads at 0.5, 0.86 and u p f.
   iii). Plot the regulation curve for full load and half load conditions
   iv). Upf load at which efficiency is maximum
   v). Performance of the transformer when a load of 30+j40 Ω is connected to the secondary.
9. Separation of losses in a transformer

   At normal voltage and frequency separate the hysterisis and eddy current losses of a single phase transformer
10. Sumpner's test
    Predetermination of efficiency and regulation at various loads and p.f.
11. Scott connection of the single phase transformers

    To determine the performance under various load conditions at upf and plotting the efficiency curves with
    (a) Main transformer secondary alone loaded, (b)Teaser transformer secondary alone loaded
    (c) Balanced loading

Sessional work assessment	
Laboratory Practicals and Rrecord	= 35
Test	= 15
Total marks	= 50

2K6 EE 601 ECONOMICS & BUSINESS MANAGEMENT

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Definition of economics-nature and scope f economic science-nature and scope of managerial economics-central problems of an economy-scarcity and choice-opportunity cost-objectives of business firms-forms of business-proprietorship-partnership-joint stock company-co-operative organization-state enterprise

Module II (14hours)

Consumption – wants –characteristics of wants- law of diminishing marginal utility- demand – law of demand-elasticity of demand- types of elasticity-factors determining elasticity-measurement- its significance in business-demand forecasting-methods of demand forecasting- supply – law of supply- elasticity of supply

Module III (14hours)

Production – factors of production – features of production – features of factors of production- division of labour – production function- Cobb-Douglas production function-production possibility curve-isoquants-marginal rate of technical substitution- properties of isoquants -law of variable proportions- returns to scale-isocost line-least cost combination of factors-expansion path-technical and economical efficiency-linear programming –graphical method-economics of large scale production.

Module IV (12hours)

Market structures and price determination – perfect competition-monopoly -monopolistic competition-oligopoly-kinked demand curve-money and banking-nature and functions of money-money market and capital market-commercial banks –functions-central banking functions-methods of credit control.

Text books and References

1 Varshney R.L & Maheshwari K.L , Managerial economics, S Chand & Co. Ltd..
2 Dwiivedi D.N, Managerial Economics, Vikas Publishing House Pvt Ltd
3. Dewett K.K, Modern Economic theory, S Chand & company Ltd.
4. Barthwal A.R ,Industrial Economics, New Age International Publishers
5. Benga T.R & Sharma S.C, Industrial Organization and Engineering Economics , Khanna Publishers
6. Ahuja H.L Modern Micro Economics –Theory and Applications , S Chand & Co. Ltd
7. Koutsoyiannis A , Modern Microeconomics, Macmillan Press Ltd.
8. Joel Dean, managerial Economics Prentice-Hall of India Pvt Ltd.
9. Dewett .K.K& Verma J.D,Elementary Economic Theory , S Chand & Co. Ltd.
10. Jhingan M.L., Macro Economic theory , Vrinda Publications Pvt.Ltd.

Sessional work assessment

Two tests	2 x 15 = 30
Two assignments	2 x 10 = 20
Total	= 50

University examination pattern

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

2K6 EE 602 POWER ELECTRONICS

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)
Power diodes-basic structure and V-I characteristics-various types –power transistors-BJT, MOSFET and IGBT-basic structure and V-I characteristics –Thyristors –basic structure-static and dynamic characteristics-device specifications and ratings-methods of turning on-gate triggering circuits using UJT-methods of turning off-commutation circuits-TRIAC,DIAC

Module II (13 hours)
Line frequency phase controlled rectifiers using SCR- single phase rectifiers with R and RL loads-half controlled and fully controlled converters with continuous and constant currents.-SCR invertors –circuits for single phase invertors –series, parallel and bridge invertors- pulse width modulated invertors- basic circuit operation.

Module III (12 hours)
AC regulator – single phase ac regulator with R and RL load - sequence control of ac regulators- cycloconverters – basic principle of operation- single phase cycloconverters- choppers – principle of operation- types of choppers.

Module IV (14 hours)
Switching regulators- buck regulators-boost regulators-buck-boost regulators-cuk regulators-switched mode power supply- principle of operation and analysis- comparison with linear power supply- uninterruptible power supply-basic circuit operation- different configurations- characteristics and applications.

Text books and References

1. Dr.PS Bimbra , Power Electronics, KhannaPublishers - Delhi
2. Sen P.C, Power electronics, Tata McGraw Hill
3. Rashid , Power Electronics, Pearson Education
4. Joseph Vidayathil , Power Electronics, McGraw Hill
5. Singh M.D & Khanchandani K.B, Power Electronics, Tata McGraw Hill
6. Ned Mohan et.al, Power Electronics, John Wiley & Sons
7. Sen P C , Modern Power Electronics, Wheeler publishers

Sessional work assessment

Two tests	2 x 15 = 30
Two assignments	2 x 10 = 20
Total	= 50

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

2K6 EE 603 : POWER SYSTEMS II

3 hours lecture and 1 hour tutorial per week

Module I (13hours)

Representation of power systems– one line diagram-per unit quantities–impedance and reactance diagrams – formation of Y bus by direct inspection and singular transformation – effect of off nominal transformers on Y_{bus} - load flow studies - formulation – solution using Gauss-Siedel ,Newton Raphson and fast decoupled methods – line loss computation.

Module I1 13hours)

Short circuit studies– symmetric faults in power systems –short circuit MVA–current limiting reactors, Symmetrical components– sequence impedances and networks of generators, transformers and transmission lines – unsymmetrical faults– single line to ground, line to line & double line to ground faults at the terminals of an unloaded alternator – faults on power systems– consideration of pre fault currents – Z- bus building algorithm –fault analysis using Z-bus

Module III (13hours)

Economic dispatch of thermal plants – system constraints - economic dispatch neglecting losses- optimum load dispatch including transmission losses – derivation of transmission loss formula using B-coefficients – automatic load dispatching – optimal load flow solution – load frequency control of single area case – turbine speed governing system –model – block diagram representation – steady state analysis – control area concept – two area load frequency control - Automatic voltage regulation.

Module IV (13 hours)

Power system stability studies-–dynamics of synchronous machine – swing equation – machine connected to infinite bus – two machine system – steady state stability –transient state stability –equal area criterion - applications –effect of clearing time on stability– critical clearing angle and time – multi machine stability – swing curves using modified Eulers method – factors affecting stability –Voltage stability problem – causes and improvement methods - introduction to HVDC transmission.

Text books and References

1. Stevenson JV, William D, Elements of Power System Analysis, McGraw Hill, 1988
2. I.J Nagrath& D.P Kothari, Modern Power System Analysis. Tata McGraw Hill, 1989
3. A.K.Mahalanabis, Computer Aided Power System Analysis& Control, Tata McGraw Hill, 1991
4. Arthur R Bergen, Vijay Vittal, Power System Analysis, Pearson Education(Singapore)Pte.Ltd,2004
5. Hadi Sadat, Power System Analysis, Tata McGraw Hill, 2003
6. J.Arrilaga, C.P Arnold ,B.J Harker, Computer modeling of Power System
7. Elgerd ollei, Electric Energy System Theory-An Introduction, Tata McGraw Hill,2ed.1995
8. Wadhwa C.L, Electric Power System, New Age Publication,3ed.2002

to answer any one

Sessional work assessment

Two tests	2 x 15 = 30
Two assignments	2 x 10 = 20
Total	= 50

University examination pattern

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

2K6 EE 604 CONTROL SYSTEMS I

3 hours lecture and 1 hour tutorial per week

Module I (14 hours)

System concepts and Modeling of Systems: Systems –elements – classification of systems-principle of automatic control-open and closed loop systems-practical examples-modeling of translational and rotational systems-force voltage and force current analogue-transfer function approach-transfer function of simple electrical and mechanical systems-block diagram reduction-signal flow graphs-Mason's gain formula.

Module II (13 hours)

Control system components : Principle of operation and transfer function of Synchros, magnetic amplifier, armature controlled DC machine

Time domain analysis : Test signals –response of systems to standard test signals-first and second order systems-time domain specifications of second order systems-higher order systems – steady state error-static and dynamic error coefficients- Routh stability criterion-Root locus method-construction of root locus-effect of poles and zeros-and their location on the root locus

Module III (12 hours)

Frequency Domain Analysis: Frequency response representation- -Bode plots- minimum and non minimum phase systems -Polar plots- Frequency domain specification-gain margin and phase margin –stability from Bode and Polar plots- Bode plot system with transportation lag- Nyquist stability criterion-M and N circles

Module IV (13 hours)

Sampled Data Control System: Sampled data control system-sampling-process-mathematical analysis of sampling process-ideal sampling-data construction and hold circuits-zero and first order hold circuits-Z transform- inverse Z transform-solution of difference equation-pulse transfer function-system response-stability in the Z plane-bilinear transformation- Jury's stability test

Text books and Reference

1. Ogata K, Modern control Engineering, Prentice Hall.
2. Chatterjee, Control System components, Khanna Publishers.
3. Nagrath and Gopal, Control System Engineering, Wiley Eastern
4. Ogata K, Discrete Time Control Systems, Prentice Hall
5. Kuo, Analysis and Synthesis of Sampled Data Control Systems, Prentice Hall
6. Nagoorkani, Advanced control Theory, R B A Publications
7. Nagoor kani, control System, R B A Publications

Sessional work assessment

Two tests	2 x 15	: 30
Two assignments	2 x 10	: 20
Total marks		: 50

University examination pattern

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

2K6 EE 605 : ELECTRICAL ENGINEERING DRAWING

1 hour lecture and 3 hours drawing per week

Module I (12 hours)

Winding diagrams

1. Simplex lap and wave dc armature windings
2. Simplex lap and wave, integral and fractional slot, double layer three phase ac armature windings
3. Mush and concentric type single layer three phase ac armature windings

Substation layouts

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

Module II (16 hours)

Transformer

1. Sectional plan and elevation of a transformer limb with windings
2. Sectional plan and elevation of the core assembly of a power transformer
3. Sectional plan and elevation of a distribution transformer tank with its accessories

DC Machines

1. Sectional front and side elevation of the yoke and pole assembly with field winding of a dc machine.
2. Sectional front and side elevation of armature with commutator of a dc machine.
3. Sectional front and side elevation of an assembled dc Machine.

Module III (18 hours)

Alternators:

1. Sectional front and side elevation of a water wheel rotor assembly with winding
2. Sectional front and side elevation of a salient pole alternator
3. Sectional front and side elevation of a turbo alternator

Induction motors:

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

Module IV (6 hours)

Developed winding diagrams using AUTOCAD (Not included for University examination)

1. Simplex lap and wave dc armature windings
2. Simplex lap and wave, integral and fractional slot, double layer three phase ac armature windings
3. Mush and concentric type single layer three phase ac armature windings

Reference Books

1. Bhattacharya S.K., Electrical Engineering Drawing, Wiley Eastern.
2. Narang K.L., A Text Book of Electrical Engineering Drawing, Tech India Publications.
3. Sawhney AK, Electrical Machine Design, Dhanpath Rai &Sons.
4. Clayton & Hancock, Performance and Design of DC Machines, ELBS
5. Say M.G., Performance and Design of AC machines, Pitman, ELBS.

Sessional work assessment

Assignments (class work)	= 30
Tests	= 20
Total marks	= 50

University examination pattern

Q I - 2 questions A and B of 30 marks from module I with choice to answer any one.
Q II - 2 questions A and B of 35 marks from module II with choice to answer any one.
Q III - 2 questions A and B of 35 marks from module III with choice to answer any one.

2K6 EE 606 (A) ELECTRICAL SYSTEM DESIGN AND ESTIMATION

3 hours lecture and 1 hour tutorial per week

Module I (14 hours)

Role of National Electric code and IE rules- types of wires and cables – selection of ratings of copper and aluminum wires and underground cables as per IS code – Criteria of selection of power cables – Grading of wires and power cables – protective devices such as fuses, relays, MCB's and ELCB's - Selection of fuses for motors- Types of fuses.

General rules for wiring – determination of number of points – determination of total load – determination of number of sub circuits-determination of ratings of main switch/isolator – DB – Distribution Board – Design and selection of bus bars and bus bar chambers in power circuits – Design – single line diagram using standard electrical signs and symbols of single phase/three phase circuits.

Module II (14 hours)

Wiring estimation for single phase/three phase residential consumers – schematic layout and diagram – single phase /three phase wiring estimation for small scale industries/offices/commercial building – Electrical Design and Estimation for High rise building.

Module III (12 hours)

Illumination systems – various types of lamps and luminaries – efficiency and applications – different types of lighting arrangement – energy efficiency in lamps and illumination – LED lighting. Design consideration for street lighting and factory lighting, flood lighting. Lightning protection – Design of lightning protection of residential buildings.

Module IV (12 hours)

Substation equipments – outdoor – indoor substations – layouts – components – selection of HV and EHV power and distribution transformers and switchgears – layout & schematic diagram for (a) 16MVA, 110/11KV outdoor substation (b) 11KV/415V, 63KVA outdoor / indoor substations.
Earthing – Pipe earthing, Plate earthing, earthmat design - test procedure.

Energy conservation – basics in domestic and industrial sector – instruments (Power Analyser single phase and three phase, clamp on meters, lux meter) – Electrical Energy Audit.

Text books and References

1. Gupta J.B Kataria & Sons -Electrical installation, Estimation & Costing
2. Raina & Battacharys, Electrical System Design, Estimation & Costing, Wiley Eastern
3. National Electric Code, Bureau of Indian Standard Publications
4. S.L Uppal & Garg - Khanna publishers. Electrical wiring estimating and costing

Sessional work assessment

Two tests	2 x 15	: 30
Two assignments	2 x 10	: 20
Total marks		: 50

University examination pattern

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

2K6 EE 606 (B) ENERGY CONSERVATION

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Energy and its various forms-units and energy content of various fuels-electrical systems –supply and demand sides, economic operation, Input-output curves, load profiling-energy auditing-instruments for energy auditing-specify energy consumption-reactive power, power factor improvement-automated control-case study.

Module II (14 hours)

Energy efficiency, energy accounting, monitoring and control, transformer loading/efficiency analysis, feeder loss evaluation, diesel generator efficiency analysis, case study.
Lighting: energy efficiency in light sources, domestic/commercial/ industrial lighting, schemes and controls, LEDs , energy conservation in lighting schemes, luminaries, case study.

Module III (14 hours)

Electric motors: energy efficient starting and control, load matching, selection of motors, efficiency and load analysis, energy efficient motors-case study
Industrial drives: Variable speed drives and energy conservation schemes, pumps and fans-efficient control strategies-over sizing.

Module IV (12 hours)

Electric loads of air conditioning and refrigeration, energy conservation, electric heating-furnace operation and scheduling-Co generation.
Energy economics: Financial evaluation of energy projects; cash flow model; time value of money; evaluation proposals-payback period, average rate of return method, Internal rate of return method, present value method.

Text books and References

1. IEEE Bronze Book, Recommended practice for energy conservation and cost effective planning in industrial facilities., IEEE inc,USA,1995
2. Albert Thumann, P.W, Plant Engineers and Managers Guide to Energy Conservation-7th Edition-TWI Press Inc, Terre Haute, 1997
3. Donald R.W., Energy Efficiency Manual, Energy institute press
4. Partab H., Art & science of utilization of electrical energy , Dhanpat Rai and Sons, New Delhi, Second Edition.
5. Tripathi S C, Electrical Energy Utilization and Conservation., Tata Mc Graw Hill.,1993
6. Efficient use of electrical energy in industries-ECQ Series, Devaki R&D Engineers, Vadodara,2001
7. Turner , Wayne C., Energy Management Handbook, 2nd edition Lilburn, GA: The Fairmount press Inc,.1993
8.UNESCAP, Guide Book on Promotion of Sustainable Energy Consumption. (www.unescap.org/enrd/energy)
9. Industrial energy conservation, Charles M Gottschalk, - John Wiley & Sons,1996
10.Energy management principles, Craig B Smith, Pergamon Press
11. Optimizing energy efficiencies in industry, G G Rajan,- TMH, Pub. Co., 2001
12. Energy management, Paul O'Callaghan, McGraw Hill Book Co

Sessional work assessment

Two tests	2 x 15	: 30
Two assignments	2 x 10	: 20
Total marks		: 50

University examination pattern

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

2K6 EE 606 (C) LINEAR SYSTEM ANALYSIS

3 hours lecture and 1 hour tutorial per week

Module I (14 hours)

System Concepts: System-classification of systems- static and dynamic systems-linear and nonlinear systems-distributed and lumped systems-time invariant and time varying systems-stochastic and deterministic system-continuous time and discrete time systems.
Modeling of Electrical and Non-electrical Systems: Modeling of electrical systems-dynamic equations of RL,RC and RLC circuits using Kirchhoff's current and voltage laws-modeling of translational and rotational mechanical systems- D'Alembert's principle-force voltage and force current analogy-gear train-dynamic equation of simple pneumatic, hydraulic, thermal and liquid level systems.

Module II (13 hours)

Transfer function: Review of Laplace transforms-concepts of transfer function-transfer function of different systems discussed in module I-block diagrams-signal flow graphs-Mason's gain formula.
Fourier series and Fourier transforms: Fourier series representation of periodic functions -symmetry conditions-exponential form of Fourier series-Fourier transform-properties of Fourier transforms-analysis by Fourier methods-relation between Laplace transform and Fourier transform

Module III (12 hours)

Time-domain analysis and stability of systems: Standard test signals-first and second order systems-steady state and transient response-time response specifications-steady state errors and error constants-effect of poles and zeros-dominant poles-higher order systems-concept of stability-bounded input, bounded output stability- Routh Hurwitz stability criterion for transfer function models.

Module IV (13 hours)

State space analysis: Concept of state space and state variables-advantage over transfer function approach-state models for typical electrical, mechanical and electromechanical systems-state space representation for continuous time, linear, single input single output systems-transfer function from state model-state transition matrix-properties-solution of state transition matrix-properties-solution of state equation-zero input zero state response. controllability and observability of linear systems-general concepts-relationship among controllability, observability and transfer functions.

Text books and Ref

1. Cheng DK, Linear System Analysis, Addison Wiley.
2. Tripati JN, Linear System Analysis, New Age International.
3. Ogatta K, Moden Control Engineering, Prentice Hall.
4. Nagrath & Gopal , Control System Engineering , Wiley Eatsern

Sessional work assessment

Two tests	2 x 15	: 30
Two assignments	2 x 10	: 20
Total marks		: 50

University examination pattern

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

2K6 EE 606 (D) CELLULAR AND MOBILE COMMUNICATION SYSTEMS

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Introduction to cellular mobile system-performance-criteria-uniqueness of mobile radio environment-operation of cellular system-hexagonal shaped cells-analogue and digital cellular systems
Cellular concepts-frequency reuse – channel assignment-hand off- interference and system capacity- tracking and grade of service- improving coverage and capacity in cellular systems.

Module II (13 hours)

Free space propagation model-reflection-diffraction –scattering-link budget design-outdoor propagation model-indoor propagation model-small scale multipath propagation-impulse model-small multipath measurements-parameters of mobile multipath channels-types of small scale fading-statistical models for multipath fading channels.

Module III (13 hours)

Modulation techniques-minimum shift keying-Gaussian MSK, M-ary QAM, M-ary FSK-orthogonal frequency division multiplexing-performance of digital modulation in Slow-Flat fading channels and frequency selective mobile channels-equalization-linear equalization-non linear equalization-algorithm for adaptive equalization-diversity techniques-RAKE receiver

Module IV (13 hours)

Multiple access techniques –FDMA-TDMA-CDMA-SDMA-capacity of cellular CDMA and SDMA
Second generation and third generation wireless network standards-WLI-blue tooth-GSM-IS 95 and DECT

Text books and References

1. R.Blak, Mobile , Wireless Communication Technology, Thomson Delmar, 2003
2. W.C.Y.Lee, Communication Engineering: Theory and Applications, II Edition, MGH International, 1998
3. T.SS.Rappaport, Wireless Communications: Principles and Practices, Second Edition Pearson Education/Prentice Hall of India, Third Indian reprint.
4. Steele R., Hanzo L., Mobile Radio Communica5tion, second edition Wiley 1999

Sessional work assessment

Two tests	2 x 15	: 30
Two assignments	2 x 10	: 20
Total marks		: 50

University examination pattern

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

2K6 EE 606 (E) INDUSTRIAL PSYCHOLOGY

3 hours lecture and 1 hour tutorial per week

Module I (14 hours)

The role of the psychologists in industry- occupational psychology- study of behavior in work situations and applications of psychological principles to problems of selection, placement, counseling and training-design of work environment. Human engineering and physical environment techniques of job analysis. Social environment-group dynamics in industry- personal psychology. Selection, training, placement, promotion, counseling, job motivations and job satisfactions.

Module II (13 hours)

The nature and scope of engineering psychology. Application of engineering psychology to industries. problem fatigue, boredom and accidents. Consumer behavior; study of consumer preference, effects of advertising. Industrial morale. case studies

Module III (12 hours)

Efficiency at work: the concept of efficiency, he work curve, its characteristics. The work methods, hours of work, nature of work, fatigue and boredom and rest pauses
The personal factors, age, abilities, interest and job satisfaction. The work environment, noise, illumination and atmospheric conditions. Increasing efficiency at work; improving the work methods. Time and motion study, its contribution and failure. resistance to time and motion studies, need for allowances in time and motion study. Case studies.

Module IV (13 hours)

Work and equipment design: Criteria in evaluation of job- related factor, job design, human factors, engineering information, input processes , mediation processes., action processes, methods deign, work space and its arrangement, human factors in job design. Accident and safety: The human economics costs of accidents, accident records and statistics, the causes of accidents. Situational and individual factors related to accident reduction. case studies

Text books and References

1. Tiffin J. and McCormic E J., Industrial Psychology,(Prentice Hall), 6 th Edn. 1975
2. McCormic E.J.:Human Factors Engineering and Design(McGraw Hill), 4th Edn.,19763 .Mair, N.R.F., Principles of Human Relations
4. Gilmer, Industrial Psychology
5. Ghiselli& Brown, Personnel and Industrial Psychology
6. Myer, Industrial psychology
7. Dunnete MD, Handbook of Industrial and Organizational Psychology
8. Blum&Taylor, Industrial Psychology

Sessional work assessment

Two tests	2 x 15	: 30
Two assignments	2 x 10	: 20
Total marks		: 50

University examination pattern

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

2K6 EE 606 (F) OPERATIONS RESEARCH

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Overview: Definition, Characteristics and phases of operation research, Type of operations research models. General methods for solving operations research models.
Linear programming: Introduction to linear programming. Formulation, graphical solution, Simplex method, Artificial variable technique, Duality theory.
Transportation Problem: Formulation optimal solution. Variations in transportation problems. Degeneracy. (separate, bold) Assignment problem, Formulation. optimal solution, variation in assignment problems.

Module II (13 hours)
Sequencing : introduction ,Terminology, notations and assumptions. Problem with n-jobs and two machines, optimal sequence algorithm, problems with n-jobs and three machines, problem with n-jobs and m-machines, graphical solutions. Travelling salesman problem.
Queueing Theory: Introduction, Terminologies of queueing system, Single channel Poisson arrivals, Exponential service times, Unrestricted queue with infinite population and finite population models, single channel poisson arrivals, Exponential service times with infinite population and restricted queue.

Module III (12 hours)

Replacement: Introduction, replacement of items that deteriorate with time-value of money unchanging and changing, Replacement of items that fail completely.
Theory of games: Introduction, Two-person zero-sum games, The maximin and minimax principles , Games without saddle points-Mixed strategies,2xn and mx2 Games-Graphical solutions, Dominance property, Use of L.P. to solve games, Algebraic solutions to rectangular games.

Module IV (14 hours)

Inventory Control: Introduction, inventory costs, Independent demand systems. Deterministic models-Fixed order size systems-Economic order quantity (EOQ)-Single item, Back ordering, Quantity discounts. Batch-type production systems: Economic production quantity. Fixed order interval systems: Economic order interval (EOI)-Single item, selective inventory control, ABC,VED,FSN Analysis.
Network analysis: Network definitions, Minimum spanning tree algorithm, Shortest root problem, Maximum flow model. Elements of project scheduling by CPM and PERT. Crashing of networks.

Text books and References

1.Operation Research, by TAHA (PHI)
2.Operations Research Methods and Problems, by M.Sasiene, A.Yespal and L.Friedman. (John Wiely)
3.Operation Research by S.D.Sharma. (Kedarnadh Ramnadh & Co.,)
4.Operation Research by R. Pannerselvam (PHI)

Sessional work assessment

Two tests	2 x 15	: 30
Two assignments	2 x 10	: 20
Total marks		: 50

University examination pattern

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

2K6 EE 607(P) : ELECTRICAL MACHINES LAB II

3 hours practical per week

3 Phase Induction Motors

1. No load and blocked rotor tests on a 3 Φ squirrel cage Induction motor.
   (i). Conduct no load blocked rotor tests on 3 Φ squirrel cage Induction motor
   (ii). Determine the equivalent circuit parameters and draw the equivalent circuit and predetermine Torque-slip characteristics for 100% and 50% applied voltage.
   (iii). Draw the circle diagram and there from predetermine the performance characteristics
2. Load tests on 3 Φ squirrel cage and slip ring Induction motors
   (i). Conduct the brake test on both types of machines
   (ii). Plot the various performance characteristics
   (iii). Find the KVAr required to improve the power factor to 0.95 at various loads.
3. Performance of Induction machine as a generator and motor
   To operate the given 3 Φ Induction machine coupled with a DC machine as
   (i). An Induction motor
   (ii). An Induction generator working on supply mains and determine the capacitance required for self excitation
   (iii). To conduct load test in both generating and motoring modes and plot the following characteristics on the same graph - efficiency, line current, power factor and slip as a function of output power
   (iv). Plot output Vs slip characteristicsand obtain hysteresis power and corresponding torque
4. Pole changing as a method of speed control and load test on pole changing induction motor
   (i). To study the different modes of operation of a 3 Φ pole changing Induction motor
   (ii). Obtain the performance characteristics and compare the results obtained for different pole combinations at different load conditions.
5. Speed control of 3 Φ Induction motor by variable frequency method
   Plot speed vs frequency characteristics of a 3 Φ cage Induction motor under variable frequency method of speed control, under no load and constant load conditions

Single Phase Induction Motor

6. Single Phase Induction Motor
   (i). Study the different type of single phase Induction motors.
   (ii). Perform no load and blocked rotor tests on a single phase Induction motor and determine the equivalent circuit parameters and there from Pre-determine the performance characteristics.
   (iii). Conduct speed control of a Single Phase Induction motor by variable voltage method and plot the characteristics.

3 Phase Alternators

7. Voltage regulation of a 3 Φ alternator
   (i). Conduct open circuit and short circuit test on a 3 Φ alternator and plot OCC , SCC and ZPF characteristics
   (ii). Predetermine the voltage regulation curve for half and full load by EMF, MMF,ZPF and ASA methods
   (iii). Plot the power Vs power angle diagram
8. Slip test on Salient pole alternator
   (i). Conduct the slip test on 3 Φ salient pole alternator to obtain direct axis and quadrature axis reactances
   (ii). Predetermine the regulation at different loads and power factors and plot the power Vs power angle diagram
9. V curves of a 3 Φ synchronous machine
   (i). Synchronise a 3 phase alternator to the supply mains using dark and bright lamp methods.
   (ii). Plot the V curves and inverted V curves as a generator and motor under constant power condition.

Sessional work assessment	
Laboratory practicals and record	= 35
Test	= 15
Total marks	= 50

2K6 EE 608(P) : POWER ELECTRONICS LAB

3 hours practical per week

1. Study of Power devices – SCR, TRIAC, DIAC, Power transistor. Power MOSFET, IGBT, etc.
2. Characteristics of SCR & TRIAC
3. Phase control circuit using R & RC Triggering
4. UJT Trigger circuit for single phase controlled rectifier.
5. Experiments on Zero voltage switching circuits.
6. Single phase fully controlled SCR circuit.
7. Experiments on buck converter.
8. Experiments on boost converter.
9. Experiments on different types of commutation.
10. Three phase half controlled and fully controlled converter.
11. Experiments on Switched mode Power supply.
12. Experiments on Single phase dual converter.
13. Experiments on Single phase Cycloconverter.
14. Experiments on Power MOSFET chopper.
15. Study of DC motor control using converter.
16. Experiments on Single phase induction motor control – PWM

A minimum of 12 experiments to be done according to the facility available in the laboratory.

Sessional work assessment	
Laboratory practicals and record	= 35
Test	= 15
Total marks	= 50

KANNUR UNIVERSITY

FACULTY OF ENGINEERING

Curricula, Scheme of Examinations & Syllabus for Semesters VII & VIII of B.Tech. Degree Programme in Electrical & Electronics Engineering with effect from 2007 Admissions

SEVENTH SEMESTER

Code	Subject	Hours /Week			Sessional Marks	University Examination	
		L	T	P/D		Hrs	Marks
2K6EE 701	Industrial Management	3	1	-	50	3	100
2K6EE 702	Digital Signal Processing	3	1	-	50	3	100
2K6EE 703	Control Systems II	3	1	-	50	3	100
2K6EE 704	Power Systems III	3	1	-	50	3	100
2K6EE 705	Elective II	3	1	-	50	3	100
2K6EE 706(P)	Advanced Electrical Engg: Lab	-	-	3	50	3	100
2K6EE 707(P)	Software Lab	-	-	3	50	3	100
2K6EE 708(P)	Mini Project	-	-	4	50	-	-
2K6EE 709(P)	Physical Education, Health & Fitness				50		
TOTAL		**15**	**5**	**10**	**450**	**-**	**700**

Elective II

2K6 EE 705(A) – High Voltage Engineering
2K6 EE 705(B) – Electrical Machine modelling & Analysis
2K6 EE 705(C) - Switched Mode Power Converters
2K6 EE 705(D) - Biomedical Engineering
2K6 EE 705(E) – Robotics & Artificial Intelligence
2K6 EE 705(F) - Entrepreneurship

EIGHTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/D		Hrs	Marks
2K6 EE 801	Instrumentation Systems	3	1	-	50	3	100
2K6 EE 802	Industrial Electric Drives	3	1	-	50	3	100
2K6 EE 803	Electrical Machine design	3	1	-	50	3	100
2K6 EE 804	Energy Technology	3	1	-	50	3	100
2K6 EE 805	Elective III	3	1	-	50	3	100
2K6 EE 806(P)	Seminar	-	-	4	50	-	-
*2K6 EE 807(P)	Project & Industrial Training	-	-	6	100	-	
2K6 EE 808(P)	Viva Voce	-	-	-	-	-	100
TOTAL **Aggregate marks for 8 semesters = 8400**		**15**	**5**	**10**	**400** **3000**	**-**	**600** **5400**

*25 Marks is allocated for Industrial Training

Elective III

2K6 EE 805(A) – Power System Operation & Control
2K6 EE 805(B) – Special Machines & Linear Machines
2K6 EE 805(C) - Neural Networks & Fuzzy Logic
2K6 EE 805(D) – Digital System design
2K6 EE 805(E) –Satellite Communication Systems
2K6 EE 805(F) – HVDC & FACTS

2K6 EE 701 INDUSTRIAL MANAGEMENT

3 hours lecture and 1 hour tutorial per week

Module I (12 HOURS)

Concepts of Management and Organisation - Functions of Management - Evolution of Management Thought : Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Theory Y, Mayo's Hawthorne Experiments, Hertzberg's Two Factor Theory of Motivation, Maslow's Hierarchy of Human Needs - Systems Approach to Management.

Module II (13 HOURS)

Designing Organisational Structures : Basic concepts related to Organisation - Departmentation and Decentralisation, Types of mechanistic and organic structures of organisation (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organisation, Cellular Organisation, team structure, boundaryless organization, inverted pyramid structure, lean and flat organization structure) and their merits, demerits and suitability. Introduction to TQM-Quality Circles, ISO 9000 series procedures.

Module III (13 HOURS)

Plant location, definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection of plant- Matrix approach. Plant Layout definition, objectives, types of production, types of plant layout - various data analyzing forms-travel chart.

Introduction to PERT / CPM : Project management, network modeling-probabilistic model, various types of activity times estimation-programme evaluation review techniques- Critical Path-probability of completing the project, deterministic model, critical path method (CP-critical path calculation-crashing of simple of networks.

Module IV (14 HOURS)

Work study - Definition, objectives, method study - definition, objectives, steps involved- various types of associated charts-difference between micromotion and memomotion studies. Work measurement- definition, time study, steps involved-equipment, different methods of performance rating- allowances, standard time calculation. Work Sampling - definition, steps involved, standard time calculations, differences with time study.

Introduction to Human Resource Management, Functions of HRM, Job Evaluation, different types of evaluation methods. Job description, Merit Rating.- difference with job evaluation, different methods of merit ratings, wage incentives, different types of wage incentive schemes. Marketing, marketing vs selling, marketing mix, product life cycle.

Text books

1. Amrine, Manufacturing Organization and Management, Pearson, 2nd Edition, 2004.
2. Industrial Engineering and Management O.P. Khanna Dhanpat Rai.

References

1. Stoner, Freeman, Gilbert, Management, 6th Ed, Pearson Education, New Delhi, 2005.
2. Panner Selvam, Production and Operations Management, PHI, 2004.
3. Ralph M Barnes, Motion and Time Studies, John Wiley and Sons, 2004.
4. Chase, Jacobs, Aquilano, Operations Management, TMH 10th Edition, 2003.
5. L.S.Srinath, PERT / CPM, affiliate East-West Press, New Delhi, 2000.
6. Gary Dessler, Human Resource Management, Pearson Education Asia, 2002.
7. Phillip Kotler, Marketing Management, Pearson, 2004.

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

University examination pattern

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

2K6 EE 702 : DIGITAL SIGNAL PROCESSING

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Discrete Signals – Signal Representation – Standard Discrete Time Signals – Classification of Discrete Time Signals – Basic Operations on Discrete Signals – Shifting, Time Reversal, Time Scaling, Scalar Multiplication, Signal Multiplier, Addition operation.

Discrete Time System – Classifications- Static & Dynamic Systems, Time Variant & Time Invariant Systems, Causal & Non Causal Systems, Linear & Non Linear Systems, FIR and IIR Systems, Stable & Unstable Systems – Representation of arbitrary Sequence. Impulse Response and Convolution Sum, Convolution and Correlation of two Sequences - Inverse System - de convolution.

Analysis of LTI discrete systems – Solution of difference equations by direct method, natural response, forced response- Step response and determination of impulse response h(n) from second order difference equation.

Module II (12 hours)

Frequency domain representations – representations of Discrete time Fourier series(DTFS)- Discrete time Fourier transform(DTFT) and its properties – frequency response of LTI Discrete- time system - sampling – aliasing effect- sampling theorem- - Z transforms - inverse Z transforms - bilinear transformation.

Representation of discrete Fourier series (DFS) - Discrete Fourier transforms (DFT) and its properties. Inverse Discrete Fourier transforms (IDFT) - linear convolution – circular convolution - linear convolution with circular convolution using DFT - overlap - add method - overlap - save method.

Module III (14 hours)

FFT - Radix2 DIT FFT algorithm - Radix2 DIF FFT algorithm - IDFT using FFT algorithm-butterfly structure - bit reversed order - in - place computations

Structures for realization of IIR systems and FIR systems.

Quantization noise – derivation for quantization noise power – Fixed point and binary floating point number representation – comparison – over flow error – truncation error –DSP chips - architecture of fixed point DSP core (schematics only)

Module IV (13 hours)

Digital filter design techniques - design of IIR filters from analog filters - analog to digital transformation - backward - difference and forward - difference approximations - impulse invariant transformation - bilinear transformation - prewarping - analog butterworth function for various filters - design example - properties of FIR filters - design of FIR filters using windows - comparison of IIR and FIR filters - finite word length effect in DSP

Text books

1. Oppenhiem A.V. & Schafer R.W., *Discrete-Time Signal Processing*, Prentice Hall of India
2. Mitra S.K., *Digital Signal Processing - A Computer Based Approach,* Tata McGraw Hill

Reference books

1. Ziemer R.E., Tranter W.H., & Fannin D.R, *Signals And Systems-Continuous And Discrete*, Pearson Education
2. Proakins J.G. & Manolakins D.G., *Digital Signal Processing-Principles Algorithms And Applications*, Prentice Hall of India
3. Rabiner L.R. & Gold B*, Theory and Application of Digital Signal Processing*, Prentice Hall Of India
4. Ifeachor E.C., & Jervis B.W., *Digital Signal Processing-A Practical Approach,* Addison Wesley
5. *DSP Users Manual,* Texas Instruments, TMS320C54*DSP
6. *CPU And peripherals reference set Vol. 1*, DSP solutions

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

University examination pattern

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

2K6 EE 703 : CONTROL SYSTEMS II

3 hours lecture and 1 hour tutorial per week

Module I (14hours)

State-space analysis of systems – Concept of state-state space and state variables-advantages over transfer function approach-state equations for typical electrical, mechanical and electromechanical systems-representation for linear time-varying and time-invariant systems- Phase variable and canonical forms-diagonalization-transfer function and state equations-matrix exponential- solution by state transition matrix-transfer function decomposition-Discrete-time state models-solution of discrete-time state equation-z transform decomposition.

Module II (10hours)

Design using conventional methods - Cascade compensation - PI, PD and PID control - lead and lag compensation using RC networks - design of lead, lag and lead-lag compensators using frequency response and root locus methods.

Module III (12 hours)

Non-linear systems - characteristics of non-linear systems - types of nonlinearities -phase plane analysis - construction –isocline method and delta method- singular points - classification of singular points.
Describing function analysis - definition - describing functions of common non-linearities –ideal relay,dead zone, saturation, combined dead zone and saturation-relay with hysteresis- stability analysis using DF - amplitude and frequency of limit cycle using DF.

Module IV (16 hours)

Liapunov methods – Sign definiteness of a function, Sylvester's criteria-stability in the sense of Liapunov - definition of stability, asymptotic stability and instability –Liapunov's second method - Liapunov stability analysis of LTIV continuous time and discrete time systems.

Controllability, observability and introduction to optimal control - concept and criteria for controllability and observability - state feed back - design via pole placement - formulation of the optimal control problem - performance measure - optimal control using second method of Liapunov - the quadratic regulator problem - solution of the reduced matrix Riccati equation

Reference books

1.Ogata K., *Modern Control Engineering*, Prentice Hall
2.Nagarath & Gopal, *Control System Engineering*, Wiley Eastern
3.Kuo B.C., *Automatic Control Systems,* Prentice Hall
4.Ogata K., *Discrete-Time Control Systems*, Prentice Hall
5.Donald E. Kirk, *Optimal Control Theory*, Prentice Hall

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

University examination pattern

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

2K6 EE 704: POWER SYSTEMS-III

3 hours lecture and 1 hour tutorial per week

Module –I (13hrs)

Circuit breakers – principle of operation – air blast CB – Oil CB – SF6 CB – Vacuum CB – CB ratings –causes of over voltages – surges and traveling waves – voltage waves on loss less transmission lines – reflection and attenuation – protection against lightning –earth wires – lightning diverters – surge absorbers - arcing grounds – neutral earthing – Basic concepts of insulation levels and their selection - BIL – coordination of insulation.

Module –II(13hrs)

Protective relaying – protective zones – requirements of protective relaying – different types of relays and their applications – generalized theory of relays – protective schemes for generators, motors, transmission lines and bus bars – static relays – amplitude and phase comparators – block diagrams – protective schemes for generators, motors, transmission lines and bus bars - microprocessor based protective relaying.

Module –III(13hrs)

Industrial utilization of motors – factors governing selection of motors – Electrical considerations-matching of characteristics of load and motor – electric braking – regenerative braking – mechanical considerations-Types of enclosures- Types of transmission- heating and cooling curves- determination of rating of motor –short time , intermittent and continuous ratings -.

Electric traction - systems of traction – requirements of traction motors - speed time curve – mechanics of train movement – tractive effort for propulsion of train – power output from driving axles – specific energy consumption – methods of current collection.

Module – IV(13hrs)

Introduction to Flexible AC transmission System (FACTS) controllers- SVC, TCSC, Voltage Source Converter based controllers- Equivalent circuit, benefits and applications.

Power quality –fundamental concepts – sources, causes and effects of power quality problems– harmonics – measurement of power quality-THD- TIF – DIN – power quality standards - monitoring - mitigation techniques- passive filter design - active filter- custom power devices- distribution static compensator – dynamic voltage restorer- unified power quality conditioner.

Reference books

1. 1.Sunil S Rao, Switch Gear Protections, Khanna Publishers
2. 2.J.B. Gupta Utilization of electric power & electric traction, S K Kataria & sons
3. 3.J.B. Gupta Switchgear & Protection S K Kataria & sons
4. 4.Soni, Gupta & Bhatnagar, A Course in Electrical Power, Dhanpat Rai & Sons
5. 5.Van. C. Warrington A.R., Protective Relays Vol. 1 & 2, Chappman & Hall
6. 6.Mason C.R., Art and Science of Protective Relaying, Wiley Eastern.
7. 7.Ravindranath M. Chander, Power System Protection and Switchgear
8. 8.K R Padiyar, "FACTS controllers for transmission and distribution," New age International, New Delhi 2007.
9. 9.Haydt G.T., Electric Power Quality

Sessional work assessment

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

University examination pattern

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

2K6 EE 705(A): HIGH VOLTAGE ENGINEERING

3 hours lecture and 1 hour tutorial per week

Module I (13 hours

Dielectrics and dielectric breakdown – electric breakdown in gas and gas mixtures- breakdown in uniform and non-uniform fields- Paschen's law-Twon-send criterion-penning effect-streamer mechanism-corona discharge-electronegative gas- breakdown in surge voltage-time lag-practical consideration in using gases for insulation purpose-breakdown in high vacuum- breakdown in liquid dielectrics-pure liquids and commercial liquids-electronic and cavitations breakdown – suspended practical mechanism-breakdown in solid dielectric-intrinsic-electromechanical-steamer and thermal breakdown-treeing phenomenon-partial discharge-breakdown of composite dielectrics

Module II (13 hours)

Generation of high voltages and currents-DC voltages-Voltage doubler- cascade-electrostatic machines-Voltage stabilization-AC voltages-cascade Transformers – series resonance circuits-impulse voltages-single stage and multistage circuits-wave shaping-tripping and control of impulse generators-synchronization with oscilloscope- generation of switching surge voltage-generation of impulse currents.

Module III (13 hours)

Measurement of high voltages and currents –DC-AC and impulse Voltages and currents – CRO – electrostatic generating and peak voltmeters, sphere gaps – factors affecting measurements- potential dividers (Capacitive and resistive)- series impedance ammeters – Ragoski coils-magnetic links-hall effect generators – PT's (magnetic and capacitive types) and CT's .

Module IV (13 hours)

H.V testing of materials and apparatus-acceptance-preventive and diagnostic tests-dielectric loss measurements-Schering bride-inductively coupled ratio arm bridge – loss measurement on complete equipment – partial discharge and ratio interference measurements – over voltage phenomenon and insulation co-ordination-traveling waves-line equations-wave transmission-reflection and attenuation-lighting phenomenon-switching surges-principle of insulation – co-ordination on HV and EHV systems-protection

Reference Books

1. Bewley L.V., Traveling waves on Transmission , Lines Dover Publishers
2. Kufee E & Abdulla M, High Voltage Engineering, Pergman Press
3. Naidu M S & Kamaraju V, High Voltage Engineering, Tata MC Graw Hill
4. Alston L L, H V Technology, Oxford, University Press
5. Craggs J D & Meed J M, H V Technique, Butterworths
6. Dieter Kind Wiley Lts, An Introduction to H V Experimental Technique
7. Kreuger Haywood, Discharge Detection in H V Equipment London
8. Thapar etal B, Power System Transients and High Voltage Principles, Capital pub
9. IEEE Standard Technique fo High Voltage testing, IEEE John wiley and Sons
10. Indian Standard

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

11. British Standards
    B5:3959, B5:3070, B5:2914-1957

IEC Publications No: 99-1, Part1 -1970

Sessional work assessment

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

University examination pattern

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

2K6 EE 705(B): ELECTRICAL MACHINE MODELLING & ANALYSIS

3 hours lecture and 1 hour tutorial per week

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

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

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

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

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

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

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

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

Reference books

1.Sengupta D.P. & Lynn J.B., *Electrical Machine Dynamics,* The Macmillan Press Ltd.
2.Jones C.V., *The Unified Theory of Electrical Machines*, Butterworth
3.Woodson & Melcher, *Electromechanical Dynamics*, John Wiley & Sons
4.Kraus P.C., *Analysis of Electrical Machines*, McGraw Hill Book Company
5.Boldia I. & Nasar S.A., *Electrical Machine Dynamics*, The Macmillan Press Ltd.

Sessional work assessment

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

University examination pattern

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

2K6 EE 705(C): SWITCHED MODE POWER CONVERTERS

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Switching regulators- Introduction- Circuit scheme - Basic switching regulators-Buck converters - Continuous conduction mode - Boundary between continuous and discontinuous conduction - Discontinuous conduction mode - Output voltage ripple –Numerical examples – Boost converter - Continuous conduction mode - Boundary between continuous and discontinuous conduction - Discontinuous conduction mode - Numerical examples –Buck Boost converter - Continuous conduction mode - Boundary between continuous and discontinuous conduction - Discontinuous conduction mode - Output voltage ripple - Numerical examples- Cuk dc-dc converter. Comparison between DC-DC converters – Applications.

Module II (13 hours)

Switching dc power supplies with electric isolation –Necessity of Isolation transformer – Fly back converters-– Push pull converter – Half bridge converter –Full bridge converter- -Forward converter – Dual forward converter

Some Typical circuit of single ended converter- Circuit diagram of simple buck regulator using SG 1524 and SG1525-Circuit diagram of PWM controlled off line forward converter using IC UC 1524 A – Circuit diagram of an Off line forward converter using a MOSFET

Current mode control of switching regulators - Basic diagram of a current mode control of a boost regulator-Integrated circuit implementation of current mode control scheme by using UC 1846. Forward converter using current mode control IC-Slope compensation in current mode regulator.

Module III (13 hours)

Switch mode dc-ac Inverters- Basic concepts of switch mode inverters - PWM switching scheme - Square wave switching scheme - Single phase inverters - Half bridge and full bridge inverters - SPWM with bipolar and unipolar voltage switching - Switch utilization in single phase inverters - Three phase inverters - SPWM in three phase voltage source inverters - Square wave operation in three phase inverters - Switch utilization - Ripple in the inverter output - Conduction of switches in three phase inverters - Effect of blanking time on voltage in PWM inverters - Square wave pulse switching - Programmed harmonic elimination switching - Current regulated modulation

Three phase current source inverter and its applications –Three phase voltage source inverter and its applications

Module IV (13 hours)

Resonant Pulse inverters - Classification – Series resonant inverters with unidirectional switches and with bidirectional switches – Frequency response for series and parallel loaded – Parallel resonant inverters – Voltage control of resonant inverters – Class E resonant inverter – ZVS resonant converters –ZCS resonant converters M type and L type – Comparison between ZVS & ZCS resonant converters- Two quadrant ZVS resonant converter – Resonant DC link Inverters

Multi level inverters and Multistage conversions –Multi level inverter- Concepts- General topology-Flying capacitor multilevel inverter –Principle of operation –Multi stage conversions – Control circuits voltage mode control and current mode control – Introduction about Matrix converter.

Reference books

1.Ned Mohan et.al, *Power Electronics*, John Wiley and Sons
2.P.C.Sen ,Modern Power Electronics , S.Chand & Company
3.Muhammed H.Rashid, Power Electronics- Third edition, Pearson education .
4.Keith H Billings, *Handbook of Switched Mode Power Supplies*, McGraw Hill Publishing Company

Sessional work assessment

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

University examination pattern

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

2K6 EE 705(D): BIOMEDICAL ENGINEERING

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Electrical activity of excitable cells - SD curve - functional organization of the peripheral nervous system - electrocardiogram (in detail with all lead systems) - electroencephalogram - electromyogram - electroneurogram - electrode - electrolyte interface - polarisation - polarisable and non polarisable electrodes - surface electrodes - needle electrodes - micro electrodes - practical hints for using electrodes - 'skin -electrode' equivalent circuit - characteristics of 'bio - amplifiers'

Module II (13 hours)

Blood pressure - direct measurements - harmonic analysis of blood pressure waveform - systems for measuring venous pressure - heart sounds - phonocardiography - cardiac catheterisation - indirect blood pressure measurement - electromagnetic blood flow meters - ultrasonic blood flow meters - impedance plethysmography - photo plethysmography - 'indicator-dilution' method for blood flow determination - spirometry - measurement of various respiratory parameters - respiratory plethysmography - chamber plethysmography

Module III (13 hours)

Measurement of gas flow rate - cardiac pacemakers and other electric stimulators - defbrillators and cardio converters - blood pumps - hemodialysis - ventilators - infant incubators - drug delivery devices - lithotripsy - therapeutic applications of laser

Module IV (13 hours)

Physiological effects of electricity - important susceptibility parameters - macro shock hazards - micro shock hazards - protection against shock - electrical isolation - electrical safety analyzers - measurement of pH, PCO_2 and PO_2

Reference books

1.John G. Webster, *Medical Instrumentation - Application and Design,* John Wiley and Sons
2.Hand Book of Biomedical Instrumentation, Khandpur, TMH
3.Raja Rao C. & Guha S.K., *Principles of Medical Electronics & Biomedical Instrumentation,* Universities Press
4.Geddes & Baker, *Principles of Applied Biomedical Instrumentation*, Wiley, Latest edition
5.Wiley, *Encyclopedia of Medical Devices and Instrumentation*, Latest edition
6.Bronzino, *Hand book of Biomedical Engineering,* IEEE Press book

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

University examination pattern

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

2K6 EE 705 (E): ROBOTICS & ARTIFICIAL INTELLIGENCE

3 hours lecture and 1 hour tutorial per week

Module I (12 Hours)

Introduction to robotics – Classification of Robots – Direct Kinematics –The Arm Equation- A Five –Axis articulated Robot(Rhino XR-3) – Inverse Kinematic Problem – Inverse Kinematics of a Five axis articulated robot – Workspace Analysis – Continuous- Path Motion .

Module II (12 Hours)

Robot control: The control problem – State equation – Constant solutions – Linear feedback systems - Single-axis PID control – PD-Gravity control – Computed-Torque control – Variable-Structure control – Impedance control . Robot applications – Industrial automation – General layout.

Module III (14 hours)

Artificial Intelligence- Definition - history and applications - propositional calculus -predicate calculus - inference rules - structures and strategies for state space search - heuristic search algorithms - heuristics in games - complexity issues - control and implementation of state space search - production systems - planning - the blackboard architecture

Module IV (14 hours)

Languages and programming techniques for AI - overview of LISP - search - higher order functions and procedural abstractions - search strategies - pattern matching - recursion - interpreters - logic programming in LISP - streams and delayed evaluation - network representations and inheritance - CLOS.

Reference books

1. Robert J.Schilling, "Fundamentals of Robotics – Analysis & Control", Prentice Hall of India Pvt. Ltd., 2006.
2.Introduction to Robotics (Mechanics & Control), John J. Craig, Pearson Education Asia 2002.
3.Saeed B.Niku, "Introduction to Robotics – Analysis, Systems, Applications", Prentice Hall of India Pvt. Ltd., 2003.
4.Luger G.F. & Stubblefield W.A., Artificial Intelligence, 3/e, Addison Wesley
5.Nils J Nilsson, Artificial Intelligence - A New Synthesis, Harcourt Asia Pte. Ltd.
6.Elain Rich & Kevin Knight, Artificial Intelligence, 2/e, Tata McGraw Hill
7.Steven L Tanimotto, The Elements of Artificial Intelligence, Computer Science Press
Winston P.H., LISP, Addison Wesley

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

University examination pattern

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

2K6 EE 705 (F): ENTREPRENEURSHIP

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Entrepreneur- Functions and classifications of entrepreneurs - Characteristics of entrepreneur - Nature and importance of entrepreneur - Entrepreneur vs. professional manager - Women entrepreneurs.

Module II (13 hours)

Concept of Entrepreneurship - Enterpreneurship and environment-Policies governing entrepreneurs-entrepreneurial development programmes - Institutions for - entrepreneurship development, -Entrepreneurship development in other countries.

Module III (13 hours)

Entrepreneurial motivation theories-entrepreneurial competencies-Developing competencies-Role of entrepreneur-Assistance programmes for small scale units-Role of SSI sector in the economy-SSI units-failure ,causes and preventive measures-

Module IV (14 hours)

Concept and classification of project- identification- project formulation - project report - project design - project appraisal - profitability appraisal - project planning - social cost benefit analysis - financial analysis and project financing. Role of financial institutions -Bank finance to entrepreneurs-Role of development financial institutions

Reference books

1. Harold Koontz & Heinz Weihrich, *Essentials of Management*, McGraw Hill International
2. Robert D Hirich & Michael P Peters Irwin, *Entrepreneurship*, McGraw Hill
3. Rao T.V. & Deshpande M.V., Prayag Metha, Manohar S Nadakarni, *Developing Entrepreneurship A Hand Book,* Learning Systems
4. Donald Kurado & Richard M Hodgelts*, Entrepreneurship A Contemporary Approach,* The Dryden Press
5. Dr Patel V.G., *Seven Business Crisis*, Tata McGraw Hill
6. Jeffry A Timmons, *New Venture Creation - Entrepreneurship for 21st Century,* McGraw Hill International, 5th Edition
7. Patel J.B., Noid S.S., *A Manual on Business Opportunity Identification*, *Selections*, EDII
8. Rao C.R., *Finance for Small Scale Industries*
9. Pandey G.W., *A Complete Guide to Successful Entrepreneurship,* Vikas Publishing

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

University examination pattern

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

2K6 EE 706(P): ADVANCED ELECTRICAL ENGINEERING LAB

3 hours practical per week

(Twelve experiments from the following topics listed will be scheduled for the laboratory depending on the availability of equipment, components etc.)

1. Determination of transfer function of DC motor (a) armature control (b) field control
2. Study and experiments on (a) DC servo motor (b) AC servo motor
3. Experiments on synchros (a) characteristics (b) data transmission (b) error detection (d) differential synchro
4. Magnetic amplifier - characteristics and control circuits.
5. Determination of transfer function of the amplidyne and load characteristics
6. Closed loop voltage voltage regulation of DC Generator using Amplidyne
7. Design and experimental determination of frequency response determination of lag, lead and lag-lead networks
8. Study and experiments using PID Controller.
9. Determination of relay characteristics
10. Experiments on Sphere Gaps
11. Study and experiments using Power , Energy and Harmonic Analyser.
12. Study of 8085 & 8086 Microprocessors and implementation of simple programs.
13. 8085 Microprocessor based generation of Non – Linear functions using proper interfacing and display devices.
14. 8086 Microprocessor based generation of Non – Linear functions using proper interfacing and display devices.
15. DC Motor interfacing and relay interfacing using 8085 & 8086 Microprocessor kits .
16. Study of 8051 Microcontroller and implementation of simple programs.
17. Generation of Sine wave , Square wave, sawtooth wave and triangular wave using 8051 Microcontroller
18. Familiarisation of DSP Kits

Sessional work assessment	
Laboratory practicals and record	= 35
Test	= 15
Total marks	= 50

2K6 EE 707(P): SOFTWARE LAB

3 hours practical per week

(12 Experiments should be done in the lab classes and recorded, covering at least one experiment per Module. The remaining should be practiced)

Module I: C Programming

1. Simple programs (Factorial computation, displaying Pascals triangle, palindrome checking , fibonacci sequence, checking for prime numbers etc.)
2. Programs using decision and statements in C (Eg. Bubble sorting, quick sorting programs etc)
3. Functions – Pass by value, pass by reference, passing arrays
4. File Handling programs (Eg: Plotting a curves after reading from a file and writing to a file)
5. Matrix manipulations – multiplication, inverse, determinants, transpose.

Module II: Numerical Analysis using C

1. Solution of differential equations – Eulers & Ranga Kutta- Comparison
2. Solution of linear equations – Gauss elimination, Gauss Jordan & Gauss- Siedel-Comparison
3. Solution of numerical integration – Trapezoidal & Simpsons -Comparison

Modulte III : MATLAB Programming:

1. Familiarization of basic MATLAB commands
2. Time domain response of a second order system for step input and obtain performance parameters.
3. Conversion of transfer function of a system into state space form and vice-versa.
4. Root locus diagram of an open loop transfer function and determine range of gain 'k' for stability.
5. Bode diagram of an open loop transfer function.
6. To draw a Nyquist plot of an open loop transfer functions and examine the stability of the closed loop system.
7. Design of a lag, lead and lag lead compensator for given specifications.

Module IV: MATLAB/SIMULINK Experiments :

1. Single phase and three phase diode bridge rectifiers
2. Single phase half wave controlled converter with R and RL load.
2. Single phase fully controlled converter with R and RL load
3. Three phase fully controlled converter with R and RL load.
4. Single phase AC voltage controller with R and RL load.
5. Buck, boost and buck boost converters for a given switching frequency
6. Cyclo converters
7. Sine PWM DC-AC Converter

Module V : Pspice/Electronic workbench/SEQUEL or any Circuit simulation software

1. Determination of node voltages and branch currents in a resistive network.
2. Thevenin's equivalent circuit of a resistive network.
3. Transient response of (a) series R-L-C circuit for step voltage input, (b) parallel R-L-C circuit for step current input.
4. Transient response of a series R-L-C circuit for alternating square voltage waveform.
5. Frequency response of a series R-L-C circuit for sinusoidal voltage input.
6. Transient response of output voltage in a single phase half wave rectifier circuit using capacitance filter.
7. Single phase and three phase diode bridge rectifiers
8. Single phase and three phase SCR bridge rectifiers

Module VI: Power system simulation (using any power flow analysis package)

1. Power flow analysis using Gauss Siedel /Newton Raphson's/ Fast Decoupled Method.
2. Developing a Single line Diagram of a Power System.
3. Fault analysis with a single line diagram. Obtaining the sub-transient fault currents for (a) Symmetrical Faults, (b) Line to Ground Fault, (c) Line to Line Faults etc.

Sessional work assessment	
Laboratory practicals and record	= 35
Test	= 15
Total marks	= 50

2K6 EE 708(P): MINI PROJECT

4 hours per week

The project work can be a modelling/design project, experimental project or computer simulation projects in the topics of Electrical & Electronics Engineering interest. It can be allotted as a group project with groups consisting of three to five students

The assessment of all the mini projects shall be done by a committee consisting of three or four faculty members specialised in the various fields of Electrical & Electronics Engineering - the students will present their project work before the committee - the group average marks for the various projects will be fixed by the committee - the guides will award the marks for the individual students in a project maintaining the group average - each group will prepare the project report and submit to the department through the guide - the Head of the department will certify the copies and shall retain one copy in the departmental library

Sessional work assessment	
Presentation	: 30
Report	: 20
Total marks	: 50

2K6 EE 709(P): PHYSICAL EDUCATION, HEALTH & FITNESS

Introductory Lectures:

Unit 1: Health and fitness: Modern concept of health and fitness, meaning, scope, need and importance of health, fitness and wellness.

Unit II: Exercise and fitness: Means and methods of developing fitness. Importance of physical activities and exercises in developing and maintaining good health, Physical fitness and well being.

Unit III : Sports and Physical education: Meaning and scope, role and importance of sports and games in the development of physical fitness and personality. Social values of sports. Rules of major games.

Practical Sessions:

(All classes will be conducted after the normal working hours of the college)

50 sessions of minimum 1 hour duration each are envisaged (including Theory and Practical). The student can opt for one of the following activities in line with the specific programme / schedule announced by the faculty.

Athletics, Badminton, Basketball, Cricket, Football, General fitness, Hockey, Kabadi, Table Tennis, Ball Badminton, Archery, Volley ball, Yoga (not all activities may be offered in a particular semester. More disciplines will be offered based on the availability of infrastructure and expertise).

In addition, health and fitness assessment such as height, Weight, Resting Pulse rate and blood Pressure will be carried out.

Objective :

a) Basically to inculcate awareness of health, general fitness and attitude to voluntary physical involvement.
b) To promote learning of basic skills in sports activities and secondarily to pave the way for mastering some of the skills through continued future involvement.

Scheme of assessment:

The student will be continuously assessed on his performance on the field of play. There will not be minimum mark for pass or fail. Total 50 marks will be given assessing their attendance, regularity, punctuality and performance for 50 hours of activity from 1st semester to 7th semester.

2K6 EE 801: INSTRUMENTATION SYSTEMS

3 hours lecture and 1 hour tutorial per week

Module I: (14 hours) **Transducers**

Definition-different types of transducers-criteria for selection-general characteristics-dynamic characteristics-calibration-transducers for measurement of displacement-velocity-acceleration-speed- angular rotation–altitude-flow-liquid level-force-torque-humidity and moisture-pressure-strain and temperature-Hall effect transducers and applications

Module II: (12 Hours) **Signal conditioning, data transmission and Telemetry**

Signal conditioning-instrumentation amplifiers-different amplifiers-filters-low pass-high pass-band pass and band rejection filters-transducer bridges- null type and deflection bridges-AC bridges using push pull transducers-Data transmission and telemetry-methods of data transmission-general telemetry systems-sampling process-principles of time division and frequency division multiplexing-Modulation-AM,FM,PM,PAM,FWM,PPM and PCM as applied to telemetry.

Module III: (14 Hours) **Display methods, Recorders Experimental and Statistical analysis**

Display methods and devices-different types of display –display system building blocks. Recorders-galvanometric recorders-pen driving system-servo recorders-magnetic recorders-digital recorders-Experiments and statistical analysis-performance of experiment-the record of experiment-accuracy and precision-classification of errors-the characteristics of experimental data-description of dispensed data-type of probability distribution-probability error-combination of variances-combined error-guarantee errors.

Module IV: (12 Hours) **Instrumentation systems**

Basic Measuring system-Analog and digital data acquisition systems-generalized input-output configuration of measuring systems-dynamic characteristics-mathematical model-the concept transfer function (with special reference to measuring system)-procedure for developing transfer function-response to various type of inputs-classification of instruments based on their order & dynamic and frequency response studies-process control systems for temperature, level and pressure.

Reference Books

1.Sawhney A.K., A Course in Electrical and Electronic Measurement and Instrumentation, Dhanpat Rai and Sons

2. William David Cooper, Electronic Instrumentation and Measurement Techniques, prentice Hall

3. Ernet O. Doblin, Measurement System Application and Design, Mc Graw Hill International Edition

4. Klaassan K.B., Electronic Measurement and Instrumentation, Cambridge University Press

5. J B Gupta, Electronic & Electrical Measurements and Instrumentation , S K Kataria & Sons

6.Earnest C Doblin, Measurement System Application and Design, McGraw Hill

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

University examination pattern

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

2K6 EE 802 : INDUSTRIAL ELECTRIC DRIVES

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Electric drives - Block diagram of an electric drive - Parts of electric drives – Choice of electric drives – Speed torque conventions and multi quadrant operations-Drive parameters- Components of load torque - Steady state stability - Load equalization – Numerical examples

Control of electrical drives - Closed loop control of drives - Multi motor drives- current limit control - Speed sensing - Current sensing - Phase locked loop speed control-Closed loop position control –Necessity of solar powered dives and battery powered drives- Advantages of electric drives.

Module II (14 hours)

Dc motor drives – Methods of speed control- combined armature voltage and field flux control – Rectifier control of DC motors – Single phase half control and fully control – Three phase half control and fully control speed torque characteristics of single phase fully controlled rectifier drive – Numerical examples – Chopper control of DC drive –Principle of operation and control technique – TRC & CLC - Closed loop speed control schemes – Drive with current limit control –Closed loop armature control with field weakening.

Module III (14 hours)

Induction motor drives – Speed torque curves for variable frequency control of induction motor-torque and power capabilities – Fixed frequency variable voltage operation – Variable frequency operation - AC voltage controller circuits – Single quadrant closed loop speed control – Four quadrant closed loop speed control variable frequency control - VSI fed induction motor drive - Operation with field weakening - CSI controlled induction motor drives – Cycloconverter control drives - Slip power recovery schemes - Rotor frequency control - Single phase induction motor drives - Open loop and closed loop variable frequency PWM inverter drive with dynamic braking – Closed loop slip speed controlled PWM inverter drive with regenerative braking - Block diagram and flow charts.

Module IV (12 hours)

Synchronous motor drives –Speed control – Speed torque curves with variable frequency control - VSI and CSI fed drives - Variable frequency control - Self controlled synchronous motor drives – Closed loop speed control of self controlled synchronous motor drive fed from VSI and CSI block diagrams - Brushless dc motor drives - Microprocessor controlled dc and ac drives –Block diagrams and flow charts.

Reference books

1. Dubey G.K, *Fundamentals of Electric Drives*, Narosa Publications
2. Dubey G.K., *Power Semiconductor Controlled Drives*, Prentice Hall
3. Vedam Subramaniam, Thyristor Control of Electric Drives
4. Sen P.C, *Thyristor DC Drives*, John Wiley & Sons
5. Bose B.K et al, *Microcomputer Control of Power Electronics and Drives*, IEE Press

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

University examination pattern

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

2K6 EE 803 : ELECTRICAL MACHINE DESIGN

3 hours lecture and 1 hour tutorial per week

Module I (14 hours)

DC machines - output equation - main dimensions - choice of specific electric and magnetic loadings - choice of speed and number of poles - design of armature conductors, slots and winding - design of air-gap and field system, - Carter's coefficient - real and apparent flux density - design examples

Module II (14 hours)

Transformers - single phase and three phase power transformers - output equation - main dimensions - choice of specific electric and magnetic loadings- design of core, LV winding, HV winding, tank and cooling tubes - design examples - temperature rise calculations - continuous and intermittent rating.

Module III (12 hours)

Alternators - salient pole and turbo alternators - output equation - main dimensions - choice of specific electric and magnetic loadings - choice of speed and number of poles - design of armature conductors, slots and winding - design of air-gap, field system and damper winding - design examples

Module IV (12 hours)

Induction machines - output equation - main dimensions - choice of specific electric and magnetic loadings - design of stator and rotor windings, stator and rotor slots and air-gap of slip ring and squirrel cage motors - calculation of rotor bar and end ring currents in cage rotor - design examples

Reference books

1. Clayton & Hancock, *Performance and Design of DC Machines*, ELBS.
2. Sawhney AK& A Chakrabarti, A course in *Electrical Machine Design*, Dhanpath Rai &Sons.
3. Say M.G., *Performance and Design of AC Machines*, Pitman, ELBS
4. Agarwal AK, Principles of Electrical machine design, SK Kataria & Sons

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

University examination pattern

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

2K6EE 804: ENERGY TECHNOLOGY

3 hours lecture and 1 hour tutorial per week

Module I (12 Hours)

Energy Conservation & Energy Audit: Need for Energy Conservation- Energy Shortage and Environmental aspects- Global & Indian Energy Scenario – Carbon Credit.

Energy audit - Need of Energy auditing-Steps of Energy auditing-Conduct Energy auditing- Energy Auditing in Motors,Transformers & Lighting Systems- Industrial distribution losses – Energy Saving Estimation.

Audit Instruments – Power, Energy & Harmonic Analyser – Thermal Imagers.

Module – II(12Hours)

Energy Saving Systems: Energy Efficient Technologies in Electrical systems – Energy Efficient Motors –Soft Starters- – LED Lighting.

Maximum Demand Controllers – Automatic Power Factor Controllers – Variable impedance type and voltage source converter based power factor correction- SVC and TCSC- STATCOM- harmonic elimination.

Module – III(14 Hours)

Recent Trends in Renewable Energy Technology:

Solar radiation and its measurement- solar radiation geometry-Photovoltaic conversion - Conceptual description of photovoltaic effect - Electrical characteristics of silicon PV cells and modules - Solar cell materials and prospects – Organic solar cells – Application of PV systems- Solar Thermal Power Generation.

Wind and small hydro power - Wind turbines - Horizontal axis and vertical axis wind turbines - Power and energy from wind turbines – Bits limit-Wind characteristics- variation of wind power with elevation- stand alone and grid connected power generation- reactive power, voltage regulation and frequency control- components of small hydro power- case study of a micro hydro project.

Module – IV(14 Hours)

Generators for renewable power generation: Induction generators and permanent magnet generators- self excited generators and doubly fed induction generators- microprocessor based control system for wind farms.

Economics of Energy Conservation: Financial analysis – Fixed and variable costs – Interest charges – Simple pay back period – Discounted cash flow methods-Net present value method-Internal Rate of return method – profitability Index-case study of financial evaluation of renewable energy systems.

References

1. Guide Book for National Certification Examination for Energy Managers & Energy Auditors – Bureau of Energy Efficiency, Ministry of Power, Govt of India.
2. Renewable energy sources and emerging technologies, DP Kothari, KC Singal and Rakesh Ranjan, Prentice Hall, New Delhi-2009.
3. Financial evaluation of renewable energy Technologies, TC Kandpal and H P Garg, Mac millan India, Delhi-2003.
4. Non –Conventional sources of energy-G.D Rai, Khanna Publishers, 2000
5. Solar Energy Utilization-G.D.Rai, Khanna Publishers, 2000
6. Renewable and novel energy sources-S.L Sab, MI Publishers, 1995.
7. Energy Technology-S Rao and B B Parulekar, Khanna Publisher, 1999.
8. Renewable energy sources and their environmental impact-S.A Abbasi and Naseema Abbasi, Prentice-Hall of India, 2001

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

University examination pattern

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

2K6 EE805 (A) POWER SYSTEM OPERATION & CONTROL

3 hours lecture and 1 hour tutorial per week

Module –I (14 hrs)

Unit commitment – constraints in unit commitment - unit commitment solution- priority list method – dynamic programming solution – hydro thermal coordination – long range and short range hydro scheduling – dynamic programming solution to the hydro thermal scheduling.

Module –II (14 hrs)

Power system security – factors affecting power system security – contingency analysis- calculation of sensitivity factors – correcting the generation dispatch – sensitivity methods – linear programming method

Module –III (14 hrs)

An introduction to state estimation of power systems – static state estimation – role & formulation -least squares estimation - weighted LSE - non linear measurements –tracking state estimation of power systems – treatment of bad data – network observability and pseudo measurements - applications of power system state estimation –block diagram of a typical power system control centre real time control of power systems – SCADA

Module IV (10 hrs)

Load forecasting- methodology – estimation of periodic components – time series approach – - estimation of stochastic components- econometric models – reactive load forecast.

References

1) Allen J. Wood, B.F. Wollenburg Power Generation Operation and Control, John Wiley & sons
2) D.P. Nagrath & Kothari Modern Power System Analysis
3) A.K.Mahalanabis, "Computer Aided Power system analysis and control", Tata McGraw Hill 1991
4) O.I. Elgerd: "Electric Energy Systems Theory", McGraw Hill, 2nd Edition, 1982,Dec

Sessional work assessment

Two tests	2 x 15 = 30
Two assignments	2 x 10 = 20
Total	= 50

University examination pattern

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

2K6 EE 805 (B) : SPECIAL MACHINES & LINEAR MACHINES

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Servo motors - symmetrical components applied to two - phase servo motors - equivalent circuit and performance based on symmetrical components - servo motor torque - speed curves

Module II (13 hours)

Stepper motors - construction features - method of operation - drive - amplifiers and transistor logic - half stepping and the required switching sequence - the reluctance type stepper motor - ratings and other characteristics

Module III (13 hours)

Reluctance motors - general - types of synchronous motors - reluctance - motors - definitions - construction - polyphase and split phase reluctance motors - capacitor type reluctance motors - hysteresis motors - construction - polyphase - capacitor type and shaded pole hysteresis motors - universal motors - universal motors - application and torque - characteristics - essential parts of universal motors

Module IV (13 hours)

Linear machines - basic difference between LEMS and rotating - machine - classification of LEMS, linear motors and levitation machines - linear induction motors - linear synchronous motors - DC linear motors - linear levitation machines

Reference books

1. Vincent Del Toro, Electric Machines and Power Systems, Prentice Hall
2. Veinott, Fractional Horsepower Electric Motors, McGraw Hill
3. Nasar S.A., Boldea I., Linear Motion Electric Machine, John Wiley & Sons

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

University examination pattern

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

2K6 EE 805 (C) : NEURAL NETWORKS & FUZZY LOGIC

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Introduction to artificial neural networks - biological neurons - Mc Culloch and Pitts modals of neuron - types of activation function - network architectures - knowledge representation - learning process - error-correction learning - supervised learning - unsupervised learning - single unit mappings and the perceptron - perceptron convergence theorem (with out proof) - method of steepest descent - least mean square algorithms - adaline/medaline units - multilayer perceptrons - derivation of the back-propagation algorithm

Module II (13 hours)

Radial basis and recurrent neural networks - RBF network structure - covers theorem and the separability of patterns - RBF learning strategies - K-means and LMS algorithms - comparison of RBF and MLP networks - recurrent networks - Hopfield networks - energy function - spurious states - error performance - simulated annealing - the Boltzman machine - Boltzman learning rule - the mean field theory machine - MFT learning algorithm - applications of neural network - the XOR problem - traveling salesman problem - image compression using MLPs - character retrieval using Hopfield networks

Module III (13 hours)

Fuzzy logic - fuzzy sets - properties - operations on fuzzy sets - fuzzy relations - operations on fuzzy relations - the extension principle - fuzzy measures - membership functions - fuzzification and defuzzification methods - fuzzy controllers - Mamdani and Sugeno types - design parameters - choice of membership functions - fuzzification and defuzzification methods - applications

Module IV (13 hours)

Introduction to genetic algorithm and hybrid systems - genetic algorithms - natural evolution - properties - classification - GA features - coding - selection - reproduction - cross over and mutation operators basic GA and structure

Introduction to Hybrid systems - concept of neuro-fuzzy and neuro-genetic systems

Reference books

1. Simon Haykins, "*Neural Network a - Comprehensive Foundation"*, Macmillan College, Proc, Con, Inc
2. Zurada J.M., "*Introduction to Artificial Neural Systems,* Jaico Publishers
3. Driankov D., Hellendoorn H. & Reinfrank M., "*An Introduction to Fuzzy Control*", Norosa Publishing House
4. Thimothy J. Ross, *"Fuzzy Logic with Engineering Applications"*, McGraw Hill
5. Bart Kosko. *"Neural Network and Fuzzy Systems"*, Prentice Hall, Inc., Englewood Cliffs
6. David E. Goldberg, *"Genetic Algorithms in Search Optimisation and Machine Learning"*, Addison Wesley
7. Suran Goonatilake & Sukhdev Khebbal (Eds.), *"Intelligent Hybrid Systems*", John Wiley & Sons

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

University examination pattern

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

2K6 EE 805 (D) : DIGITAL SYSTEM DESIGN

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Finite state machine design - the concept of state machine - timing in state machine - FSM design procedure - ASM notation - Moore and Mealy machine design - examples of Moore and Mealy machines - finite state machine word problems

Module II (13 hours)

Asynchonous design - asynchronous ASM - asynchronous system - design principles - problem of asynchronous circuits - hazards - critical races - examples

Module III (13 hours)

Designing with programmable devices - programmable LSI techniques - PLA - logic cell array and atifuse FPGAs - designing with FPGAs - large PAL structures - MAX and XC7000 EPLDs - RAM based FPGAs - FLEX8000/10K families - selecting and using FPGAs

Module IV (13 hours)

Hardware description languages - introduction to VHDL - behavioral modeling - transport vs inertial delay - simulation deltas - sequential processing - process statement - signal assignment vs variable assignment - sequential statements - data types - subprograms and packages - predefined attributes - configurations - subprogram overloading - VHDL synthesis - design examples

Text books

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

Reference books

1. Zoran Salacic, "*Digital System Design and Prototyping Using Field Programmable Logic*", Kluwer Academic Publishers
2. Stephen Brown & Zvonoko Vranesic, "*Fundamentals of Digital Logic with VHDL Design*", McGraw Hill
3. Bhasker J., "*A VHDL Primer*", Addison Wesley 3rd Ed.
4. Navabi Z., "*VHDL: Analysis and Modeling of Digital Systems*", McGraw Hill

Sessional work assessment

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

University examination pattern

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

2K6 EE 805(E) : SATELLITE COMMUNICATION SYSTEMS

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Satellite orbits - solar day and sidereal day - orbital parameters - satellite trajectory - period, velocity and position of a satellite - geostationary satellites - non-geostationary constellations - launching of geostationary satellites - Hohmann transfer - effect of earth's shape - other heavenly bodies - atmospheric drag and radiation pressure on the satellite's orbit

Module II (13 hours)

Communication satellites - spacecraft subsystems - payload - repeater, antenna, attitude and control systems - telemetry, tracking and command - power sub system and thermal control

Earth stations - antenna and feed systems - satellite tracking system - amplifiers - fixed and mobile satellite service earth stations

Module III (13 hours)

Communication link design - frequency bands used - antenna parameters - transmission equations - noise considerations - link design - very small aperture terminals (VSAT) - VSAT design issues

Module IV (13 hours)

Multiple access techniques - frequency division multiple access - time division multiple access - code division multiple access - access protocols for data traffic

Reference books

1. Richharia M., *Satellite Communication Systems*, Second Ed., Macmillan Press Ltd.
2. Robert M Gagliardi, *Satellite Communication*
3. Tri T Ha, *Digital Satellite Communication,* MGH

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

University examination pattern

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

2K6 EE 805(F): HVDC & FACTS

3 hours lecture and 1 hour tutorial per week

MODULE I (14 hrs)

Basics of power transmission networks- Control of power flow in AC systems . Flexible AC transmission system (FACTS) controllers - Basic Types of FACTS Controllers.-Equivalent circuit of FACTS Controllers- Benefits of FACTS controllers,

Analysis of uncompensated AC line- Passive reactive power compensation - Series capacitor connected at midpoint of line- Shunt capacitor connected at midpoint of line Comparison- STATCOM at midpoint of line – SSSC at midpoint of line- Comparison –Some examples

MODULE II (13 hrs)

Configuration of SVC- Operation and control of TSC, TCR - SVC controller - Operation and control of STATCOM-Twelve and Twenty four pulse STATCOM - Comparison between SVC and STATCOM.

Static series compensation: Operation and control of TCSC - SSR and its damping-. Static voltage and phase angle regulators- TCVR and TCPAR- Operation and control of SSSC- Operation and Control. of UPFC.

MODULE III (12 hrs)

DC power transmission- Introduction- comparison of AC and DC transmission- Need for HVDC -Application of DC transmission-Description of DC transmission system- Planning for DC transmission, Thyristor valves, Valve firing- HVDC converters – Pulse number- choice of converter configuration. Graetz circuit- simplified analysis. Converter bridge characteristics

MODULE IV (13 hrs)

Converter and HVDC system control.- Principle of DC link control-Converter control characteristics- modification, System control hierarchy, Firing angle control-IPC-EPC, Current and extinction angle control, Starting and Stopping of DC link-Start up of DC link, Power control, Higher level controllers-Converter faults and protection- Smoothing reactors- Protection of DC line –DC breakers-characteristics and types- applications , Monopolar operation

REFERENCES:

1. K R Padiyar, “FACTS controllers in power transmission and distribution ,” New Age International publishers,New Delhi 2007
2. N.G. Hingorani & L. Gyugyi, “Understanding FACTS: Concepts and technology of flexible AC transmission systems ” IEEE Press, 2000
3. T.J.E Miller, “Reactive Power Control in Electric Systems”, John Wiley & Sons,1986
4. K R Padiyar, “HVDC Power transmission systems, Technology and System Interactions,” New Age International publishers, NewDelhi, 1999.
5. Ned Mohan et.al, “Power Electronics-converters, application and applications” John Wiley and Sons, New York, 2001.

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

University examination pattern

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

2K6 EE 806(P) : SEMINAR

4 hours per week

Individual students should be asked to choose a topic in a field of their interest but in Electrical & Electronics Engineering, preferably from outside the B.Tech syllabus and give a seminar on that topic for about thirty minutes - a committee consisting of at least three faculty members (preferably specialized in different fields of Electrical & Electronics Engineering) shall assess the presentation of the seminars and award the marks to the students based on the merits of the topic of presentation - each student shall submit two copies of a write up of his seminar talk - one copy shall be returned to the student after duly certifying it by the Head of the Department and the other will be kept in the departmental library.

Sessional work assessment	
Presentation	: 30
Report	: 20
Total marks	: 50

2K6 EE 807(P) : PROJECT& INDUSTRIAL TRAINING

6 hours per week

The project work can be a Modelling and Simulation, Design or Experimental, in the field of Electrical & Electronics Engineering. It can be allotted as a group project with groups consisting of three to five students. Each group will prepare the project report and submit to the department through the guide - the Head of the Department will certify the copies and shall retain one copy in the departmental library

All students shall undergo an industrial training programme either by attending training program for a minimum of five days in a registered industry/Govt. establishment/Research institute or by visiting at least five reputed industries/Engineering establishments. They have to submit a report of the industrial training program.

The assessment of all the projects shall be done by a committee consisting of three or four faculty members specialised in the various fields of Electrical & Electronics Engineering - the students will present their project work before the committee - the group average marks for the various projects will be fixed by the committee - the guides will award the marks for the individual students in a project maintaining the group average

A maximum of 25 marks will be awarded for the industrial training

Sessional work assessment	
Project work	: 75
Industrial Training	: 25
Total marks	: 100

2K6 EE 808(P) : VIVA VOCE

There is only University examination for Viva Voce. Examiners will be appointed by the university for conducting the viva voce. The viva voce exam will be based on the subjects studied for the B.Tech course, mini project, project & Industrial training and seminar reports of the student - the relative weightages would be as follows

Sessional work assessment

Subjects	: 30
Mini project	: 20
Project & Industrial Training	: 30
Seminar	: 20
Total marks	: 100