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 MECHANICAL ENGINEERING With effect from 2007 Admissions

THIRD SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/D		Hrs	Marks
2K6ME 301	Engineering Mathematics II	3	1	-	50	3	100
2K6ME 302	Computer Programming	3	1	-	50	3	100
2K6ME 303	Mechanics of Solids	3	1	-	50	3	100
2K6ME 304	Electrical Machines	3	1	-	50	3	100
2K6ME 305	Fluid Mechanics	3	1	-	50	3	100
2K6ME 306	Metallurgy and Material Science	3	1	-	50	3	100
2K6ME 307(P)	Fluid Mechanics and Machinery Lab	-	-	3	50	3	100
2K6ME 308(P)	Strength of Materials Lab	-	-	3	50	3	100
TOTAL		**18**	**6**	**6**	**400**	**-**	**800**

FOURTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/D		Hrs	Marks
2K6ME 401	Engineering Mathematics III	3	1	-	50	3	100
2K6ME 402	Humanities	3	1	-	50	3	100
2K6ME 403	Thermodynamics	3	1	-	50	3	100
2K6ME 404	Manufacturing Processes	3	1	-	50	3	100
2K6ME 405	Fluid Machinery	3	1	-	50	3	100
2K6ME 406	Machine Drawing	1	-	3	50	3	100
2K6ME 407(P)	Production Engg Lab I	-	-	3	50	3	100
2K6ME 408(P)	Electrical Engineering Lab	-	-	3	50	3	100
TOTAL		**16**	**5**	**9**	**400**	**-**	**800**

2K6ME 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

2K6ME 302 : 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 ME 303 MECHANICS OF SOLIDS

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Introduction - general concepts - definition of stress - stress tensor - stress analysis of axially loaded members - strength design of members - axial strains and deformations in bars - stress-strain relationships - Poisson's ratio - thermal strain - Saint Venant's principle - elastic strain energy for uniaxial stress - statically indeterminate systems - generalised Hooke's law for isotropic materials - relationships between elastic constants - introduction to anisotropy – orthotropy

Module II (13 hours)

Torsion - torsion of circular elastic bars - statically indeterminate problems - torsion of inelastic circular bars - axial force, shear force and bending moment - diagrammatic conventions for supports and loading, axial force, shear force and bending moment diagrams - shear force and bending moments by integration and by singularity functions

Module III (13 hours)

Bending stresses in beams - bending stresses in beams - shear flow - shearing stress formulae for beams - inelastic bending of beams - deflection of beams - direct integration method - singularity functions - superposition techniques - moment area method - conjugate beam ideas - elementary treatment of statically indeterminate beams - fixed and continuous beams

Module IV (13 hours)

Transformation of stresses and strains (two-dimensional case only) - equations of transformation - principal stresses - mohr's circles of stress and strain - strain rosettes - compound stresses - superposition and its limitations - eccentrically loaded members - columns - theory of columns - buckling theory - Euler's formula - effect of end conditions - eccentric loads and secant formula

Text book

1. Popov E.P., *Engineering Mechanics of Solids,* Prentice Hall of India

Reference books

1. Timoshenko S.P. & Young D.H., *Elements of strength of materials,* McGraw Hill
2. Shames I.H., *Introduction to Solid Mechanics,* Prentice Hall of India
3. Crandall S.H., Dahl N.C. & Lardner T.J., *Introduction to Mechanics of Solids*, McGraw Hill
4. Beer F.P. & Johnston E.R., *Mechanics of Materials,* McGraw Hill

Sessional work assessment

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

University examination pattern

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

2K6 ME 304 ELECTRICAL MACHINES

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

DC Generators EMF equation - Armature reaction - Power flow diagram voltage build up- Internal and external characteristics - Control of terminal voltage

DC Motors: Back EMF - Torque and speed equations- Power flow diagram- Losses - components- efficiency- Performance characteristics - Starting method using 3 point starter- Speed control.

Module II (14 hours) .

Transformers: Ideal and real transformer - Equivalent circuit - Phasor diagram - Losses - efficiency and regulation - All day efficiency - OC and SC tests- Auto transformers - Voltage and current relationships - Saving of copper - Three phase transformers- Star and Delta connections .

3 phase induction motors -Production of torque - slip and frequency of rotor current - torque slip characteristics- no-load and blocked rotor tests- equivalent circuit -losses and power flow.

Module III (13 hours)

Starting methods for three phase induction motors - direct on line starting - auto transformer starting - star delta starting - rotor resistance starting

Alternators - Voltage regulation – predetermination - EMF method - MMF method - Synchronizing with 3 phase mains

Control of Permanent magnet stepper motors

Module IV (13 hours)

Electrical drives: advantages of electrical drives - parts of electrical. drives - choice of electric drives - status of DC and AC drives - dynamics of electric drives' - fundamental torque equations - multi-quadrant operation - equivalent values of drive parameters - components of load torque - nature and classification of load torque.

Electrical drives: power semiconductor device- SCR - symbol and characteristics - input-output characteristic of AC to DC,. AC to AC and DC to DC converters (no derivation) - three phase induction motor drives- stator voltage control and slip power recovery scheme.

Text books

1. A Text Book of Electrical Technology- B.L. Thereja, A.K.Thereja for Module 1-3
2. Dubey et.al , Thyristorised power controllers, Narosa publications. for Module 4

Reference books

1. Nagarath I. J. & Kothari. D. P.; Electric Machines, Tata McGraw Hill
2. Stephen J Chapman, Electric Machinery Fundamentals, McGraw Hill.
3. Tara V.D., Electrical Machines & Power Systems, Prentice Hall.
4. Fitzgerald A.E. & Kingsley, Electrical ¥achinery, McGraw Hill.
5. Puchestein, Lloyd & Cenrad, Alternatirig Current Machines, Asia Publishing House.
6. Vincent Del Toro, Electrical Machines and Power Systems, Prentice Hall
7. M.D and Kanchandani K.B., Power Electronics, Tata Mc Graw Hill.
8.Electric Drives – N.K.De and P.K. Sen , 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 ME 305 FLUID MECHANICS

3 hours lecture and 1 hour tutorial per week

Module 1(15 hrs)

Introduction and basic concepts-distinction between fluids and solids – Application areas of fluid mechanics-Classification of fluid flows-system and control volume. Properties of fluids-Continuum-density and specific gravity-vapour pressure and cavitation-viscosity-surface tension and capillary effects -Pressure -Variation of pressure in a stationary fluid- Manometers.

Fluid static-hydrostatic forces on submerged plane and curved surfaces-Buoyancy and stability. Fluid kinematics-Lagrangian and Eulerian descriptions-Fundamentals of flow visualization-stream lines, stream tubes, path tubes, streak lines. Types of motion -deformation of fluid elements-vorticity and rotationality-Reynolds transport theorem.

Module 2 (14 hrs)

Mass, Bernoullis and Energy equations-Static, Dynamic and Stagnation Pressures-limitation on the use of Bernoulli equation-Hydraulic grade line and Energy grade line-Applications of Bernoulli equation-Flow rate and velocity measurements-Pitot tube and Pitot static probes- Obstruction flow meters-Orifice, Venturi and Nozzle meters-Flow in Pipes- Laminar and turbulent flows- Hagen-Poiseuille equation-Darcy-Weisbach equation-Minor losses-Moody's Chart

Module 3 (12 hrs)

Differential analysis of fluid flow-Conservation of Mass-Derivation of continuity equation- stream function-irrotationality-velocity potential- relationship between stream function and velocity potential in irrotational flows- Conservation of linear momentum- Navier-Stokes equation-Newtonian versus non Newtonian fluids- exact solution of continuity and Navier-Stokes equation. Introduction to Computational Fluid Dynamics.

Module 4 (11 hrs)

Introduction to boundary layer-The boundary layer approximation-boundary layer equations- displacement thickness- momentum thickness-Blasius solution for flow over a flat plate-Momentum integral equation-Flow over bodies- Drag and Lift- Drag and lift coefficients- Friction and pressure drag-Flow separation.

Text book

1. Fluid Mechanics- Yunus A Cengel and John M Cimbala, McGraw Hill

Reference books

1. Fluid Mechanics- White F.M, McGraw Hill
2. Fluid Mechanics- Shames I.H, McGraw Hill
3. Fluid Mechanics and its applications- Gupta V. and Gupta S., Wiley Eastern
4. Introduction to Fluid Mechanics- Fox and Mc Donald- John Wiley and 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 ME 306 : METALLURGY AND MATERIAL SCIENCE

(3 Hours Lecture and 1 Hour Tutorial per week)

Module 1(10Hours)

Classification of materials-Properties of Engineering Materials –structure of atoms and molecules –Chemical bonds-primary and secondary or molecular bonds- Bond energy and Activation energy-Crystal structure –Bravai's lattices –BCC,FCC and CPH structures –Atomic packing factor-Miller indices-Interplaner spacing –Xray diffraction –Metallographic-Specimen preparation¿ –metallurgical ,scanning electron microscopes-grain size measurement-etching common etchants used

ModuleII (15Hours)

Defects and Imperfections in crystals –Point defect ,line defects, edge dis location screw dislocation-interaction of dislocations-Frank reed sources –surface imperfections-Diffusion mechanisms-Fick's Laws of diffusion –mechanical behaviour-Elastic ,anelastic and visco elastic materials-plastic deformation mechanisms-slip –twinning-strengthening mechanisms –phases-solid solutions and compounds-Hume-rothery rules-freezing of pure metal-Homogeneous nucleation –Heterogeneous nucleation-crystal growth-cast metal structure

Module III (15 Hours)

Phase diagrams –cooling curves-types equilibrium diagrams-phase diagrams of Cu-Ni ,Bi-Cd ,Pb-Sn; and Fe-C-Important reactions –pertaining to phase diagrams. Liver Rule

Heat treatment of carbon steels-annealing ,normalizing ,hardening ,tempering, austempering and martempering –Hardenability and Jomini test-case hardening surface hardening –metallic coating and surface treatments –failure of material –Creep-Creep resistant materials-fracture-brittle and ductile fracture –protection against fracture –fatigue –fatigue mechanisms-Sn curves

Module IV (12Hours)

Steels-high alloy steels- tool steels-stainless steels- uses of steels

Cast iron –classifications- structure –applications

Copper alloys and their uses

Aluminium alloys and their uses

Materials with medical applications

Ceramic materials –classification and their uses composites and glasses

Text Book:

1. R.K. Rajput, Material Ssience and Engineering, S.K. Khataria and sons

Reference books-

1. Shackle Ford .JF.,Material science for Engineers –Prentice hall
2. Narang.B.S .,Material Science & Processes –-CBS Publishers
3. Van Vlack L.H., Elements of Material Science -Addison-Wesley.
4. M G K Narula ., Material Science--Tata Mc Grow Hill
5. Prof. Kodgire ., Material Science& Metallurgy –-Everest publications
6. Higgins R.A., Engineering Matellurgy Part I., ELBS
7. Raghavan B., Material Science and Engineering, Prentice Hall 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 ME 307(P) : FLUID MECHANICS AND MACHINERY LAB

3 hours Practical per week

Study of plumbing tools and pipe fittings - measurement of meta centric height and radius of gyration of floating bodies - measurement of viscosity of fluids - study of discharge measuring instruments - measurement of pressure and velocity

Calibration of venturi meter - orifice meter - notches and weirs - nozzle meters & Rota meters - pipe friction - minor losses in pipes - verification of Bernoulli's theorem - demonstration of laminar and turbulent flow in pipes - critical velocity - forces on curved and plane surfaces

Evaluation of the performance of turbines - main and operating characteristics - Muschel's curves - performance of pumping and other machinery like centrifugal pumps - reciprocating pumps - gear pumps - hydraulic ram and torque

Sessional work assessment	
Lab 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

2K6 ME 308(P) : STRENGTH OF MATERIALS LAB

3 hours Practical per week

1. Standard tension test on mild steel using Universal Testing Machine and suitable extensometers
2. Stress - strain characteristics of brittle materials - cast iron
3. Double shear test on mild steel specimens
4. Torsion test on mild steel/brass specimens
5. Spring test - open and closed coiled springs - determination of spring stiffness and modulus of rigidity
6. Determination of modulus of rigidity of wires
7. Impact test - Izod and Charpy
8. Hardness tests - Brinnell hardness, Rockwell hardness (B S C scales), Rockwell superficial hardness (N & T scales) & Vickers hardness
9. Bending test on beams
10. Fatigue testing - study of testing machine
11. Photo elastic method of stress measurements (two dimensional problems)

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

2K6ME 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

2K6ME 402 : 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 I for 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 ME 403 THERMODYNAMICS

(3 Hours Lecture and 1 Hour Tutorial per week)

Module I (13hours)
Thermodynamics systems-Description of systems –properties-states, processes and cycles- Thermodynamic equilibrium-forms of energy-equations of state for gasses-compressibility factor –VT,PV,PT, Diagrams pure substances, properties of steam-Temperature and Zeroth law of thermodynamics –Various temperature scale –Temperature measuring instruments

Module II (13 Hours)
First law of thermodynamics –concept of heat and work-First law applied to cyclic processes and Non-cyclic processes-definition of stored energy –open system –general and steady flow-application of first law assess performance

Module III (13hours)
Second law of thermodynamics –thermal energy reservoirs-Kelvin –Planck and Clausius statements and their equivalence-Reversible and Irreversible processes-Reversible cycle-Carnot corollaries-thermodynamic temperature scale –Clausius inequality –concept of entropy-calculation of entropy changes from the Tds equations –availability –reversible work and irreversibility –increase of entropy principle-Helmholtz and Gibbs functions

Module IV (13 hours)

Thermodynamic property relations- Maxwells equations- Clapeyron equation –general relations for internal energy , enthalpy and entropy in terms of p,v,T and specific heats- the Joule Thomson coefficient Δh ,Δu and Δs of real gases- mixtures of gases-analysis –Gibbs-Dallton model- Properties gas mixtures based on Dalton model

Text Book:-
Zemansky .M.W ,Thermodynamics,Mc Graw Hill

Reference Books:-

1) Cengel.Y.A & Boles .M .A, Thermodynamics- An Engineering Approch , Mc Graw Hill
2) Jones .I. B & Dugan .R.E Engineering Thermodynamics, Prentice Hall
3) P K Nag , Engineering Thermodynamics ,Tata Mc Graw Hill
4) J.P Holman –Thermodynamics Mc Graw Hill

Sessional work assessment

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

University examination pattern

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

2K6 ME 404 MANUFACTURING PROCESSES

3 hours lecture and 1 hour tutorial per week

Module I: Conventional machining operations (12 hours)

Single point tools – center lathe – lathe operations – Boring – Shaping – Planing – Milling- drilling – grinding – abrasive wheels – centerless grinding – tool materials – machinability

Module II: Non-conventional machining operations (14 hours)

High speed machining – hard machining – high speed grinding – creep feed grinding – low-stress grinding – water-jet machining – abrasive jet machining – chemical machining – electrochemical machining – electric discharge machining – laser beam machining – electron beam machining – electrolytic grinding – plasma arc cutting – applications

Module III: Metal fabrication techniques (12 hours)

Forming operations – forging – rolling – extrusion- drawing – casting – sand casting – die casting – investment casting – continuous casting – miscellaneous techniques – powder metallurgy – welding – thermal processing of metals – annealing processes – Normalizing – Spheroidizing

Module IV: Manufacturing processes of non-metals (14 hours)

Fabrication and processing of ceramics – glass forming – heat treating glasses- fabrication and processing of clay products – hydro plastic forming – slip casting – powder pressing – tape casting – processing of polymers – compression and transfer molding – injection molding – extrusion – blow molding – casting – drawing – processing of composites.

Text Books

1. G Boothroyd,Winston A Knight - "Fundamentals of machining and machine tools" CRC Press,Taylor & Francis Group.

2. Milton C Shaw "Metal cutting principles" , Oxford University Press,2005.

3. Callister Jr, William D "Material Science and Engineering – An Introduction " Wiley India Pvt Ltd.

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

2K6ME 405 : FLUID MACHINERY

3 hours lecture and 1 hour tutorial per week

Module I (13 hrs.)
Classification of fluid machines, stage, stator, rotor- Cylindrical co-ordinate system- integral form of continuity, momentum and energy equations,Concept of relative velocity,velocity vector equation, velocity triangle- Performance indices like power and efficiency, Flow of fluid over flat plate and curved surfaces,fixed and moving,propulsion of ships, rockets and missiles.
Dimensional analysis: Rayleigh's method and Buckingham's pi theorem-Principles of modeling and similitude as applied to fluid mechanics problems.

Module II (13 hrs.)
Hydraulic Turbine: Hydro-electric power plant, components, surge tank fore bay, Classification of turbines on various criteria, Pelton turbine, work and efficiency, conditions for optimum performance, Francis and Kaplan turbine components, Euler's turbine equation, work done and efficiency, Draft tube theory, function and efficiency, Cavitation in turbine, turbine setting, Model testing, Derivation of dimensionless numbers, Specific and unit quantities, specific speed, Testing of turbine, characteristic curves, selection criteria, Governing of turbine. .

MODULE III(13 hrs.)
Rotodynamic pumps: whirling of fluid, vortex motion-free and forced vortex, spiral flow, features of rotodynamic and positive displacement pumps .Centrifugal Pump: Working Principle, Classification of centrifugal pump, Volute pump,Turbine pump, Heads, work done by impeller, efficiencies , Pressure rise in impeller, pressure recovery, Head-discharge curve, effect of various losses, Comparison of forward, radial and backward curved blades, surging, Priming of Pump, Cavitation and separation in pump. Model analysis, specific speed, characteristic curves, slurry pump, deep well pump.

MODULE IV(13 hrs.)
Reciprocating Pump: Working principle, single and double acting pump, piston and plunger pumps, multicylinder pumps, Duplex and Triplex pumps. Indicator diagram, effect of acceleration and friction, work done, efficiency, slip, function of air vessel, work saved by fitting air vessel, separation in reciprocating pump, comparison with centrifugal pump.working principle of axial and radial piston pumps,vane pump and gear pump.
Hydraulic Systems: Jet pump, airlift pump, hydraulic ram, Fluid coupling, working principle, torque converter, working principle, Hydraulic accumulator, pressure intensifier, hydraulic press, crane, jack.

REFERENCES:

1. Jagadish Lal ,Hydraulic machines.
2. Bansal,R.K , Fluid mechanics and hydraulic machines, Laxmi Publications.
3. J.F.Douglas, J.M.Gasiorek and J.A.Swaffield, Fluid Mechanics, Addison-Wesley, 1995.
4. B.S.Massey, Mechanics of Fluids, Van Nostrand Reinhold.

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 ME 406:MACHINE DRAWING

(1Hour Lecture and 3 Hours Drawing per week)

Module I (8hours) (Two drawing exercises)

Introduction to machine drawing –principles of orthographic projections applied to machine drawing – first angle projection and third angle projection-methods of dimensioning –conversion of pictorial projections in to orthographic projections –sectional views-rules and conventions of sectioning –full sectional, half sectional ,partial sectional and revolved sectional views of simple machine parts –welded joints –types of welds –nomenclature of welds –welding symbols drawing of welded machine parts with details of welding –screwed fastenings- screw thread forms –V and square threads –nomenclature of threads – conventional representation of threads –hexagonal and square threaded bolt and nuts –locking arrangements of nuts –various types of machine screws and set screws –foundation bolts –hook bolt- split bolt –bolt with square plate –rag bolt and Lewis foundation bolt

Module II (16 Hours) (five drawing exercises)

Shaft joints-cotter and pin joints-socket and spigot joint –gib and cotter joint-sleeve and cotter joint-and knuckle joint Couplings- muff couplings , flanged couplings ,flexible couplings ,Oldham's coupling and universal coupling –Parallel and tapered sunk keys –hollow flat saddle keys –feather key and pin key Bearings –solid journal bearing –bush bearing s –Plummer block –foot step bearing and pedestal bearing – bracket and hangers –rolling contact bearings –ball bearings –roller bearings and thrust bearings
Pipe joints –coupler joint-union joint-nipple joint –integral and screwed flanged joints

Module III (20 hours) (six drawing exercises)

Assembly drawings – types –accepted norms –engine parts –piston –connecting rod –eccentric –stuffing box and cross head –Parts of a lathe – tail stock –head stock assembly-tool post and carriage –valves-stop valves-safety valves-check valves-pressure relief valves and flow direction control valves –miscellaneous assemblies-vices-screw jack –jigs and fixtures and assembly of pumps

Module IV (8 hours) (Two drawing exercises)

Limit ,fits and tolerances-nomenclature –classification of fits –systems of fits and tolerances –designation-selection of fits and tolerances
Surface texture-nomenclature of surface texture-designation of surface texture –selection of surface characteristics-indication of surface roughness-Working drawings of simple machine elements-computer aided drafting –elements of computer aided drafting –simple exercises using Auto CAD

Reference Books :-

1) Machine drawing by P.I.Varghese & K.C.John, VIP Publishers
2) Machine Drawing by N.D. Butt Panchal
3) Machine Drawing P S Gill S.K.Kataria & sons
4) Machine Drawing by Narayana. K I,Kannaiah& Reddy. K.V
5) Machine Drawing by Narayana. V. I Mathur .M.C .,Jain brothers

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 ME 407(P) : PRODUCTION ENGINEERING LAB I

3 hours Practical per week

Classifications of machine tools and machining processes - specification of machine tool; power source; centre lathe - general features, parts and functions - machining on centre lathe - cutting tools - materials, types, grinding; cutting variables - selection of speeds, feeds and depth of cut - use of cutting fluids - methods of holding work - lathe operations - turning, thread cutting, drilling, boring, reaming, profile turning, knurling; tolerance and surface finish - CNC machine tools

Exercises

Jobs on centre lathe requiring simple turning, taper turning, knurling, boring and thread cutting

Sessional work assessment	
Lab 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

2K6 ME 408(P) : ELECTRICAL ENGINEERING LAB

3 hours practical per week

1. a) Determination of voltage-current relation of a linear resistance and incandescent lamp
   b) measurement of high and low resistance using voltmeter and ammeter
2. R, L and C series and parallel circuits: measurement of voltage-current relation and verification by calculation - plotting the instantaneous power against time
3. Calibration of the single phase energy meter by direct loading at various power factors
4. Measurement of power in the three phase circuit using single, two and three wattmeters for balanced load and for three and four wire system
5. Determination of the equivalent circuit of transformer by open and short circuit test - calculation of efficiency and regulation at various loads and power factors.
6. Determination of the regulation of alternator by emf and mmf methods
7. Starting the cage induction motor using star-delta switch and plotting the performance characteristics
8. Conducting the no load and blocked rotor test on cage induction motor - determining equivalent circuit and calculating torque-slip characteristics
9. a) Plotting OCC of DC shunt generator at rated speed - determining the critical resistance. b) Conducting load test on DC shunt generator and plotting external characteristics - deducing internal characteristics
10. Conducting load test on DC series motor and plotting the performance characteristics
11. Study of single phase capacitor start and capacitor run induction motors - plotting speed - voltage relation of single phase fan motor

Sessional work assessment	
Lab 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

MECHANICAL ENGINEERING

with effect from 2007 Admissions

FIFTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/D		Hrs	Marks
2K6 ME 501	Engineering Mathematics IV	2	1	-	50	3	100
2K6 ME 502	Environmental Engineering and Disaster Management	2	-	-	50	3	100
2K6 ME 503	Mechanics of Machinery	2	-	-	50	3	100
2K6 ME 504	Thermal Engineering	2	-	-	50	3	100
2K6 ME 505	CAD/CAM/CAE	2	1	-	50	3	100
2K6 ME 506	Machine Tools	2	-	-	50	3	100
2K6 ME 507(P)	Production Engg Lab II	-	-	3	50	3	100
2K6 ME 508(P)	Thermal Engineering Lab	-	-	3	50	3	100
TOTAL		**12**	**2**	**6**	**400**	**-**	**800**

SIXTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/D		Hrs	Marks
2K6 ME 601	Economics and Business Management	2	-	-	50	3	100
2K6 ME 602	Dynamics of Machinery	2	-	-	50	3	100
2K6 ME 603	Heat and Mass Transfer	2	-	-	50	3	100
2K6 ME 604	Advances in Manufacturing Engineering	2	1	-	50	3	100
2K6 ME 605	Operations Research	2	1	-	50	3	100
2K6 ME 606	Elective I	2	-	-	50	3	100
2K6 ME 607(P)	Heat Transfer Lab	-	-	3	50	3	100
2K6 ME 608(P)	CAD/CAM/CAE Lab	-	-	3	50	3	100
TOTAL		**12**	**2**	**6**	**400**	**-**	**800**

Elective I

ELECTIVE-1

2K6 ME 606(A): Numerical Methods
2K6 ME 606(B): Mechatronics
2K6 ME 606(C): CNC Programming
2K6 ME 606(D): Tool Engineering and Design
2K6 ME 606(E): Vibration and Noise Control

2K6 ME 501: ENGINEERING MATHEMATICS –IV

3 hrs. 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 legendary'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

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

Reference Books

1. Wylie CR & Barrett LC, Advanced Engineering Mathematics, Mc Graw Hill
2. Kreyszig E, advanced Engineering Mathematics, John Wiley.
3. NP Bali & Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications
4. Dr.B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 502 ENVIRONMENTAL ENGINEERING & DISASTER MANAGEMENT

3 hrs. 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 nd 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.

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

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.

2K6ME 503: MECHANICS OF MACHINERY

3 hrs. lecture and 1 hour tutorial per week

Module I (13 hours)

Introduction to mechanism and machines – Kinematic Pairs – Kinematic Chains and Linkages – Structure and Kinematic Diagrams - Various mechanism – Kinematic inversion - degree of freedom – Displacement analysis – Relative motion – Velocity and Acceleration analysis – Instantaneous centre – Complex number method – Mechanical advantage – Relative acceleration – Coriolis acceleration – graphical and analytical methods – Topics from path curvature theory – Fixed and moving centroides – Inflection points and inflection circle – Euler Savary equation.

Module II (13 hours)

Force analysis of machinery – static and dynamic force analysis of plane motion mechanisms – analytical, graphical and complex method – principle of superposition – matrix method – method of virtual work – complex number method.

Module III (14 hours)

Gears– Gear Tooth Action - The Law of Gearing - Involute spur gears – involutometry – spur gear details – interference – gear standardization – backlash –internal gear – cycloidal gear – non standard gear – theory and details of bevel, helical and worm gearing – Gear trains – simple and compound gear trains – planetary trains – solution of planetary gear train problems – applications – Force analysis in spur – helical – bevel and worm gearing.

Module IV (12 hours)

Kinematic synthesis – tasks of kinematic synthesis – type and dimensional synthesis – graphical synthesis for motion – path and prescribed timing – function generator – overlay method – analytical synthesis techniques – complex number modelling – Freudenstien's equation – loop closure equation technique – one case study in synthesis of mechanism.

Text Book

1. A.Ghosh & A.K.Mallik, Kinematic Analysis and Synthesis of Mechanism, Affiliated East West Press.
2. H.Hamilton,Mabie & Charles F.Reinholtz , Mechanism and dynamics of Machinery, John Wiley & sons.

Reference Books:

1. J.E.Shigley & J.J.Uicker Jr.,Theory of Machines and Mechanisms, Mc Graw Hill.
2. S.S Rattan, Theory of Machines, Tata Mc Graw Hill.
3. V.P. Singh, Theory of Machines, Dhanpat Rai and Co.

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 504 THERMAL ENGINEERING

3 hrs. lecture and 1 hour tutorial per week

Module I (14 hours)

Internal combustion engines - classification - four stroke and two stroke engines - spark ignition and compression ignition engines - valve timing diagram - thermodynamic analysis of air standard cycles - Otto, diesel and duel combustion cycles - engine testing - performance and characteristics of constant speed and variable speed engines - heat balance test - Morse test - retardation test - actual engine cycles - effect of dissociation - variable specific heats and heat losses - scavenging - objectives - effects and methods

Module II (13 hours)

Systems and components of IC engines - fuel systems - ignition systems - cooling - starting - lubrication - governing of IC engines - supercharging of SI and CI engines - turbocharging - exhaust emissions of IC engines - alternate potential engines - free piston engine - Wankel engine and stratified charged engine - automotive transmission system and its components

Module III (12 hours)

Combustion in IC engines - flame propagation - normal and abnormal combustion - detonation - pre ignition - after burning - HUCR - fuel rating - additives in petrol - combustion chambers of SI engines - combustion in CI engines - phase of normal combustion - diesel knock - effect of engine variables on diesel knock - cetane number - additives in diesel - combustion chambers of CI engines

Module IV (13 hours)

Gas turbine plants - open and closed cycles - thermodynamic cycles - regeneration - reheating - intercooling - efficiency and performance of gas turbines - rotary compressors - analysis - centrifugal and axial flow compressors - combustion chambers of gas turbines - cylindrical - annular and industrial type combustion chamber design - combustion intensity - combustion efficiency - pressure loss combustion process and stability loop - axial flow turbines - elementary and vortex theories - design of nozzles and blades for turbines - limiting factors in turbine design

Text Book and References

1. Rogowsky, *"Elements of Internal Combustion Engines"*, Tata McGraw Hill
2. Gill, Smith & Ziurys, *"Fundamentals of Internal Combustion Engines"*, Oxford and IBH
3. Maleev, "*Internal Combustion Engine Theory and Design*" McGraw Hill
4. Judge, "*Modern Petrol Engines*," Chapman & Hall
5. Benson & Whitehouse, "*Internal Combustion Engines*" Vol. I & II, Pergamon press
6. Mathur & Mehta, "*Thermodynamics and Heat Power Engineering*", Vol. I & II
7. Cohen & Rogers, "*Gas Turbine Theory*," Longmans

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 505 CAD/CAM/CAE

3 hrs. lecture and 1 hour tutorial per week

Module I (13 hours)

Fundamentals of CAD: Introduction: Design Process: Application of computers in design: Creating manufacturing database: benefits of CAD. Computer Hardware; Graphic input devices; display devices; Graphics output devices; Central processing unit (CPU) Geometric modelling- wireframe and solid modelling, engineering analysis-FEM, design review and evaluation, automated drafting, design data base, softwares used in CAD, data exchange between CAD and CAM. Fundamentals of CAM: Definition of automation, levels of automation, high volume discrete parts production, Detroit type of automation, transfer machines, analysis of automated flow lines, assembly
machines, flow line balancing, line balancing.

Module II (14 hours)

NC/CNC Machine Tools; NC machine tools- basic components, coordinate systems; features of NC machine tools. Computer Numerical Control: basic theory of numerical control, advantages of NC, open and closed loop system, information flow and control theory, classification of CNC machine tools, position control and continuous path control, principles of displacement measurement, digital linear and rotary displacement transducer, analog displacement measuring system. CNC part programming: Manual programming, work piece modelling and computer aided part programming, canned cycles, Computer assisted Part Programming languages, programming in APT.

Module III (13 hours)

Basic concepts of Robotics: Introduction, basic structure of Robots, resolution, accuracy, and repeatability. Classification and structure of Robotic systems: PTP and CP systems, control loops of robotic systems, types of robots Drives and Control systems: hydraulic systems, DC servo motors, control approaches of Robots. Applications of Robots. Programming: manual teaching, lead – through teaching, programming languages. Sensors and Intelligent Robots: introduction to Robotic sensors, vision systems, range detectors, force and torque sensors.

Module IV (12 hours)

Advanced concepts in automation: direct numerical control,Adaptive control, Group Technology (GT): Part families; part classification and coding system: Group technology machine cells: Advantages of GT. Computer Aided Process Planning: Introduction and

benefits of CAPP. Types of CAPP systems, machinability data selection systems in CAPP. CAE, CIM, FMS, computer integrated manufacturing

Text Book and References

1. Groover & Zimmers “CAD/CAM” PHI
2. Rdhakrishnan “CAD/CAM”
3 Mikell P. Groover, “Automation, Production Systems and Computer Aided Manufacturing”, Prentice Hall, 1980
4 Mechatronics : HMT (TMH)
5 CNC Programming made easy: B.K.Jha, Vikas Publishing House
6 Robot Technology – Fundamental: James G Keramas, Vikas Thomson Learning
7 Computer Integrated Design and Manufacturing by D.D. Bedworth, M.RHenderson & P.M. Wolfe, Tata MCGraw Hill Pub. Co.
8. CAD/CAM - theory and Practice by Zeid Ibraham, Tata McGraw Hill Pub Co

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 506: MACHINE TOOLS

3 hrs. lecture and 1 hour tutorial per week

MODULE I (13 hours)

Basic Concepts of Machine Tools: General requirements of machine tools- tool- work motions on lathe, milling, drilling, shaping, slotting, planing and grinding machines- cutting speeds and feeds- estimation of machining time.

Kinematics of Machine Tools: Selection of range of speeds and feeds- layout of speeds- graphical representation of speed and structure diagram- ray diagram for machine tool gear boxes

Machine Tool Drive: Stepped and step less regulation of speeds- feed and speed mechanisms in lathe, milling and drilling machines- gauging of components.

MODULE II (13 hours)

Cutting Tools: Geometry of cutting tools and tool nomenclature- single point and multipoint cutting tools- tools used for turning, milling, drilling and broaching- tool materials and their properties- grinding wheels and their selection. Production Lathes: Turret lathes- tools and attachments- operations and tools layout- automatic screw machine

Metal Cutting: Mechanics of chip formation- types of chips- orthogonal and oblique cutting- velocity relationships- cutting forces and factors affecting cutting forces- cutting force and power analysis- thermal aspects of machining- cutting fluids and their selection.

MODULE III (13 hours)

Machinability and Tool Life: Tool wear and tool life- tool life equations- tool life specifications and criteria- effect of machining parameters on tool life- variables affecting machinability -Economics of machining: Selection of optimum machining conditions- machine law and tool law

Jigs and fixtures: Basic principles- elements of jigs and fixtures- design principles common to jigs and fixtures.

MODULE IV (13 hours)

Press working: Different types of presses- principles of operation and selection- computation of capacities tonnage- center of pressure- cutting operations- shear action in die cutting operations- compound and progressive dies

Text Book and References

1. HMT, Production Technology, Tata McGraw Hill
2. Ghosh & Mallik, Manufacturing Science, Affiliated East-West Press
3. Juneja & Sekhon, Fundamentals of Metal Cutting and Machine Tools, Wiley Eastern
4. Sharma P C, A Text book of Production Engineering, S Chand & Company
5. ASTME, Fundamentals of Tool Design, Prentice Hall of India
6. Bhattacharya A, Metal Cutting: Theory and Practice, Central Book Publishers
7. Boothroyd, Fundamentals of Metal Machining and Machine Tools, McGraw Hill

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 507(P): PRODUCTION ENGG LAB II

3 hrs. practical per week

Introduction: limits and fits - horizontal milling machine - vertical milling machine - shaping machine - slotting machine - surface, centreless and cylindrical grinding - spindle drives - milling cutters - indexing head - simple, compound, differential and angular indexing - grinding wheel - drilling - reaming - tool layout

Introduction

Exercises:

1. Multi-start thread
2. Square thread
3. Eccentric turning
4. Exercise on limits and fits
5. Internal thread
6. Spur gear
7. Helical gear by simple and differential indexing
8. Surface, slot and keyway milling
9. Shaper exercise on cube with V-groove, slot and guide ways
10. Grinding
11. Tool grinding

Text Books and References

1. HMT, *Production Technology*, Tata McGraw Hill
2. ASTME, *Tool Engineer's Handbook*
3. Burghardt, Asilered & Anderson, *Machine Tool Operations I & II*, McGraw Hill
4. Chapman W.A.J., *Workshop Technology: Part 2.*, Viva Low Priced Student Edition

Rao R.V., Metal Cutting and Machine Tools, S K Kataria & Sons

Sessional Work Assessment

Laboratory practical and record	–	35 marks
Tests	–	15 marks
Total	–	50 marks

2K6ME 508(P): THERMAL ENGINEERING LAB

3 hrs. practical per week

1. Study of systems and components of petrol and diesel engines
2. Study of automotive parts
3. Study of air compressors, blower and fan
4. Study of boilers and turbines
5. Performance test on refrigeration plant
6. Performance test on air conditioning plant
7. Performance test on boilers
8. Determination of flash and fire points of oils
9. Determination of viscosity of oils
10. Determination of calorific value of fuels
11. Valve timing diagram on petrol and diesel engines
12. Load test on single cylinder four stroke diesel engine
13. Load test on twin cylinder four stroke diesel engine
14. Load test on four cylinder four stroke diesel engine
15. Load test on single cylinder four stroke petrol engine
16 Load test on twin cylinder four stroke petrol engine
17. Load test on four cylinder four stroke petrol engine
18. Load test on two stroke petrol engine
19. Heat balance test on petrol engine
20. Heat balance test on diesel engine
21. Cooling curve test on petrol engine
22. Cooling curve test on diesel engine
23. Morse test on petrol engine
24. Morse test on diesel engine
25. Retardation test on diesel engine
26. Retardation test on petrol engine
27. Variable speed test on petrol engine
28. Variable speed test on diesel engine
29. Performance test on rotary air compressor
30. Performance test on air blower

12 experiments should be done as a minimum depending up on the lab facility.

Text Book and References

1. Rogowsky, *"Elements of Internal Combustion Engines"*, Tata McGraw Hill

2 Gill, Smith & Ziurys, *"Fundamentals of Internal Combustion Engines"*, Oxford and IBH

3 Maleev, "*Internal Combustion Engine Theory and Design*" McGraw Hill

Sessional Work Assessment

Laboratory practical and record	–	35 marks
Tests	–	15 marks
Total	–	50 marks

2K6 ME 601: ECONOMICS AND BUSINESS MANAGEMENT

3 hrs. lecture and 1 hour tutorial per week

Module 1 (12 hours)

Definition of economics – nature and scope of 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 organisation – state enterprise

Module II (14 hours)

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 (14 hours)

Production – factors 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 economic efficiency – linear programming – graphical method – economies of large scale production

Module IV (12 hours)

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 Book and References

1. Varshney R.L & Maheshwari K.L, Managerial Economics, S Chand & company Ltd.
2. Dwivedi 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
   Benga T.R & Sharma S.C, Industrial Organisation And Engineering Economics,
5. Benga T.R & Sharma S.C, Industrial Organisation And Engineering Economics, Khanna Publishing
6. Ahuja H.L, Modern Micro Economics – Theory and Applications, S Chand & Company 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 & Company Ltd.
   Jhingan M.L, Macro Economic Theory, Vrinda Publications Pvt. Ltd.
10. Jhingan M.L, Macro Economic Theory, Vrinda Publications Pvt. Ltd.

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 602: DYNAMICS OF MACHINERY

3 hrs. lecture and 1 hour tutorial per week

Module I (13 hours)

Introduction to mechanical vibration – free and forced - response of single degree of freedom - linear systems – coulomb damping – support excitation – vibration isolation – whirling of shafts – two degree of freedom systems – coordinate transformations – coupling - natural coordinates – beat phenomenon – undamped vibration - vibration absorbers.

Module II (13 hours)

Multi degree of freedom systems – matrix formulation – influence coefficients – Eigen value problem – expansion theorem – modal analysis – solution methods – general response of discrete linear systems – self exited vibrations – criterion for stability - instability caused by friction – instability in oil film lubricated bearings – galloping of transmission lines – introduction to nonlinear vibration – introduction to random vibration.

Module III (13 hours)

Cam design – cam and follower types – displacement diagrams – Advanced cam profile techniques – cam profile synthesis – graphical and analytical methods – Gyroscope-gyroscopic couple – stability of two wheeler – four wheeler – gyroscopic effect:on aeroplane – steering, rolling and pitching of ships.

Module IV (13 hours)

Flywheel analysis– turning moment diagram – flywheel design – flywheel applications - balancing - static and dynamic balancing – balancing of masses rotating on several planes – balancing of reciprocating masses –balancing of mult-icylinder engines – balancing machines.

Text Book

1 W. T. Thomson, Theory of vibration with applications, Prentice Hall

2. J. P. Den Hartog, Mechanical vibrations, Mc Graw Hill.

3. J.E.Shigley & J.J.Uicker Jr.,Theory of Machines and Mechanisms, Mc Graw Hill.

References

1. S.S Rattan, Theory of Machines, Tata Mc Graw Hill.

2. V.P. Singh, Theory of Machines, Dhanpat Rai and Co..

3. Erdman A.G & Sandor G.N., Mechanism Design: Analysis and Synthesis

4. Leonard Meirovitch, Elements of vibration analysis, Mc Graw Hill

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 603: HEAT AND MASS TRANSFER

3 hrs. lecture and 1 hour tutorial per week

Module I (16 hrs)

Basic Concepts of Thermodynamics and Heat Transfer. Heat and Other Forms of Energy. Heat Transfer Mechanisms. Simultaneous Heat Transfer Mechanisms.

Heat Conduction: Heat Conduction Equation .One-Dimensional Heat Conduction Equation. General Heat Conduction Equation. Boundary and Initial Conditions. Solution of Steady One-Dimensional Heat Conduction Problems. Heat Generation in a Solid. Variables Thermal Conductivity. Steady Heat Conduction in Plane Walls. Heat Conduction in Cylinders and Spheres. Critical Radius of Insulation. Heat Transfer from Finned Surfaces Transient Heat Conduction. Transient Heat Conduction in Large Plane Walls, Long Cylinders and Spheres. Transient Heat Conduction in Semi-Infinite Solids. Numerical Methods in Heat Conduction. Finite Difference Formulation of Differential Equations. One-Dimensional Steady Heat Conduction. Transient Heat Conduction.

Module 2 (12 hrs)

Convective Heat Transfer: Physical Mechanism of Forced Convection. Velocity Boundary Layer. Thermal Boundary Layer. Empirical relation in forced convection. Flow Over a Flat Plates. Flow across Cylinders and Spheres. Flow in Tubes. Physical Mechanism of Natural Convection. Empirical relation in free convection. Natural Convection over Surfaces, inside Enclosures, and from Finned Surfaces. Combined Natural and Forced Convection.

Module 3 (12 hrs)

Boiling and Condensation: Boiling Heat Transfer. Pool Boiling. Flow Boiling. Critical Heat Flux (CHF). Condensation Heat Transfer. Film Condensation. Film Condensation inside Horizontal Tubes

Heat Exchangers: Type of Heat Exchangers. Temperature Distribution – Overall heat transfer coefficient, Heat Exchange Analysis – LMTD Method and NTU Method.

Module 4 (12 hrs)

Radiation Heat Transfer: Introduction to Physical mechanism. Radiation properties. Thermal Radiation. Blackbody Radiation. Solar Radiation. Radiation laws. The View Factor. Radiation Heat Transfer, Radiation Shields.

Mass Transfer: Introduction. Mass Diffusion. Fick’s law of diffusion. Boundary Conditions. Steady Mass Diffusion through a wall. Mass Convection

Text Book and References

1 Yunus A. Cengel., "Heat Transfer – A practical approach", Second Edition, Tata McGraw-Hill

2. Incropera. F.P.and Dewitt.D.P. "Introduction to Heat Transfer", John Wiley and Sons

3. Holman, J.P. "Heat Transfer", McGraw-Hill Book Co., Inc., New York, 6th Edn.

4. Sachdeva, S.C., "Fundamentals of Engineering Heat & Mass Transfer", Wiley Eastern Ltd., New Delhi

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 604: ADVANCES IN MANUFACTURING ENGINEERING

3 hrs. lecture and 1 hour tutorial per week

Module I (13 hours)

Computer technology - introduction - CPU - types of memory - input/output devices - computer programming - operating the computer system - mini/micro computers and programmable controllers - computer aided design - fundamentals of CAD - the design process - application of computers for design - manufacturing data base - computer graphics - software configuration - constructing the geometry - transformations - data base structure and content - wire frame and solid models

Module II (13 hours)

Numerical control - basic components of NC systems - NC coordinate systems - motion control system - application of numerical control - NC part programming - punched tape - tape coding and format - manual part programming - computer assisted part programming - APT language - NC programming with interactive graphics

Module III (13 hours)

Manufacturing systems - development of manufacturing system - components of FMS - FMS work station - Job coding and classification - group technology - benefits of FMS - tools and tooling - machining centres - head indexers - pallets - fixtures - work handling equipments - system storage - automated guided vehicles - industrial robots - programming of robots - assembly & inspection

Module IV (13 hours)

Flexible manufacturing system management - FMS control software - manning of FMS - tool management - controlling precision - simulation and analysis of FMS - approaches to modelling for FMS - network simulation - simulation procedure - FMS design - economics of FMS - artificial intelligence

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Text Book and References

1. Groover M.P. *"Automation, Production Systems and Computer Integrated Manufacturing"*, Prentice Hall of India
2. Groover, Emory & Zimmers, *"CAD/CAM Computer Aided Design and Manufacturing"*, Prentice Hall of India
3. Joseph Talavage & Hannam, *"Flexible Manufacturing Systems in Practice"*, Marcel Dekker Inc.
4. Kant Vajpayee, *"Principles of Computer Integrated Manufacturing"*, Prentice Hall of India
5. Yoram Koren, *"Computer Control of Manufacturing Systems"*, McGraw, Hill Book Company

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 605: OPERATIONS RESEARCH

3 hrs. lecture and 1 hour tutorial per week

Module I: Linear algebra (13 hours)

Vectors - vector space and Euclidean space - vector operations - matrix operations - unit vector - sum vector - linear dependence - bases - spanning set - rank - simultaneous equations - basic solutions - point sets - lines and hyper planes - linear inequalities - convex sets - extreme points - fundamental theorem of linear programming

Module II: Linear programming (13 hours)

Statement of the LP problem - slack and surplus variables - basic feasible solutions - reduction of a feasible solution to basic feasible solution - artificial variables - optimality conditions - unbounded solutions - Charnes' M method - two phase method - degeneracy - duality

Module III: Transportation, assignment and game problems (13 hours)

Transportation problem - coefficient matrix and its properties - basic set of column vectors - linear combination of basic vectors - tableau format - stepping stone algorithm - UV method - inequality constraints - degeneracy in transportation problems - assignment problem as a maximally degenerate transportation problem - Köning's method - rectangular zero sum games - von Neuman's theorem - saddle points - pure and mixed strategies - formulation of the primal and dual LP problem for fixed strategies - dominance - graphical solutions

Module IV: Queuing theory (13 hours)

Basic structure of queuing models - exponential and Poisson distributions - birth and death processes - queuing models based on Poisson inputs and exponential service times - basic model with constant arrival rate and service rate - finite queue - limited source queue models involving non-exponential distributions - single service model with Poisson arrival and any service time distribution - Poisson arrival with constant service time - Poisson arrival and Erlang service times - priority disciplines - dynamic programming - Bellman's principle of optimality - formulation and solution of simple problems

Text Book

1. Hadley G, Linear Programming, Addison Wesley
2. Hillier & Lieberman, Operations Research, John Wiley
3. Ravindran, Solberg & Phillips, Operations Research, John Wiley

References

1. Saskrieni, Yaspen & Friedman, Operations Research: Methods and Problems, Wiley Toppen
2. Wagner, Principles of Operations Research, 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 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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 606(A): NUMERICAL METHODS

3 hrs. lecture and 1 hour tutorial per week

MODULE I: **(14 hours)** Systems of equations Introduction to mathematical modeling-algorithms-convergence – rate, order of convergence- errors in numerical algorithms-Finding roots of polynomial equations- bisection method- method of false position-Newton-Raphson method- fixed point iteration-Secant method –Convergence of these methods-Gauss elimination method for systems of linear equation-pivoting strategies-LU decomposition – Iterative techniques for linear systems-Jacobi, Gauss Seidel method-Conjugate gradient method-Non-linear systems of equations-Newton's method –application problems-power method for the determination of Eigen values.

MODULE II (12 hours). Interpolation Lagrange form of the interpolating polynomial-Newton's form of the interpolating polynomial- divided differences- finite difference operators- Newton's forward and backward interpolations- Stirling's interpolation formula-errors of interpolation formulae- Cubic spline interpolation-curve fitting- linear regression.

MODULE III: (**13 hours)**

Numerical differentiation and integration Numerical differentiation- differential formulae in the case of equally spaced points- Richardson extrapolation- Numerical integration –Newton-Cotes quadrature- trapezoidal and Simpson's rules- Gaussian integration-error analysis-Initial value problems of ordinary differential equations- Euler's method-Taylor methods.

MODULE IV: (13 hours) Numerical solution of ordinary differential equations

Runge-Kutta methods –multistep methods-Adam-Bashforth and Adam-Moulton method-Predictor-Corrector schemes-Milne's method-Solution of boundary value problems in ordinary differential equations-finite difference methods for solving two dimensional Laplace equation for a rectangular region- finite difference method of solving heat equation and wave equation with given initial and boundary condition.

Text Book

1.Froberg C.E., *Introduction to Numerical Analysis,* Addison Wesley

2.Gerald C.F., *Applied Numerical Analysis,* Addison Wesley

3.Hildebrand F.B., *Introduction to Numerical Analysis,* T.M.H.

4.James M.L., Smith C.M. & Wolford J.C., *Applied Numerical Methods for Digital Computation,* Harper & Row

5.Mathew J.H., *Numerical Methods for Mathematics, Science and Engineering,* P.H.I

References

1.Bradie Brian, A Friendly Introduction to Numerical Analysis, Pearson Education.

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 606(B): MECHATRONICS

3 hrs. lecture and 1 hour tutorial per week

MODULE I: (11 hours) Introduction to mechatronics-sensors and transducers-signal conditioning-pneumatic and hydraulic systems-mechanical and electrical systems.

MODULE II: (11 hours) System modeling-mathematical models-mechanical, electrical, fluid and thermal system building blocks-system models- dynamic response of systems- first and second order systems-modeling dynamic systems-systems transfer functions-frequency response-stability.

MODULE III: (15 hours) Controllers Closed loop controllers-continuous and discrete processes-proportional, derivative and integral controls-PID controller-digital controllers-controller tuning-adaptive control.

MODULE IV: (15 hours) Digital circuitsMicro controllers and micro processors-digital logic circuits-micro controller architecture and programming-programmable logic controllers

Text Book

1. Bolton W., *Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering,* Addison Wesley Longman Limited

References

1. Dorf R.C. & Bishop R.H., *Modern Control Systems*, Addison Wesley
2. Krishna Kant, *Computer Based Industrial Control*, Prentice Hall of Indian Private Limited
3. HMT Limited, *Mechatronics*, Tata McGraw Hill Publishing Company Limited
4. Herbert Taub & Donald Schilling, *Digital Integrated Electronics*, McGraw Hill International Editions

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.

Sessional Work Assessment		
Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 606(C): CNC PROGRAMMING

3 hrs. lecture and 1 hour tutorial per week

Module I (13hrs)

An Introduction to Numerical Control Machinery: The History of NC, CNC Machines, Input Media, Binary Numbers, Tape Formats, Objectives of Numerical Control, Applications in Industry

Numerical Control Systems: Components, Types of Control Systems, Servomechanisms, Loop Systems, The Cartesian, Coordinate System, Positive and Negative Movement, Positioning Systems, Setting the Machine Origin, Dimensioning

Process Planning and Tool Selection: Process Planning, Tooling for Numerical Control, Tooling for Hole Operations, Milling Cutters Special Inserted Cutters, Speed and Feeds, Tool Changes, Automatic Tool Changers, Tool Storage, Tool Length and Tool Length Offset

Module II (13hrs)

Programming Coordinates: Hole Operations, Milling Operations, Mixing Absolute and Incremental Positioning, Metric Coordinates

Two Axis Programming: Introduction, Parts of a CNC Program, Word Address Format, Absolute Positioning, Incremental Positioning, Milling and Drilling Examples

Three Axis Programming: Introduction, A Programming Task Using Three Axes, Other G-Codes Used in CNC Programming, Using an Indexer, Programming Examples

Math for Numerical Control Programming: Using Trigonometry for Cutter Offsets, Milling and Lathe examples

Linear and Circular Interpolation: Linear Interpolation, Circular Interpolation,

Cutter Diameter Compensation: Definitions and Codes, Program Example, Special Considerations, Fine Tuning with Cutter Diameter Compensation

Module III (13hrs)

Do Loops and Subprograms: Do Loops, Subprograms, Calling a Subprogram, Subroutines for Cutter Diameter Compensation, Nested Loops

Advanced CNC Features: Mirror Imaging, Polar Rotation, Helical Interpolation

The Numerical Control Lathe: Lathe Bed Design, Axis Movement, Tool holders and Tool Changing, Spindle Speeds, Feed rates, Machine Origin and Work Coordinate Systems, Quick setters

Programming CNC Turning Machines: Machine Reference Point, Diameter vs. Radius Programming, Turning and Facing, Taper Turning, Circular Interpolation, Drilling, Threading

Module IV(13hrs)

Use of Computers in Numerical Control Programming: Offline Programming Terminals, Computer-Assisted Programming, Computer-Aided Programming Languages, CAD/CAM Systems, Solid Modeling Systems

The Future of Numerical Control: NC in Prototype and Job Shops, CNC in Manufacturing, Employment Opportunities in NC

Text Book and References

1. Lynch; Computer Numerical Machining, 1992, McGraw-Hill

2 Stanton, George C. Bridgeport Heidenhain CNC Mill: Programming & Operating Instructions.

3 Valentino, J.V. & Goldenberg, J. (2003). *Introduction to computer numerical control (CNC)* (3rd Ed.). Upper Saddle River, NJ: Prentice Hal

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 606(D): TOOL ENGINEERING AND DESIGN

3 hrs. lecture and 1 hour tutorial per week

MODULE I: (13 hours) Design of chips forming tools

Single point tools-tool geometry-tool materials-milling cutters-drills and reamers-grinding wheels-tipped tools-design of tool holders and boring bars-vibration damping of boring bars-form tools-influence of cutting parameters on cutting force and power-cutting power estimation in turning, milling and drilling.

MODULE II: (13 hours) Press working tools

Power presses-die cutting operations-centre of pressure-punch and die size and press tonnage calculations-scrap-strip layout-compound and progressive dies-die design for simple components-drawing dies-blank development-press tonnage estimation-blank holding pressure-multiple draws-draw dies for simple shells.

MODULE III: (13 hours) Design of fixture

Elements of fixture-standard work holding devices-principles of location and clamping-plain and concentric location-clamping elements-quick acting clamps-design and sketching of fixtures for milling of simple components.

MODULE IV: (13 hours) Design of jigs

Jigs for drilling and reaming-types of jigs-guide bushings-indexing jigs-design and sketching of jigs for simple jobs

Text Book and References

1. Kempster M.H.A., "*An Introduction to Jig and Tool Design"*, ELBS
2. ASTME, *Fundamentals of Tool Design*
3. Grant H.E., "*Jigs and Fixtures - Non Standard Clamping Devices*", Tata McGraw Hill
4. Goroshkin A.K., "*Jigs and Fixtures Hand Book*", MIR Publishers
5. Wilson & Holt, "*Hand book of Fixture Design*", McGraw Hill
6. Colving & Haas, "*Jigs and Fixtures - A Reference Book*", McGraw Hill
7. Cole B., "*Tool Design*", Taraporevala
8. Donaldson, Lecain & Goold, "*Tool Design*", Tata McGraw Hill

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 606(E): VIBRATION AND NOISE CONTROL

3 hrs. lecture and 1 hour tutorial per week

MODULE I: (13 hours)

Introduction to mechanical vibration-free and forced response of single degree of freedom linear systems-Coulomb damping-support excitation-vibration isolation-whirling of shafts-measurement of vibration-accelerometer-seismometer.

MODULE II: (13 hours)

Two degree of freedom systems-coordinate transformations-coupling natural coordinates-beat phenomenon-undamped vibration absorbers-multi degree of freedom systems-matrix formulation-influence coefficients-Eigen value problem-expansion theorems-model analysis-solution methods-general methods of discrete linear systems.

MODULE III: (13 hours)

Vibration of continuous systems-exact methods-boundary value problem-Eigen value problem-axial vibration of rods-bending vibration of bars-Rayleigh's quotient-response of systems by modal analysis-energy of continuous systems-general elastic waves-formulation and decoupling of equilibrium equations-approximate methods-different methods like Rayleigh's energy method, Rayleigh-Ritz method and Holzer's method

MODULE IV: (13 hours)

Self excited vibrations-criterion of stability-instability caused by friction-instability in oil film lubricated bearings-galloping of transmission lines-introduction to nonlinear vibration-introduction to random vibration-stationary random process-probability density functions-auto correlation function-power spectral density function-noise-sound level meter scale-psychological scale-equivalent sound level-noise and loss of hearing-psychological effects of noise-noise exposure limits-noise control-control at the source-control along the path-control at the receive

Text Book

1. Thomson W.T., *Theory of Vibration with Applications*, Prentice Hall
2. Den Hartog J.P., *Mechanical Vibrations*, McGraw Hill, Self excited vibration, Module IV
3. Sanders M.S. & McCormick E.J., *Human Factors in Engineering and Design*, McGraw Hill, Noise, Module IV

References

1. Leonard Meirovitch, *Elements of Vibration Analysis,* McGraw Hill
2. Amitabha Ghosh & Asok Kumar Mallik, *Theory of Mechanisms and Machines*, Affiliated East-West Press
3. Kinsler L.E. & Fray A.R., *Fundamentals of Acoustics*, John Wiley, Module IV
4. Beranek L.L., *Noise and Vibration Control*, McGraw Hill, Module IV
5. Love AEH, *Treatise on Mathematical Theory of Elasticity, Dover,* Elastic Waves, Module III
6. Constable JER & Constable K.M., *Principles and Practice of Sound Insulation*, Isaac Pitman & Sons

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.

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6 ME 607(P) HEAT TRANSFER LAB

3 hrs. practicals per week

List of experiments

1. Performance study on parallel flow and counter flow Heat exchanger.
2. Performance study on Shell and tube Heat exchanger.
3. Measurement of emissivity.
4. Measurement of solar radiation.
5. Determination of thermal conductivity of metal rod.
6. Experiment on forced convection heat transfer.
7. Experiment on unsteady state conduction.
8. Experiment on drop wise and film wise condensation.
9. Measurement of critical heat flux.
10. Experiment on natural convection heat transfer.
11. Experiment on boiling heat transfer.
12. Determination of thermal resistance of composite wall
13. Determination of Stefan Boltzman constant.
14. Determination of thermal conductivity of asbestos powder.
15. Determination of effectiveness of fin.

Text Book and References

1 Yunus A. Cengel., "Heat Transfer – A practical approach", Second Edition, Tata McGraw-Hill

2. Incropera. F.P.and Dewitt.D.P. "Introduction to Heat Transfer", John Wiley and Sons

3. Holman, J.P. "Heat Transfer", McGraw-Hill Book Co., Inc., New York, 6th Edn.

4. Sachdeva, S.C., "Fundamentals of Engineering Heat & Mass Transfer", Wiley Eastern Ltd., New Delhi

Sessional Work Assessment

Laboratory practical and record	–	35 marks
Tests	–	15 marks
Total	–	50 marks

2K6 ME 608(P) CAD/CAM/CAE LAB

3 hrs. practicals per week

1. Exercise on solid modeling using available software packages- Concepts of computer aided modeling, design, analysis and manufacturing- Survey of various available software for the above areas– introduction to computer graphics, curves and surface generation, sweep, revolve, loft, extrude, filleting, chamfer, splines etc. Scaling and rotation transformation using commercial solid modeling packages: 2 D drafting and 3 D modeling.
2. Assembly and mechanical design – assembling of various parts and tolerance analysis – synthesis and design of mechanisms - four bar chain, cam and follower, two stroke and four stroke engines – 3D modeling, assembling, animation and analysis using available software packages.
3. Computer aided manufacturing – part programming fundamentals – hands on training in computer controlled machining operations – part programming, simulation and operation on CNC lathe and CNC milling machines- modeling, simulation and programme generation using software packages.
4. Exercises on Finite Element Analysis –introduction to FEM -1 D, 2 D,3 D elements – shape function- processing –boundary conditions, structured and free mesh generation – analysis – linear and nonlinear analysis – static and dynamic analysis – post processing – display , animation, extraction of nodal data –exercises on heat conduction and elasticity using available FEM packages.]
5. Programming of Industrial Robots – introduction to robotics – structure, workspace analysis and various components- actuators – sensors – encoders – end effectors – applications –hands on training on industrial robots – manual and programmed path planning. Programming of Robots using available software packages.
6. Computer aided inspection and quality control- introduction to CMM- classification – structures – components – familiarity with measurement software packages and its modules –demonstration of the capability of coordinate measuring machines using a sample component eg.- engine block.
7. concepts of reverse engineering and rapid prototyping technology

Text Book and References

1. Rogers D.F. & Adams J.A., "*Mathematical Elements for Computer Graphics*", McGraw Hill
2. Rogers David F., "*Procedural Elements for Computer Graphics*", McGraw Hill
3. Cook, Robert Davis et al., "*Concepts and Applications of Finite Element Analysis*", John Wiley
4. Koren Yoram, "*Computer Control of Manufacturing Systems*", McGraw Hill
5. Kundra Rao & Tewari, "*Numerical Control and Computer Aided Manufacturing*", Tata McGraw Hill
6. Ramamurthy V., "*Computer Aided Mechanical Design*", Tata McGraw Hill
7. Fu K.S., Gonzalez R.C. & Lee C.S.G., "*Robotics: Control, Sensing, Vision and Intelligence*", McGraw Hill
8. Koren Yoram, "*Robotics for Engineers*", McGraw Hill
9. Bosch J.A., "*Coordinate Measuring Machines and Systems*", Marcel Decker Inc

Sessional Work Assessment

Laboratory practical and record	–	35 marks
Tests	–	15 marks
Total	–	50 marks

KANNUR UNIVERSITY

FACULTY OF ENGINEERING

Curricula, Scheme of Examinations and Syllabi

for

B.Tech Degree Programme in

MECHANICAL ENGINEERING

V11 and V111 Semesters

With Effect From 2007 Admissions

SEVENTH SEMESTER

Code	Subject	Hours/Week			Sess Mrk	University Exam	
		L	T	P		Hrs	Mrk
2K6ME 701	Metrology and Instrumentation	3	1	-	50	3	100
2K6ME 702	Industrial Management	3	1	-	50	3	100
2K6ME 703	Machine Design I	3	1	-	50	3	100
2K6ME 704	Power plant Engineering	3	1	-	50	3	100
2K6ME 705	Elective II	3	1	-	50	3	100
2K6ME 706(P)	Instrumentation Lab	-	-	3	50	3	100
2K6ME 707(P)	Computational Lab	-	-	3	50	3	100
2K6ME 708(P)	Mini Project	-	-	4	50	-	-
2K6ME 709(P)	Physical Education, Health and Fitness	-	-	-	50	-	-
TOTAL		**15**	**5**	**10**	**450**	**-**	**700**

ELECTIVE-11

2K6ME 705 (A) MARKETING MANAGEMENT

2K6ME 705 (B) OPTIMIZATION TECHNIQUES

2K6ME 705 (C) INDUSTRIAL PSYCHOLOGY

2K6ME 705 (D) ADVANCED FLUID MECHANICS

2K6ME 705 (E) MULTIPHASE FLOW

2K6ME 701: METROLOGY AND INSTRUMENTATION

3 hours lecture & 1 hour tutorial per week

Module I (13 hours)

Applications of measuring instruments-functional elements of an instrument-instrument as transducer-generalised measuring instrument-generalised mathematical model of measuring systems-zero order, first order and second order instruments-classification of instruments - input/output configurations - methods of correction for spurious inputs-inherent insensitivity - high-gain feed-back - signal - filtering and opposing inputs - static calibration and determination of bias and random error of an instrument- assumption of Gaussian distribution for experimental data-chi-square goodness-of-fit test-method of least squares for curve fitting - static characteristics-accuracy loading effect-backlash-friction-hysteresis-threshold-dead space- resolution-static sensitivity and linearity-problems on friction-loading effect-sensitivity and calibration

Module II (13 hours)

Uncertainty in "computed quantities" from measured values - estimation of permissible uncertainties of instruments for specific purposes - potentiometer transducer as a zero order instrument - analysis of its loading error - mercury-in-glass thermometer as a first order instrument - step, ramp and frequency response of first order instruments - problems - seismic instrument as a second order instrument - step, terminated ramp, ramp and frequency response of second order instruments - slip gages - assembling the blocks - temperature problems - LVDT - comparators: principle of working of mechanical, electrical, pneumatic comparators - measurement of strain: strain gauge classification - unbonded and bonded strain gauges - gage factor - strain gauge rosettes - selection and installation of bonded gauges - ballast, DC bridges and constant current circuits - temperature compensation – calibration

Module III (13 hours)

Measurement of force: multiple lever system for weighing - strain gauge load cells - temperature sensitivity-ballistic weighing-hydraulic & pneumatic load cells-measurement of torque: water brake Heenan & Froude hydraulic dynamometer - general purpose electric dynamometer - measurement of temperature: pressure thermometers-RTDs-compensation for lead resistance-thermistors - thermocouples - series in parallel connected thermocouples -

materials used and there ranges - pyrometry-infrared pyrometry - air pollution measurement: gas chromatography - Orsat's apparatus - nuclear instrumentation: Gieger Muller counter - ionisation chamber - scintillation counters

Module IV (13 hours)

Acoustical measurements: characterisation of sound (noise) - basic acoustical parameters - sound pressure - sound pressure level, power, intensity and power level - combination of sound pressure levels - attenuation with distance - psychoacoustic relationships - micro-phones - sound level meter - principles of automatic control: open and closed loop systems - servo mechanism - process control and regulators - mathematical modelling of mechanical and electrical systems - transfer function of simple systems - time domain analysis of control system: steady state response - steady state error - error coefficients - stability of control systems: concept of stability - method of determining stability of linear control systems - Routh Hurwitz criterion

Text Books and References

1. Beckwith T.G., Marangoni R.D. & Lienhard J.H., "*Mechanical Measurements"*
2. Doebelin E.O., *"Measurement Systems"*, McGraw Hill Publishing Company
3. Holman J.P., *"Experimental Methods for Engineers"*, McGraw Hill Inc.
4. Kuo, *"Automatic Control Systems"*, Asian Student Edition, Prentice Hall of India

Sessional work assessment

Two assignments = 20

Two tests = 30

Total marks = 50

University examination pattern

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

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

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

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

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

2K6ME 702 : INDUSTRIAL MANAGEMENT

3 hours lecture & 1 hour tutorial per week

Module I (14 hours)

Management concepts - system concepts of management - management functions - planning - principles of planning - organizing - organization structures - principles of organizing - span of control - delegation - leadership - directing - controlling

Decision making - strategic and tactical decisions - models of decision making - single stage decisions under risk - multi stage decision making - decision trees - decision making under uncertainty - Baye's decision theory - equally likely - minimax - maximum likelihood - maximin criterion –

Module II (12 hours)

Network techniques - basic concepts - network construction - CPM and PERT networks - algorithm for critical path - slacks and their significance - crashing - network flow problems - the shortest route problem - minimal spanning tree problem - maximal flow in capacitated network

Module III (14 hours)

Production planning and control - scope and objectives - functions of PPC - product consumption cycle - production planning - process planning - material requirement planning - forecasting - methods of forecasting - moving average method - single exponential smoothing - linear regression - linear forecaster - scheduling - objectives - performance measures - priority rules - single machine scheduling - job shop scheduling - 2 jobs N machines - flow shop scheduling - N jobs 2 machines - N jobs 3 machines scheduling

Module IV (12 hours)

Human resources management - job design - job enrichment - job enlargement - job evaluation - merit rating - wages and incentives - work study - method study - time study - work sampling.

Costing - cost concepts - concept of cost accounting - elements of cost - overhead costs - methods of allocation of overhead costs - depreciation - methods of depreciation - financial management - time value of money - comparison of alternatives - payback period method -

net present value method - internal rate of return method - basics of financial accounting - profit and loss account - balance sheet preparation

Text books

1. Koontz H., O'Donnel & Weihrich H., *Essentials of Management*, McGraw Hill Book Company
2 Mazda F., *Engineering Management*, Low Price Edition, Addison Wesley
3. Pandey I.M., *Financial Management*, Eighth Edition, Vikas Publishing House Private Limited
4 Bhattacharya A.K., *Principles and Practice of Cost Accounting*, Wheeler Publishing
5 Venkata Ratnam C.S. & Srivastava B.K., *Personnel Management and Human Resources*, Tata McGraw Hill Publishing Company Limited
6 Barnes., *Motion and Time Study Design and Measurement of Work*, Wiley
7 Jerome D Weist, *A Management Guide to PERT/CPM*, Mc.Graw Hill Co.
8 Samuel Eilon., Elements of Production Planning and Control, Prentice Hall India.

Reference books

1 Chase R.B., Aquilano N.J. & Jacobs F.R., *Production and Operations Management: Manufacturing and Services*, Eighth Edition, Tata McGraw Hill Publishing Company Limited
2 Prasanna Chandra, *Financial Management: Theory and Practice*, Fourth Edition, Tata McGraw Hill Publishing Company Limited

Sessional work assessment

Two assignments = 20
Two tests = 30
Total marks = 50

University examination pattern

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

2K6ME 703: MACHINE DESIGN I

3 hours lecture & 1 hour tutorial per week

Module I (13 Hours)

Introduction to design- Steps in design process –Design factors –Tolerances & fits – principles of standardization – Codes & standards – Selection of materials

Introduction to Computer aided design – Introduction to modeling, drafting, simulation and analysis software packages.

Stress & Strength considerations of mechanical elements – Stress concentration Theories of failure –Impact load – Fatigue loading – consideration of creep and thermal stresses in design.

Module II (13 Hours)

Threaded fasteners –Thread standards – Stresses in screw threads – preloading of bolts – bolted joints – eccentric loading – gasketed joints – Fatigue loading - analysis of power screws.

Keys – types of keys and pins – stresses in keys and pins – design of keys – design of cotter and pin joints

Riveted Joints – stresses in riveted joints – strength analysis – boiler and tank joints – structural joints

Module III (13 Hours)

Welded joints – types of welded joints – stresses in butt and fillet welds – torsion and bending in welded joints- welds subject to fluctuating loads – design of welded machine parts and structural joints.

Springs – Stresses in helical springs- deflection of helical springs – extension, compression and torsion springs- design of helical springs for static and fatigue loading – critical frequency of helical springs – stress analysis and design of leaf springs

Module IV (13 Hours)

Power shafting – stresses in shafts – design for static loads – reversed bending and steady torsion – design for strength and deflection – design for fatigue loading – critical speed of shafts – stresses in couplings – design of couplings

Text books:

1. Joseph Edward Shigley, Mechanical Engineering Design, McGraw Hill Book Company.
2. V B Bhandari, Design of Machine elements, Tata McGraw Hill Publishing Co. Ltd.

Reference books:

1. Stegel, Maleev & Hartman, Mechanical Design of Machines, International Book Company
2. Phelan R. M, Fundamentals of Mechanical Design, Tata McGraw Hill Publishing Co. Ltd.
3. Doughtie V L & Vallance. A V., Design of Machine Elements, McGraw Hill Book Company.
4. Paul H Black & O Eugene Adams Jr., Machine Design, McGraw Hill Book Company.
5. M F Spotts, T E Shoup, Design of Machine elements, Prentice Hall
6. V B Bhandari, Introduction to Machine Design, Tata McGraw Hill Publishing Co. Ltd.
7. Georeg E Dieter, Engineering Design, McGraw Hill Book Company.
8. Jack A Collins, Failure of Materials in Mechanical Design: Analysis, Prediction, Prevention. John Wiley & Sons Inc.
9. Ibrahim Zeid, CAD/CAM theory and practice, McGraw Hill Book Company.

Data hand books (allowed for reference during examinations)

1. Prof. Narayana Iyengar B R & Dr. Lingaiah K, Machine Design Data Hand Book Vol. I & II.
2. P. S. G. Tech, Machine Design Data Handbook

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6ME 704 POWER PLANT ENGINEERING

3 hours lecture and 1 hour tutorial per week

MODULE I (12 hours)

Steam engineering-temperature entropy diagram-mollier diagram-rankine cycle-modified rankine cycle-reheat and regenerative-binary vapour cycle-steam generators-classifications-cochran boiler-lancashire boiler-cornish boiler-locomotive boiler-babcock and wilcox boiler-stirling boiler-high pressure boilers-boiler mountings and accessories

MODULE II (12 hours)

Steam nozzles-flow through steam nozzles-throat pressure for maximum discharge- effect of friction-super saturated flow-steam turbines-impulse and reaction turbines-velocity diagram-condition for maximum efficiency-compounding-reheat factor-blade height-governing of steam turbines-cogeneration and combined cycle power generation-steam engines-components-compounding-indicator diagram

MODULE III (16 hours)

Thermal power plants-general layout-site selection-fuel handling storage and burning systems-dust and ash handling system-chimney draught-nuclear power plants-classification-components-safety measures-effects of nuclear radiation-nuclear waste disposal-gas turbine power plants-classification-closed open and other systems-hydro electric power plants-combined operation of different power plants-non conventional power generation-solar thermal collection-thermal storage-ocean power-principle of OTEC systems-wind energy-wind turbine-geothermal energy-geothermal electrical power plants-biogas energy-biogas production-design and construction of biogas plants

MODULE IV (12 hours)

Economics of power generation-terms and definitions-estimation of load-load curve-load factor-diversity factor-capacity factor-use factor-economics in plant selection-economics of generation and distribution of power-useful life-tariff for electrical energy-environmental pollution and its control-steam power plant pollutants-control of pollutants-control of particulate matter-control of SO_2- control of NO_2-control of waste water from steam power plants-pollution from nuclear power plants-noise pollution and noise control

Text Book:

1. El Wakil, “Power Plant Technology” McGraw Hill

Reference Books:

1. Nag, “Power Plant Engineering” TMH
2. Ngpal, “Power Plant Engineering” Khanna
3. Vapat & Scrotski, “Power Station Engineering and Economy” TMH
4. John F Lee, “Power Station Engineering and Economy” TMH

Sessional work Assessment

Two Tests	=30
Two Assignments	=20
Total Marks	=50

University examination pattern

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

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

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

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

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

2K6ME 705 (A): MARKETING MANAGEMENT

3 hours lecture & 1 hour tutorial per week

Module I (14 hours)

Introduction to marketing - concept of market and marketing - marketing environment - controllable factors - factors directed by top management - factors directed by marketing - uncontrollable factors - demography, economic conditions, competition, social and cultural forces, political and legal forces, and technology

Module II (14 hours)

Marketing planning - marketing planning process - Boston consultancy group model - marketing mix - marketing mix variables - market segmentation and market targeting - introduction to segmentation - targeting and product positioning

Module III (12 hours)

Marketing research - need and scope - marketing research process - research objectives, developing research plan, collecting information, analysis, and findings - consumer behaviour - factors influencing consumer behaviour - perceived risks - product life cycle - marketing strategies for different stages of product life cycle

Module IV (12 hours)

Marketing communication - marketing mix variables - steps in developing effective communication - identification of target audience - determination of communication objectives - designing the message - selecting the communication channels - promotion mix evaluation - advertising and sales promotion - factors in advertising - sales promotion tools

Text books

1. Kotler P., *Marketing Management: Analysis, Planning, Implementation and Control*, Prentice Hall of India Private Limited
2. Ramaswamy V.S. & Namkumari S., *Marketing Management: Planning, Implementation and Control*, Macmillan India Limited

Reference books

1. Stanton W.J., Etzel M.J. & Walker B.J., *Fundamentals of Marketing,* McGraw Hill International Edition
2. Majumdar R., *Marketing Research, Text, Applications and Case Studies,* New Age International (P) Limited Publishers
3. Robert, *Marketing Research,* Prentice Hall of India

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6ME 705 (B): OPTIMIZATION TECHNIQUES

3 hours lecture and 1 hour tutorial per week

MODULE I: Linear Programming I (14 hours)

Systems of linear equations and inequalities-convex sets-convex functions-formulation of linear programming problems-theory of simplex method-simplex algorithm-Big M method and two phase method-degeneracy-duality in linear programming-dual simplex method-optimization software packages-LINDO, LINGO-using LINGO to solve LPPs.

MODULE II: Linear Programming II (14 hours)

Sensitivity analysis-parametric programming-bounded variable problems-Integer programming-transportation problem-development of the method-degeneracy-unbalanced problems-assignment problem-development of the Hungarian method-routing problems.

MODULE III: Non-linear Programming (13 hours)

Mathematical preliminaries of non-linear programming-gradient and Hessian-unimodal functions-local and global optima-convex and concave functions-role of convexity-unconstrained optimization-Fibonacci search-golden section search-optimal gradient method-classical optimization-Legrange multiplier method-Kuhn-Tucker conditions-quadratic programming-separable convex programming-Frank and Wolfe method.

MODULE IV : Dynamic Programming and Metaheauristics (13 hours)

Nature of dynamic programming problem-Bellman's optimality principle-Cargo loading problem-replacement problems-multistage production planning and allocation problems.

Introduction to Genetic Algorithm-steps-coding and selection-reproduction-cross over and mutation

Text books and Reference books

1. Bazarra M.S., Jarvis J.J. & Sherali H.D., '*Linear Programming and Network Problems*', John Wiley
2. Bazarra M.S., Sherali H.D. & Shetty C.M., '*Nonlinear Programming, Theory and Algorithms'*, John Wiley
3. Hadley G., '*Linear Programming*', Addison Wesley
4. Hillier F.S. & Lieberman G.J. '*Introduction to Operations Research'*, McGraw Hill
5. Ravindran A., Phillips D.T. & Solberg J.J., *Operations Research Principles and Practice*, John Wiley

6. Taha H.A., *Operations Research, An introduction*, P.H.I.
7. Wagner H.M., '*Principles of Operations Research with Application to Managerial Decisions'*, P.H.I.

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6ME 705(C): INDUSTRIAL PSYCHOLOGY

3 hours lecture & 1 hour tutorial per week

Module I (13 hours)

Introduction - psychology as a science - areas of applications - study of individual - individual differences - study of behavior - stimulus - response behavior - heredity and environment - human mind - cognition - character - thinking - attention - memory- emotion - traits - attitude - personality

Module II (13 hours)

Organizational behavior - definition - development - fundamental concept - nature of people - nature of organization - an organizational behavior system - models - autocratic model - hybrid model - understanding a social - system social culture - managing communication - downward, upward and other forms of communication

Module III (13 hours)

Motivation - motivation driver - human needs - behavior modification - goal setting - expectancy model - comparison models - interpreting motivational models - leadership - path goal model - style - contingency approach

Module IV (13 hours)

Special topics in industrial psychology - managing group in organization - group and inter group dynamics -managing change and organizational development - nature planned change - resistance - characteristic of OD - OD process.

Text books

1 Keith Davis & Newstrom J.W., "*Human Behavior At Work*", McGraw Hill International

2 Schermerhorn J.R. Jr., Hunt J.G. & Osborn R.N., "*Managing Organizational Behavior*", John Willy

3 Luthans, "*Organizational Behavior*", McGraw Hill, International

4 Morgan C.T., King R.A., John Rweisz & John Schoples, "*Introduction to Psychology*", McGraw Hill

5 Blum M.L. & Naylor J.C., Horper & Row, "*Industrial Psychology*", CBS Publisher

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6ME 705(D): ADVANCED FLUID MECHANICS

3 hours lecture & 1 hour tutorial per week

MODULE I: (13 hours)

Basic equations of fluid flow: Reynolds transport equation-integral and differential formations-integral form of equations of the continuity-momentum and energy equations-use of integral equation-differential form of these equations-Stoke's postulates and constitutive equations-Navier-Stokes equations and energy equations for Newtonian fluids.

Non dimensionalisation of the equations of motion and order of magnitude analysis: Choice of characteristic quantities-identification of the non dimensional parameters- classification of flows based on the characteristic Reynolds number-approximate equations for low Re and high Re flows and boundary layer equations-boundary equations.

MODULE II: (13 hours)

Some exact solutions of the Navier-Stokes equations: Couette flows-plane Poisseuille-flow between rotating cylinders-Stokes problems-fully developed flow through circular and non-circular pipes

Approximate solutions: Creeping flow past a sphere-theory of hydrodynamic lubrication-boundary layer on a flat plate-Blassius solution and use of momentum integral equation.

MODULE III: (14 hours)

Introduction to compressible flows: Basic concepts-equations for one dimensional flow through steam tubes-speed of sound and Mach number-qualitiative difference between incompressible, subsonic and supersonic flows-characteristic velocities-adiabatic flow ellipse

Isentropic flow through a duct: Criterion for acceleration and deceleration-stagnation quantities-isentropic relations-use of gas tables-operation of nozzles at off design conditions.

Normal shocks in one dimensional flow: Occurrence of shocks-analysis of normal shocks-Prandtl's equation-Rankine-Hugoniot equation and other normal shock relations-moving shocks.

MODULE IV: (12 hours)

Oblique shocks and expansion waves: Oblique shock relations-θ-β-M relations-shock polar-supersonic flow over a wedge-expansion waves-Prandtl-Meyer function-intersection of shocks-detached shocks-Mach deflection-shock expansion theory.

Flow with friction: Fanno lines and Fanno flow relations-effect of friction on properties-choking-isothermal flows.

Flow with heat transfer: Rayleigh lines-effect of heat addition-thermal choking

Text books and Reference books

1. Muralidhar K. & Biswas G., *Advanced Engineering Fluid Mechanics,* Narosa Publishing House
2. Rathakrishnan E., *Gas Dynamics*, Prentice Hall India
3. Gupta V. & Gupta S., *Fluid Mechanics and its Applications*, Wiley Eastern Ltd.
4. White F.M., *Viscous Fluid Flow*, McGraw Hill
5. Zuckrow M.J. & Hoffman D.H., *Gas Dynamics*, McGraw Hill

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6ME 705(E): MULTI-PHASE FLOW

3 hors lecture & 1 hour tutorial per week

Module I (13 hours)

Basic equations and empirical correlations for multi-phase flow - flow patterns - identification and classification - flow pattern maps and transition - momentum and energy balance - homogeneous and separated flow models - correlations for use with homogeneous and separated flow models - two phase flow through inclined pipes and singularities - void fraction and slip ratio correlations - influence of pressure gradient - empirical treatment of two phase flow - drift flux model - correlations for bubble, slug and annular flows - pressure losses through enlargements, contractions, orifices, bends and values

Module II (13 hours)

Boiling and multiphase heat transfer - vapour-liquid equilibrium mechanisms - pool boiling convective boiling - heat transfer in partial and fully developed sub-cooled boiling - void fraction and pressure drop in sub-cooled boiling - saturated boiling heat transfer - two phase forced convection laminar and turbulent flow solutions for film heat transfer - empirical equations for film boiling and transition boiling - burnout mechanism and correlations - critical coefficient in nucleate and convective boiling

Module III (13 hours)

Condensation - basic processes of condensation - mechanism of evaporation and condensation - film condensation on a planar surface - dropwise condensation - pressure gradient in condensing systems - methods of improving heat transfer coefficient in condensation

Module IV (13 hours)

Critical multiphase flows - mathematical models - critical flow criterion - compatibility conditions and their physical interpretation - experimental observations - propagation of small disturbances - pressure drop limitation effect - graphical representation of critical flow conditions

Text books

Collier J.G., *Convective Boiling and Condensation,* McGraw Hill

Reference books

1. Hsu Y.Y. & Graham R.W., *Transport Processes in Boiling and Two Phase Systems,* Hemisphere
2. Ginoux J.J., *Two Phase Flows and Heat Transfer,* Hemisphere, McGraw Hill
3. Tong L.S., *Boiling Heat Transfer and Two Phase Flow,* Wiley
4. Hewitt G., Delhaye J.M. & Zuber N., *Multiphase Science and Technology,* Vol. I., McGraw Hill

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6ME 706(P): INSTRUMENTATION LAB

3 hours practicals per week

Study on concepts of measurement, types of errors, accuracy, precision, hysterisis, least square curve fitting, study of Stroboscope, transducers, strain gauges, rotometer, slip gauges and various precision measuring instruments.

List of experiments

1. Calibration of Bourden tube pressure gauge.
2. Calibration of LVDT.
3. Calibration of Thermocouple.
4. Calibration of Micrometer and vernier caliper.
5. Measurement of area by planimeter.
6. Preparation of psychrometric chart.
7. Statistical analysis of data.
8. Measurement using Profile projector.
9. Measurement of vibration and analysis.
10. Temperature measurement by pyrometer.
11. Calibration of Tachometer.
12. Determination of PH value.
13. Sound level measurement and analysis.
14. Flaw detection using ultrasonic tester.
15. Analysis of exhaust gas of I C engines.
16. Velocity measurement by Pitot tube.
17. Flaw measurement using Rotometer.
18. Measurement of drag and lift coefficients of an aerofoil using wind tunnel.
19. Experiment on strain gauges.

Sessional work assessment

Lab Practicals and Record = 35

Tests = 15

Total marks = 50

2K6ME 707(P): COMPUTATIONAL LAB

3 hours practicals per week

This laboratory is expected to expose the students to the latest software packages related to the subjects covered during the course of B.Tech. in Mechanical Engineering. At least two experiments each from the four different modules need to be performed.

Module 1

Solving basic mathematical problems such as curve fitting, numerical differentiation & Integration and numerical solution of differential equations using

C / C++ / FORTRAN /JAVA / MATLAB.

Module II

Modeling and analysis of basic structural engineering problems using software such as ANSYS and NISA.

Module III

Modeling and analysis of basic fluid dynamics and heat transfer problems using software such as FLUENT.

Module IV

Using discrete event simulation software such as ARENA / SIMULINK for solving production scheduling problems, queuing problems and for network analysis.

Using LINGO / LINDO for solving linear programming problems.

Sessional work assessment

Lab Practicals and Record = 35

Tests = 15

Total marks = 50

2K6ME 708(P): MINI PROJECT

4 hours per week

The project work can be a design project, experimental fabrication project or software development project on any of the topics of mechanical engineering interest - it can be allotted as a group project with groups consisting of three or four students

The assessment of all the mini projects should be done by a committee consisting of three or four faculty members specialised in the various fields of **Mechanical Engineering** - the students will present their project work before the committee - the relative gradings and group average marks for the various projects will be fixed by the committee - the guide will award the marks for the individual students in the 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 keep them in the departmental library

Sessional work assessment

Presentation	= 30
Report	= 20
Total marks	= 50

2K6ME 709(P): PHYSICAL EDUCATION, HEALTH AND FITNESS

Introductory Lectures

Unit I. 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 wellness.

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, 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, BMI, Blood Pressure, Physical Fitness Tests assessing various motor qualities of each individuals will be carried out (optional - based on request).

Objectives

(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 I^{st} semester to 7^{th} semester.

EIGHTH SEMESTER

Code	Subject	Hours/Week			Sess Mrk	University Exam	
		L	T	P		Hrs	Mrk
2K6ME 801	Gas Dynamics	3	1	-	50	3	100
2K6ME 802	Refrigeration and Air conditioning	3	1	-	50	3	100
2K6ME 803	Machine Design II	3	1	-	50	3	100
2K6ME 804	Inventory and Supply Chain Management	3	1	-	50	3	100
2K6ME 805	Elective III	3	1	-	50	3	100
2K6ME 806(P)	Seminar	-	-	4	50	-	-
2K6ME 807(P)	Project and Industrial Training	-	-	6	100*	-	-
2K6ME 808(P)	Viva Voce	-	-	-	-	-	100
TOTAL **Aggregate marks for 8 semesters =8400**		**15**	**5**	**10**	**400** **3000**	**-**	**600** **5400**

*** 25 Marks is allotted for Industrial Training**

ELECTIVE-111

2K6ME 805(A) : FINITE ELEMENT ANALYSIS

2K6ME 805(B) : NEURAL NETWORKS AND FUZZY LOGIC

2K6ME 805(C) : COMPUTATIONAL FLUID MECHANICS AND HEAT TRANSFER

2K6ME 805(D) : SYSTEM SIMULATION AND MODELING

2K6ME 805(E) : QUALITY ENGINEERING AND MANAGEMENT

2K6ME 801 : GAS DYNAMICS

3 hours lecture & 1 hour tutorial per week

Module 1

Basic equations of fluid flow. Continuity, Momentum, Energy equations. Navier-Stokes equations. Introduction to compressible flow. Equation of state. Entropy Equation, The Stagnation Concept, Stagnation Pressure and Temperature, Consequences of Constant Density. Speed of sound. Mach number and Mach angle.

Module 11

Equations for compressible, one-dimensional duct flows. Sonic Velocity and Mach Number, Wave Propagation, Equations for Perfect Gases in terms of Mach Number, h-s and T-s Diagrams. Steady one dimensional isentropic flow with area change – Governing equations, effect of area change on flow properties, limiting conditions (choking), governing equation for the isentropic flow of a perfect gas, isentropic flow tables for a perfect gas, effect of area change on the flow properties, the converging nozzle. Effect of varying the back pressure and inlet pressure. Converging diverging or De Laval nozzle

Module 111

Shock waves – normal shock waves in perfect gas – governing equations, normal shock wave tables, the Rankine – Hugoniot equation for a normal shock wave, Prandtl's velocity equation, entropy change and shock strength. Oblique shock waves in perfect gas Governing equations, property ratios across an oblique shock wave, Rankine – Hugoniot equation. Expansion waves

Module 1V

Steady one dimensional adiabatic flow with friction in a constant area duct – governing equations, Fanno line, Fanno line equation for perfect gas, friction parameter, relationship between duct length and Mach number, entropy change caused by friction, effect of friction on flow properties, Fanno line tables.

Steady one dimensional flow with heat transfer in a constant area duct – governing equations, Rayleigh line, intersection of Fanno line and Rayleigh line, Rayleigh line equations for a perfect gas, relationship between heat transfer, stagnation temperature and Mach number, effect of heat transfer on flow properties, Rayleigh line tables.

Text books

1. Rathakrishnan. E., Gas dynamics, Prentice Hall India, New Delhi, 1995.
2. Shapiro, A.H., Dynamics & Thermodynamics of Compressible fluid flow, Ronald Press.
3. Zuckrow. M.J. & Hoffman, D.H., Gas Dynamics, McGraw Hill, New York.
4. Zucker R. D. and Biblarz Oscar, "Introduction to Gas Dynamics", John Wiley and Sons. Inc., Second Edition

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6ME 802 : REFRIGERATION AND AIR CONDITIONING

3 hours lecture & 1 hour tutorial per week

MODULE I (12 hours)

Introduction to refrigeration-unit of refrigeration-refrigerator and heat pump-coefficient of performance-reversed Carnot cycle-pressure enthalpy diagram-vapour compression refrigeration cycle-analysis of practical vapour compression cycle-non conventional refrigeration systems-thermo electric refrigeration-vortex tube-pulse tube refrigeration-refrigerant mixtures-cooling by adiabatic demagnetization

MODULE II (12 hours)

Steam jet refrigeration-analysis of steam jet refrigeration system-components-advantages and limitations-air refrigeration systems-thermodynamic analysis of bell coleman cycle-application to air craft refrigeration-absorption refrigeration systems-principle and operation of aqua ammonia and lithium-bromide water systems-electrolux system-comparison between vapour compression and absorption systems-introduction to adsorption refrigeration system-MEMS cooling systems

MODULE III (14 hours)

Refrigerants-thermodynamic physical and chemical properties of refrigerants-selection criteria of refrigerants-refrigerant compressors-reciprocating compressors-single and multi stage compression-effect of clearance-effect of inter cooling-optimum pressure ratios-efficiencies-rotary compressor-screw-vane type compressor-centrifugal compressor-hermetic-semi hermitic and open compressors-condensers-air cooled condensers-water cooled condensers and evaporative condensers-expansion devices-purpose and types-capillary tube-automatic expansion valve-thermostatic expansion valve-evaporators-flooded evaporators-dry expansion systems-natural convection evaporators-forced convection evaporators-shell and tube evaporators-shell and coil evaporators

MODULE IV(14 hours)

Psychrometry-psychrometric properties and relations-psychrometric chart-psychrometric processes-summer air conditioning system-winter air conditioning system-year round air conditioning system-central air conditioning system-unitary air conditioning system-direct

expansion system-all water system-all air system-air water system-design procedure for air conditioning systems-estimation of air conditioning load-noise and noise control-refrigeration and air conditioning controls-high pressure and low pressure cutout-high side and low side float valve-flow regulating devices-thermostats-humidstats

Text Book:

1. Stoecker, “Refrigeration and Air Conditioning.”, Mc Graw Hill

Reference Books:

1. Roy J Doosat, “ Principles of Refrigeration.”, Pearson Education
2. C.P Arora, “Refrigeration and Air Conditioning.” TMH
3. Ananthanarayanan, “Basic Refrigeration and Air Conditioning.”, Mc Graw Hill
4. McQuston, “Heating, Ventilating and Air Conditioning” John Wiley

Sessional work assessment

Two tests	= 30
Two assignments	= 20
Total marks	= 50

University examination pattern

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

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

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

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

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

2K6ME 803: MACHINE DESIGN 11

3 hours lecture and 1 hour tutorial per week

Module I (13 Hours)

Design of clutches & brakes –friction clutches and brakes – uniform pressure and uniform wear assumptions – design of disc and cone types of clutches and brakes – design of external contracting and internal expanding elements – band type clutches and brakes – centrifugal clutches

Design of belts and chain drives – belt and chain drives of common types – design of flat and V belt drives Selection of roller chains

Module II (13 Hours)

Design of gears – spur, helical, bevel and worm gears – tooth loads – gear materials – design stresses - basic tooth stresses – stress concentration – service factor - velocity factor – bending strength of gear teeth - Buckingham's equation for dynamic load – surface strength and durability - heat dissipation - design for strength and wear.

Module III (13 Hours)

Lubrication & Journal bearing design – types of lubrication and lubricants – viscosity – journal bearing with perfect lubrication – hydrodynamic theory - design considerations – heat balance – journal bearing design – rolling contact bearings – bearing types - bearing life – static and dynamic capacity - selection of bearings with axial and radial loads – selection of tapered roller bearings – lubrication seals, shaft, housing and mounting materials

Module IV (13 Hours)

Product design for manufacturing – general design considerations for rolled sections – forgings – screws machine products –turned parts – machined round holes – parts produced on milling machine – welded parts and castings – modification of design for manufacturing easiness for typical products – preparation of working drawings – working

drawings for manufacture of parts with complete specifications including manufacturing details like tolerance – surface finish etc. – computer applications in the preparation for working drawings.

Text book

Shigley J.E., *Mechanical Engineering Design*, McGraw Hill Book Company

Reference books

1. Siegel, Maleev & Hartman, *Mechanical Design of Machines*, International Book Company
2. Phelan R.M., *Fundamentals of Mechanical Design,* Tata McGraw Hill Publishing Co. Ltd.
3. Doughtie V.L.& Vallance A.V., *Design of Machine Elements*, McGraw Hill Book Company
4. Juvinall R.C. & Marshek K.M., *Fundamentals of Machine Component Design*, John Wiley
5. Bralla J.G., *Handbook of Product Design for Manufacture*, McGraw Hill Book Company

Data hand books (allowed for reference during examinations)

1. Prof. Narayana Iyengar B.R. & Dr Lingaiah K., Machine Design Data Handbook
2. P.S.G., Tech., *Machine Design Data Handbook*

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6ME 804 : INVENTORY & SUPPLY CHAIN MANAGEMENT

3 hours lecture & 1 hour tutorial per week

Module I (12 hours)

Supply chain management (SCM) - concept of logistics and SCM - decision phases - design, planning and operation - decision areas - type of supply chain views - flows in supply chain - supply chain and competitive performance - performance measures for SCM - strategic fit - drivers of supply chain

Module II (12 hours)

Sourcing and procurement - sourcing - factors in source selection - vendor rating - qualitative and quantitative methods - purchasing - objectives and procedure - purchasing systems - tender method - computer based systems/EDI - inventory concept - functions of inventory - selective inventory control techniques - structure of inventory problem - costs associated with materials management - relevant costs

Module III (14 hours)

Independent demand items - probabilistic - single order quantities - payoff matrix - incremental analysis - mathematical formulation of discrete and continuous cases - independent demand items - deterministic and dynamic - deterministic inventory models without and with backordering - sensitivity analysis - quantity discount - all units and incremental discounts

Module IV (14 hours)

Independent demand items - probabilistic and dynamic inventory models - Q and P system models - dependent demand items - deterministic models - lot sizing models - lot by lot - EOQ - part period balancing - wagner-whitin method - concept of just-in-time - kanban - introduction to distribution requirement planning

Text books

1. Dobler D.W. & Burt D.N., *Purchasing and Supply Management: Text and Cases*, Tata McGraw Hill Publishing Company Limited
2. Tersine R.J., *Principles of Inventory and Materials Management*, Prentice-Hall Inc
3. Starr M.K. & Miller D.W., *Inventory Control: Theory and Practice*, Prentice Hall of India
4. Chopra S. & Meindl P., *Supply Chain Management: Strategy, Planning, and Operation,* Pearson Education Asia

Reference books

1. Christopher M., *Logistics and Supply Chain Management*, Pitman Publishing Company
2. John Mortimer (Editor), *Logistics in Manufacturing: An IFS Executive Briefing*, IFS Publications, U.K. & Springer-Verlag
3. Narasimhan S.L., Mcleavy D.W. & Billington P.J., *Production Planning and Inventory Control*, Prentice Hall of India
4. Raghuram G. & Rangaraj N., *Logistics and Supply Chain Management: Cases and Concepts*, Macmillan India Limited

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6ME 805(A): FINITE ELEMENT ANALYSIS

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Linear vector spaces - linear transformations and functionals - linear, bilinear and quadratic forms - theory of normed spaces - theory of inner product spaces - concepts from variational calculus - variational methods of approximation - Ritz method - weighted residual method - Galerkin method - subdomain method - collocation method

Module II (11 hours)

Finite element analysis of one dimensional problems - procedure - one dimensional elements and interpolation functions - analysis of one dimensional second and fourth order equations - approximation errors in the finite element method - computer implementation

Module III (15 hours)

Finite element analysis of two dimensional problems - two dimensional elements and interpolation functions - second order equations involving a scalar valued function - comments on mesh generation and composition of boundary conditions - analysis of plane elasticity and incompressible fluid flow problems - time dependent problems (transient heat transfer) - isoparametric elements and numerical integration

Module IV (13 hours)

Alternative formulations - least square formulation - mixed formulation - Eigenvalue problems - nonlinear problems - three dimensional elements and interpolation functions - formulation of three dimensional problems (two and three dimensional Navier-Stokes equations - three dimensional heat transfer equations)

Text books

1. Reddy J.N., *An Introduction to the Finite Element Method,* McGraw Hill International Edition
2. Reddy J.N., *Applied Functional Analysis and Variational Methods in Engineering*, McGraw Hill, International Edition

Reference books

1. Huebner K.H., *The Finite Element Method for Engineers*, John Wiley
2. Zenkiewicz O., *The Finite Element Method*, McGraw Hill International Edition

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6ME 805(B): 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 system

Text books and Refrerence 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. Ross T.J., *"Fuzzy Logic with Engineering Applications"*, McGraw Hill
5. Bart Kosko. *"Neural Network and Fuzzy Systems"*, Prentice Hall, Inc., Englewood Cliffs
6. Goldberg D.E., *"Genetic Algorithms in Search Optimisation and Machine Learning"*, Addison Wesley
7. Suran Goonatilake & Sukhdev Khebbal (Eds.), *"Intelligent Hybrid Systems*", John Wiley

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6ME 805(C): COMPUTATIONAL FLUID MECHANICS

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Classification of partial differential equations - system of first and second-order partial differential equations - initial and boundary conditions - finite difference formulations - finite difference equations - finite difference approximation of mixed partial derivatives

Module II (12 hours)

Parabolic partial differential equations - explicit methods - implicit methods - parabolic equations in two-space dimensions - consistency, stability, and error analysis of finite difference equations - artificial viscosity

Module III (12 hours)

Elliptic equations - finite difference formulations - solution algorithms - hyperbolic equations - finite difference formulations -splitting methods - multiple-step method

Module IV (16 hours)

Scalar representation of the navier - stokes equations - model equations - numerical algorithms - incompressible navier - stokes equations - primitive variable and vorticity - stream function formulations - poisson equation for pressure - numerical algorithms - boundary conditions - staggered grid

Text book

Hoffmann Klaus A., "*Computational Fluid Dynamics for Engineers - Volume I*", Engineering Education System, Wichita

Reference books

1. Patankar Suhas V., "*Numerical Heat Transfer and Fluid Flow*", Taylor & Francis
2. Fletcher C.A.J., "*Computational Techniques for Fluid Dynamics I*, Springer Verlag
3. Anderson Dale A., Tannehill John C. & Pletcher Richard H., "*Computational Fluid Mechanics and Heat Transfer*", Taylor & Francis

Sessional work assessment

Computer run assignments	= 20
Two tests	= 30
Total	= 50

University examination pattern

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

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

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

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

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

2K6ME 805(D): SYSTEM SIMULATION AND MODELING

3 hours lecture and 1 hour tutorial per week

MODULE I (14 hours)

System concepts-systems and system environment-component of a system-discrete and continous systems-types of system study-system analysis-system design and system postulation-system models-types of models-system simulation-steps in a simulation study-comparison of simulation and analytical models-Monte Carlo simulation –examples of simulation of single server queuing system and simple inventory systems-concepts in discrete event system simulation-event scheduling/time advance algorithms-modeling world views.

MODULE II (12 hours)

Random number generation-techniques for generating random number-linear congruential method-test for random numbers-frequency tests-Kolmogorov-Smirnov test and the Chi-square test-random variate generation-inverse transformation method-exponential, uniform, and empirical discrete and empirical continuous distributions-input modeling for simulation-data collection-identifying the distribution using histograms-parameter estimation-Chi-square goodness of fit test.

MODULE III (13 hours)

Verification and validation of simulation models-verification of simulation models-calibration and validation of models-face validity-validation of model assumption and validating input output transformations-output analysis for a single model-types of simulation with respect to output analysis-measures of performance and their estimation-output analysis for terminating simulation-confidence interval estimation for a fixed number of replication-confidence interval with specified precision-output analysis for steady state simulation-initialization bias-replication methods-sample size determination for a specified precision-batch means method.

MODULE IV (13 hours)

Simulation modelling and analysis of manufacturing systems-objectives-performance measures-issues in simulation of manufacturing systems-simulation of simple job shop manufacturing systems-introduction to simulation software for manufacturing applications-salient features of simulation languages such as general purpose simulation systems(GPSS),

and simulation language for alternative modelling(SLAM)-salient features of simulators such as WITNESS and Arena.

Text book

Banks J., Carson J.S. & Nelson B.L., *Discrete-Event System Simulation*, Prentice Hall of India

Reference books

1. Askin R.G. & Standridge C.R., *Modelling and Analysis of Manufacturing Systems*, John Wiley
2. Deo N., *System Simulation with Digital Computer*, Prentice-Hall of India Private Limited
3. Gordon G., *System Simulation*, Prentice Hall of India Private Limited
4. Law A.W. & Kelton W.D., *Simulation Modelling and Analysis*, Third Edition, McGraw Hill International Editions
5. Kelton W.D., Sadowski R.P. & Sadowski D.A., *Simulation with ARENA*, WCB/McGraw Hill International Editions

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6ME 805 (E): QUALITY ENGINEERING AND MANAGEMENT

3 hours lecture and 1 hour tutorial per week

Module I (10 hours)

Introduction to the concept of quality - quality control - quality assurance - quality management - quality and total quality - small q and big Q - concept of total quality management - TQM axioms - major contributions of deming, juran and crossby to quality management - enablers for total quality - strategic quality management

Module II (10 hours)

Quality costs - analysis of quality costs - loss function - taguchi methods - total quality tools - pareto chart - fishbone diagram - checksheet - histograms - scatter diagrams - run charts - flow diagram - survey - implementing - total quality - ISO 9000 certification - quality circles- motivation theories

Module III (10 hours)

Customer needs and product quality - market research - product design - quality function deployment - reliability - reliability goals - failure mode, effect, and criticality analysis - design for safety - error proofing design for manufacturability - manufacturing planning for quality - quality responsibilities on the factory floor - total employee involvement and empowerment - benchmarking - continuos improvement strategies - kaizen approach

Module IV (11 hours)

Statistical tools in quality - making predictions using the normal, poisson and binomial probability distributions - statistical process control - control charts for variables - $\overline{X}$, R and σ charts - process capability indices - control charts for attributes - P, np, c and u charts

Module V (11 hours)

Acceptance sampling - lot by lot acceptance using single sampling by attributes - OC curve - average outgoing quality and the AOQL - double sampling - multiple and sequential sampling - dodge - romig sampling tables - ATI and AFI - introduction to life testing and reliability

Text books

1. Juran J.M., Gryna F.M., "*Quality Planning and Analysis*", Tata McGraw Hill Publishing Company
2. Grant E.L. & Leavenworth R.S., "*Statistical Quality Control*", McGraw Hill International Edition
3. Geoetsch D.L. & Davis S.B., "*Introduction to Total Quality: Quality Management for Production, Processing and Services",* Prentice Hall International, Inc.
4. Logothetis N., "*Managing for Total Quality*", Prentice Hall of India Private Limited
5. Bharat Wakhlu, "*Total Quality*", Wheeler Publishing

Sessional work assessment

Two tests	= 30
Two assignments	= 20
Total marks	= 50

University examination pattern

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

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

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

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

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

2K6ME 806(P): SEMINAR

4 hours per week

Individual students should be asked to choose a topic in any field of mechanical 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 specialised in different fields of mechanical engineering) will assess the presentation of the seminars and award the marks to the students - each student should be asked to submit two copies of a write up of his seminar talk - one copy should be returned to the student after duly certifying it by the H O D and the other kept in the departmental library

Sessional work assessment

Presentation	= 30
Report	= 20
Total marks	= 50

2K6ME 807(P): PROJECT AND INDUSTRIAL TRAINING

(7 hours per week)

The project work can be a Modeling and Simulation, Case study, Design or Experiments in the field of Mechanical Engineering. It can be allotted as a group project with groups consisting of 3 to 4 students. The project work started in the seventh semester (mini project) may be continued in this semester - the students should complete the project work in this semester and present it before the assessment committee

The assessment committee will assess the various projects, fix the relative grading and group average marks - the guides will award the marks for the individual students in a project maintaining the group average - each group should submit the copies of the completed project report signed by the guide (in the format prescribed by the department) to the department - the Head Of the Department will certify the copies and return them to the students - one copy will be kept in the departmental library

All students should undergo Industrial Training Programme either by attending a training programme for a minimum of 5 days in a Registered Industry / Research Institute or by visiting at least 5 reputed Industries / Engg Establishments. They have to submit a report of the Industrial Training Programme.

A maximum of 25 marks will be awarded for the Industrial Training.

Sessional work assessment

Project Work = 75

Industrial Training = 25

Total marks = 100

2K6ME 808(P): VIVAVOCE

There is only university examination for VIVA VOCE - the university will appoint examiners for conducting the viva voce examination - the examiners will ask questions from subjects studied for the B.Tech. Course, Mini Project, Project and Industrial Training and Seminar etc. The relative weightage will be as follows :

Subjects	= 30.
Mini Project	= 20
Project and Industrial Training	= 30
Seminar	= 20
Total marks	= 100

KANNUR UNIVERSITY

FACULTY OF ENGINEERING

Curricula, Scheme of Examinations and Syllabi

for

B.Tech Degree(Part-Time) Programme in

MECHANICAL ENGINEERING

V11 and V111 Semesters

With Effect From 2007 Admissions

SEVENTH SEMESTER

Code	Subject	Hours/Week			Sess Mrk	University Exam	
		L	T	P		Hrs	Mrk
2K6PTME 701	Metrology and Instrumentation	2	-	-	50	3	100
2K6PTME 702	Industrial Management	2	-	-	50	3	100
2K6PTME 703	Machine Design I	2	1	-	50	3	100
2K6PTME 704	Power plant Engineering	2	-	-	50	3	100
2K6PTME 705	Elective II	2	-	-	50	3	100
2K6PTME 706(P)	Instrumentation Lab	-	-	3	50	3	100
2K6PTME 707(P)	Computational Lab	-	-	3	50	3	100
2K6PTME 708(P)	Mini Project	-	-	3	50	-	-
2K6PTME 709(P)	Physical Education, Health and Fitness	-	-	-	50	-	-
TOTAL		**10**	**1**	**9**	**450**	**-**	**700**

ELECTIVE-11

2K6PTME 705 (A) MARKETING MANAGEMENT

2K6PTME 705 (B) OPTIMIZATION TECHNIQUES

2K6PTME 705 (C) INDUSTRIAL PSYCHOLOGY

2K6PTME 705 (D) ADVANCED FLUID MECHANICS

2K6PTME 705 (E) MULTIPHASE FLOW

2K6PTME 701: METROLOGY AND INSTRUMENTATION

2 hours lecture per week

Module I (13 hours)

Applications of measuring instruments-functional elements of an instrument-instrument as transducer-generalised measuring instrument-generalised mathematical model of measuring systems-zero order, first order and second order instruments-classification of instruments - input/output configurations - methods of correction for spurious inputs-inherent insensitivity - high-gain feed-back - signal - filtering and opposing inputs - static calibration and determination of bias and random error of an instrument- assumption of Gaussian distribution for experimental data-chi-square goodness-of-fit test-method of least squares for curve fitting - static characteristics-accuracy loading effect-backlash-friction-hysteresis-threshold-dead space- resolution-static sensitivity and linearity-problems on friction-loading effect-sensitivity and calibration

Module II (13 hours)

Uncertainty in "computed quantities" from measured values - estimation of permissible uncertainties of instruments for specific purposes - potentiometer transducer as a zero order instrument - analysis of its loading error - mercury-in-glass thermometer as a first order instrument - step, ramp and frequency response of first order instruments - problems - seismic instrument as a second order instrument - step, terminated ramp, ramp and frequency response of second order instruments - slip gages - assembling the blocks - temperature problems - LVDT - comparators: principle of working of mechanical, electrical, pneumatic comparators - measurement of strain: strain gauge classification - unbonded and bonded strain gauges - gage factor - strain gauge rosettes - selection and installation of bonded gauges - ballast, DC bridges and constant current circuits - temperature compensation – calibration

Module III (13 hours)

Measurement of force: multiple lever system for weighing - strain gauge load cells - temperature sensitivity-ballistic weighing-hydraulic & pneumatic load cells-measurement of torque: water brake Heenan & Froude hydraulic dynamometer - general purpose electric dynamometer - measurement of temperature: pressure thermometers-RTDs-compensation for lead resistance-thermistors - thermocouples - series in parallel connected thermocouples -

materials used and there ranges - pyrometry-infrared pyrometry - air pollution measurement: gas chromatography - Orsat's apparatus - nuclear instrumentation: Gieger Muller counter - ionisation chamber - scintillation counters

Module IV (13 hours)

Acoustical measurements: characterisation of sound (noise) - basic acoustical parameters - sound pressure - sound pressure level, power, intensity and power level - combination of sound pressure levels - attenuation with distance - psychoacoustic relationships - micro-phones - sound level meter - principles of automatic control: open and closed loop systems - servo mechanism - process control and regulators - mathematical modelling of mechanical and electrical systems - transfer function of simple systems - time domain analysis of control system: steady state response - steady state error - error coefficients - stability of control systems: concept of stability - method of determining stability of linear control systems - Routh Hurwitz criterion

Text Books and References

1 Beckwith T.G., Marangoni R.D. & Lienhard J.H., "*Mechanical Measurements"*

2 Doebelin E.O., *"Measurement Systems"*, McGraw Hill Publishing Company

3 Holman J.P., *"Experimental Methods for Engineers"*, McGraw Hill Inc.

4 Kuo, *"Automatic Control Systems"*, Asian Student Edition, Prentice Hall of India

Sessional work assessment

Two assignments = 20

Two tests = 30

Total marks = 50

University examination pattern

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

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

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

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

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

2K6PTME 702 : INDUSTRIAL MANAGEMENT

2 hours lecture per week

Module I (14 hours)

Management concepts - system concepts of management - management functions - planning - principles of planning - organizing - organization structures - principles of organizing - span of control - delegation - leadership - directing - controlling

Decision making - strategic and tactical decisions - models of decision making - single stage decisions under risk - multi stage decision making - decision trees - decision making under uncertainty - Baye's decision theory - equally likely - minimax - maximum likelihood - maximin criterion –

Module II (12 hours)

Network techniques - basic concepts - network construction - CPM and PERT networks - algorithm for critical path - slacks and their significance - crashing - network flow problems - the shortest route problem - minimal spanning tree problem - maximal flow in capacitated network

Module III (14 hours)

Production planning and control - scope and objectives - functions of PPC - product consumption cycle - production planning - process planning - material requirement planning - forecasting - methods of forecasting - moving average method - single exponential smoothing - linear regression - linear forecaster - scheduling - objectives - performance measures - priority rules - single machine scheduling - job shop scheduling - 2 jobs N machines - flow shop scheduling - N jobs 2 machines - N jobs 3 machines scheduling

Module IV (12 hours)

Human resources management - job design - job enrichment - job enlargement - job evaluation - merit rating - wages and incentives - work study - method study - time study - work sampling.

Costing - cost concepts - concept of cost accounting - elements of cost - overhead costs - methods of allocation of overhead costs - depreciation - methods of depreciation - financial

management - time value of money - comparison of alternatives - payback period method - net present value method - internal rate of return method - basics of financial accounting - profit and loss account - balance sheet preparation

Text books

1. Koontz H., O'Donnel & Weihrich H., *Essentials of Management*, McGraw Hill Book Company
2 Mazda F., *Engineering Management*, Low Price Edition, Addison Wesley
3. Pandey I.M., *Financial Management*, Eighth Edition, Vikas Publishing House Private Limited
4 Bhattacharya A.K., *Principles and Practice of Cost Accounting*, Wheeler Publishing
5 Venkata Ratnam C.S. & Srivastava B.K., *Personnel Management and Human Resources*, Tata McGraw Hill Publishing Company Limited
6 Barnes., *Motion and Time Study Design and Measurement of Work*, Wiley
7 Jerome D Weist, *A Management Guide to PERT/CPM*, Mc.Graw Hill Co.
8 Samuel Eilon., Elements of Production Planning and Control, Prentice Hall India.

Reference books

1 Chase R.B., Aquilano N.J. & Jacobs F.R., *Production and Operations Management: Manufacturing and Services*, Eighth Edition, Tata McGraw Hill Publishing Company Limited

2 Prasanna Chandra, *Financial Management: Theory and Practice*, Fourth Edition, Tata McGraw Hill Publishing Company Limited

Sessional work assessment

Two assignments = 20

Two tests = 30

Total marks = 50

University examination pattern

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

2K6PTME 703: MACHINE DESIGN I

2 hours lecture & 1 hour tutorial per week

Module I (13 Hours)

Introduction to design- Steps in design process –Design factors –Tolerances & fits – principles of standardization – Codes & standards – Selection of materials

Introduction to Computer aided design – Introduction to modeling, drafting, simulation and analysis software packages.

Stress & Strength considerations of mechanical elements – Stress concentration Theories of failure –Impact load – Fatigue loading – consideration of creep and thermal stresses in design.

Module II (13 Hours)

Threaded fasteners –Thread standards – Stresses in screw threads – preloading of bolts – bolted joints – eccentric loading – gasketed joints – Fatigue loading - analysis of power screws.

Keys – types of keys and pins – stresses in keys and pins – design of keys – design of cotter and pin joints

Riveted Joints – stresses in riveted joints – strength analysis – boiler and tank joints – structural joints

Module III (13 Hours)

Welded joints – types of welded joints – stresses in butt and fillet welds – torsion and bending in welded joints- welds subject to fluctuating loads – design of welded machine parts and structural joints.

Springs – Stresses in helical springs- deflection of helical springs – extension, compression and torsion springs- design of helical springs for static and fatigue loading – critical frequency of helical springs – stress analysis and design of leaf springs

Module IV (13 Hours)

Power shafting – stresses in shafts – design for static loads – reversed bending and steady torsion – design for strength and deflection – design for fatigue loading – critical speed of shafts – stresses in couplings – design of couplings

Text books:

1 Joseph Edward Shigley, Mechanical Engineering Design, McGraw Hill Book Company.

2 V B Bhandari, Design of Machine elements, Tata McGraw Hill Publishing Co. Ltd.

Reference books:

1 Stegel, Maleev & Hartman, Mechanical Design of Machines, International Book Company

2 Phelan R. M, Fundamentals of Mechanical Design, Tata McGraw Hill Publishing Co. Ltd.

3 Doughtie V L & Vallance. A V., Design of Machine Elements, McGraw Hill Book Company.

4 Paul H Black & O Eugene Adams Jr., Machine Design, McGraw Hill Book Company.

5 M F Spotts, T E Shoup, Design of Machine elements, Prentice Hall

6 V B Bhandari, Introduction to Machine Design, Tata McGraw Hill Publishing Co. Ltd.

7 Georeg E Dieter, Engineering Design, McGraw Hill Book Company.

8 Jack A Collins, Failure of Materials in Mechanical Design: Analysis, Prediction, Prevention. John Wiley & Sons Inc.

9 Ibrahim Zeid, CAD/CAM theory and practice, McGraw Hill Book Company.

Data hand books (allowed for reference during examinations)

1 Prof. Narayana Iyengar B R & Dr. Lingaiah K, Machine Design Data Hand Book Vol. I & II.

2 P. S. G. Tech, Machine Design Data Handbook

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

2K6PTME 704 POWER PLANT ENGINEERING

2 hours lecture per week

MODULE I (12 hours)

Steam engineering-temperature entropy diagram-mollier diagram-rankine cycle-modified rankine cycle-reheat and regenerative-binary vapour cycle-steam generators-classifications-cochran boiler-lancashire boiler-cornish boiler-locomotive boiler-babcock and wilcox boiler-stirling boiler-high pressure boilers-boiler mountings and accessories

MODULE II (12 hours)

Steam nozzles-flow through steam nozzles-throat pressure for maximum discharge- effect of friction-super saturated flow-steam turbines-impulse and reaction turbines-velocity diagram-condition for maximum efficiency-compounding-reheat factor-blade height-governing of steam turbines-cogeneration and combined cycle power generation-steam engines-components-compounding-indicator diagram

MODULE III (16 hours)

Thermal power plants-general layout-site selection-fuel handling storage and burning systems-dust and ash handling system-chimney draught-nuclear power plants-classification-components-safety measures-effects of nuclear radiation-nuclear waste disposal-gas turbine power plants-classification-closed open and other systems-hydro electric power plants-combined operation of different power plants-non conventional power generation-solar thermal collection-thermal storage-ocean power-principle of OTEC systems-wind energy-wind turbine-geothermal energy-geothermal electrical power plants-biogas energy-biogas production-design and construction of biogas plants

MODULE IV (12 hours)

Economics of power generation-terms and definitions-estimation of load-load curve-load factor-diversity factor-capacity factor-use factor-economics in plant selection-economics of generation and distribution of power-useful life-tariff for electrical energy-environmental pollution and its control-steam power plant pollutants-control of pollutants-control of particulate matter-control of SO_2- control of NO_2-control of waste water from steam power plants-pollution from nuclear power plants-noise pollution and noise control

Text Book:

1. El Wakil, “Power Plant Technology” McGraw Hill

Reference Books:

1. Nag, “Power Plant Engineering” TMH
2. Ngpal, “Power Plant Engineering” Khanna
3. Vapat & Scrotski, “Power Station Engineering and Economy” TMH
4. John F Lee, “Power Station Engineering and Economy” TMH

Sessional work Assessment

Two Tests	=30
Two Assignments	=20
Total Marks	=50

University examination pattern

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

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

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

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

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

2K6PTME 705 (A): MARKETING MANAGEMENT

2 hours lecture per week

Module I (14 hours)

Introduction to marketing - concept of market and marketing - marketing environment - controllable factors - factors directed by top management - factors directed by marketing - uncontrollable factors - demography, economic conditions, competition, social and cultural forces, political and legal forces, and technology

Module II (14 hours)

Marketing planning - marketing planning process - Boston consultancy group model - marketing mix - marketing mix variables - market segmentation and market targeting - introduction to segmentation - targeting and product positioning

Module III (12 hours)

Marketing research - need and scope - marketing research process - research objectives, developing research plan, collecting information, analysis, and findings - consumer behaviour - factors influencing consumer behaviour - perceived risks - product life cycle - marketing strategies for different stages of product life cycle

Module IV (12 hours)

Marketing communication - marketing mix variables - steps in developing effective communication - identification of target audience - determination of communication objectives - designing the message - selecting the communication channels - promotion mix evaluation - advertising and sales promotion - factors in advertising - sales promotion tools

Text books

1 Kotler P., *Marketing Management: Analysis, Planning, Implementation and Control*, Prentice Hall of India Private Limited

2 Ramaswamy V.S. & Namkumari S., *Marketing Management: Planning, Implementation and Control*, Macmillan India Limited

Reference books

1 Stanton W.J., Etzel M.J. & Walker B.J., *Fundamentals of Marketing,* McGraw Hill International Edition

2 Majumdar R., *Marketing Research, Text, Applications and Case Studies,* New Age International (P) Limited Publishers

3 Robert, *Marketing Research,* Prentice Hall of India

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6PTME 705 (B): OPTIMIZATION TECHNIQUES

2 hours lecture per week

MODULE I: Linear Programming I (14 hours)

Systems of linear equations and inequalities-convex sets-convex functions-formulation of linear programming problems-theory of simplex method-simplex algorithm-Big M method and two phase method-degeneracy-duality in linear programming-dual simplex method-optimization software packages-LINDO, LINGO-using LINGO to solve LPPs.

MODULE II: Linear Programming II (14 hours)

Sensitivity analysis-parametric programming-bounded variable problems-Integer programming-transportation problem-development of the method-degeneracy-unbalanced problems-assignment problem-development of the Hungarian method-routing problems.

MODULE III: Non-linear Programming (13 hours)

Mathematical preliminaries of non-linear programming-gradient and Hessian-unimodal functions-local and global optima-convex and concave functions-role of convexity-unconstrained optimization-Fibonacci search-golden section search-optimal gradient method-classical optimization-Legrange multiplier method-Kuhn-Tucker conditions-quadratic programming-separable convex programming-Frank and Wolfe method.

MODULE IV : Dynamic Programming and Metaheauristics (13 hours)

Nature of dynamic programming problem-Bellman's optimality principle-Cargo loading problem-replacement problems-multistage production planning and allocation problems.

Introduction to Genetic Algorithm-steps-coding and selection-reproduction-cross over and mutation

Text books and Reference books

1 Bazarra M.S., Jarvis J.J. & Sherali H.D., '*Linear Programming and Network Problems*', John Wiley

2 Bazarra M.S., Sherali H.D. & Shetty C.M., '*Nonlinear Programming, Theory and Algorithms',* John Wiley

3 Hadley G., '*Linear Programming*', Addison Wesley

4 Hillier F.S. & Lieberman G.J. '*Introduction to Operations Research',* McGraw Hill

5 Ravindran A., Phillips D.T. & Solberg J.J., *Operations Research Principles and Practice*, John Wiley

6 Taha H.A., *Operations Research, An introduction*, P.H.I.

7 Wagner H.M., '*Principles of Operations Research with Application to Managerial Decisions'*, P.H.I.

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6PTME 705(C): INDUSTRIAL PSYCHOLOGY

2 hours lecture per week

Module I (13 hours)

Introduction - psychology as a science - areas of applications - study of individual - individual differences - study of behavior - stimulus - response behavior - heredity and environment - human mind - cognition - character - thinking - attention - memory- emotion - traits - attitude - personality

Module II (13 hours)

Organizational behavior - definition - development - fundamental concept - nature of people - nature of organization - an organizational behavior system - models - autocratic model - hybrid model - understanding a social - system social culture - managing communication - downward, upward and other forms of communication

Module III (13 hours)

Motivation - motivation driver - human needs - behavior modification - goal setting - expectancy model - comparison models - interpreting motivational models - leadership - path goal model - style - contingency approach

Module IV (13 hours)

Special topics in industrial psychology - managing group in organization - group and inter group dynamics -managing change and organizational development - nature planned change - resistance - characteristic of OD - OD process.

Text books

1 Keith Davis & Newstrom J.W., "*Human Behavior At Work*", McGraw Hill International

2 Schermerhorn J.R. Jr., Hunt J.G. & Osborn R.N., "*Managing Organizational Behavior*", John Willy

3 Luthans, "*Organizational Behavior*", McGraw Hill, International

4 Morgan C.T., King R.A., John Rweisz & John Schoples, "*Introduction to Psychology*", McGraw Hill

5 Blum M.L. & Naylor J.C., Horper & Row, "*Industrial Psychology*", CBS Publisher

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6PTME 705(D): ADVANCED FLUID MECHANICS

2 hours lecture per week

MODULE I: (13 hours)

Basic equations of fluid flow: Reynolds transport equation-integral and differential formations-integral form of equations of the continuity-momentum and energy equations-use of integral equation-differential form of these equations-Stoke's postulates and constitutive equations-Navier-Stokes equations and energy equations for Newtonian fluids.

Non dimensionalisation of the equations of motion and order of magnitude analysis: Choice of characteristic quantities-identification of the non dimensional parameters- classification of flows based on the characteristic Reynolds number-approximate equations for low Re and high Re flows and boundary layer equations-boundary equations.

MODULE II: (13 hours)

Some exact solutions of the Navier-Stokes equations: Couette flows-plane Poisseuille-flow between rotating cylinders-Stokes problems-fully developed flow through circular and non-circular pipes

Approximate solutions: Creeping flow past a sphere-theory of hydrodynamic lubrication-boundary layer on a flat plate-Blassius solution and use of momentum integral equation.

MODULE III: (14 hours)

Introduction to compressible flows: Basic concepts-equations for one dimensional flow through steam tubes-speed of sound and Mach number-qualitiative difference between incompressible, subsonic and supersonic flows-characteristic velocities-adiabatic flow ellipse

Isentropic flow through a duct: Criterion for acceleration and deceleration-stagnation quantities-isentropic relations-use of gas tables-operation of nozzles at off design conditions.

Normal shocks in one dimensional flow: Occurrence of shocks-analysis of normal shocks-Prandtl's equation-Rankine-Hugoniot equation and other normal shock relations-moving shocks.

MODULE IV: (12 hours)

Oblique shocks and expansion waves: Oblique shock relations-θ-β-M relations-shock polar-supersonic flow over a wedge-expansion waves-Prandtl-Meyer function-intersection of shocks-detached shocks-Mach deflection-shock expansion theory.

Flow with friction: Fanno lines and Fanno flow relations-effect of friction on properties-choking-isothermal flows.

Flow with heat transfer: Rayleigh lines-effect of heat addition-thermal choking

Text books and Reference books

1 Muralidhar K. & Biswas G., *Advanced Engineering Fluid Mechanics,* Narosa Publishing House

2 Rathakrishnan E., *Gas Dynamics*, Prentice Hall India

3 Gupta V. & Gupta S., *Fluid Mechanics and its Applications*, Wiley Eastern Ltd.

4 White F.M., *Viscous Fluid Flow*, McGraw Hill

5 Zuckrow M.J. & Hoffman D.H., *Gas Dynamics*, McGraw Hill

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6PTME 705(E): MULTI-PHASE FLOW

2 hors lecture per week

Module I (13 hours)

Basic equations and empirical correlations for multi-phase flow - flow patterns - identification and classification - flow pattern maps and transition - momentum and energy balance - homogeneous and separated flow models - correlations for use with homogeneous and separated flow models - two phase flow through inclined pipes and singularities - void fraction and slip ratio correlations - influence of pressure gradient - empirical treatment of two phase flow - drift flux model - correlations for bubble, slug and annular flows - pressure losses through enlargements, contractions, orifices, bends and values

Module II (13 hours)

Boiling and multiphase heat transfer - vapour-liquid equilibrium mechanisms - pool boiling convective boiling - heat transfer in partial and fully developed sub-cooled boiling - void fraction and pressure drop in sub-cooled boiling - saturated boiling heat transfer - two phase forced convection laminar and turbulent flow solutions for film heat transfer - empirical equations for film boiling and transition boiling - burnout mechanism and correlations - critical coefficient in nucleate and convective boiling

Module III (13 hours)

Condensation - basic processes of condensation - mechanism of evaporation and condensation - film condensation on a planar surface - dropwise condensation - pressure gradient in condensing systems - methods of improving heat transfer coefficient in condensation

Module IV (13 hours)

Critical multiphase flows - mathematical models - critical flow criterion - compatibility conditions and their physical interpretation - experimental observations - propagation of small disturbances - pressure drop limitation effect - graphical representation of critical flow conditions

Text books

Collier J.G., *Convective Boiling and Condensation,* McGraw Hill

Reference books

1 Hsu Y.Y. & Graham R.W., *Transport Processes in Boiling and Two Phase Systems*, Hemisphere

2 Ginoux J.J., *Two Phase Flows and Heat Transfer*, Hemisphere, McGraw Hill

3 Tong L.S., *Boiling Heat Transfer and Two Phase Flow*, Wiley

4 Hewitt G., Delhaye J.M. & Zuber N., *Multiphase Science and Technology,* Vol. I., McGraw Hill

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6PTME 706(P): INSTRUMENTATION LAB

3 hours practicals per week

Study on concepts of measurement, types of errors, accuracy, precision, hysterisis, least square curve fitting, study of Stroboscope, transducers, strain gauges, rotometer, slip gauges and various precision measuring instruments.

List of experiments

1 Calibration of Bourden tube pressure gauge.
2 Calibration of LVDT.
3 Calibration of Thermocouple.
4 Calibration of Micrometer and vernier caliper.
5 Measurement of area by planimeter.
6 Preparation of psychrometric chart.
7 Statistical analysis of data.
8 Measurement using Profile projector.
9 Measurement of vibration and analysis.
10 Temperature measurement by pyrometer.
11 Calibration of Tachometer.
12 Determination of PH value.
13 Sound level measurement and analysis.
14 Flaw detection using ultrasonic tester.
15 Analysis of exhaust gas of I C engines.
16 Velocity measurement by Pitot tube.
17. Flaw measurement using Rotometer.
18. Measurement of drag and lift coefficients of an aerofoil using wind tunnel.
19.Experiment on strain gauges.

Sessional work assessment

Lab Practicals and Record = 35
Tests = 15
Total marks =50

2K6PTME 707(P): COMPUTATIONAL LAB

3 hours practicals per week

This laboratory is expected to expose the students to the latest software packages related to the subjects covered during the course of B.Tech. in Mechanical Engineering. At least two experiments each from the four different modules need to be performed.

Module 1

Solving basic mathematical problems such as curve fitting, numerical differentiation & Integration and numerical solution of differential equations using

C / C++ / FORTRAN /JAVA / MATLAB.

Module II

Modeling and analysis of basic structural engineering problems using software such as ANSYS and NISA.

Module III

Modeling and analysis of basic fluid dynamics and heat transfer problems using software such as FLUENT.

Module IV

Using discrete event simulation software such as ARENA / SIMULINK for solving production scheduling problems, queuing problems and for network analysis.

Using LINGO / LINDO for solving linear programming problems.

Sessional work assessment

Lab Practicals and Record = 35

Tests = 15

Total marks = 50

2K6PTME 708(P): MINI PROJECT

3 hours per week

The project work can be a design project, experimental fabrication project or software development project on any of the topics of mechanical engineering interest - it can be allotted as a group project with groups consisting of three or four students

The assessment of all the mini projects should be done by a committee consisting of three or four faculty members specialised in the various fields of **Mechanical Engineering** - the students will present their project work before the committee - the relative gradings and group average marks for the various projects will be fixed by the committee - the guide will award the marks for the individual students in the 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 keep them in the departmental library

Sessional work assessment

Presentation	= 30
Report	= 20
Total marks	= 50

2K6PTME 709(P): PHYSICAL EDUCATION, HEALTH AND FITNESS

Introductory Lectures

Unit I. 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 wellness.

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, 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, BMI, Blood Pressure, Physical Fitness Tests assessing various motor qualities of each individuals will be carried out (optional - based on request).

Objectives

(b) 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 Ist semester to 7th semester.

EIGHTH SEMESTER

Code	Subject	Hours/Week			Sess Mrk	University Exam	
		L	T	P		Hrs	Mrk
2K6PTME 801	Gas Dynamics	2	1	-	50	3	100
2K6PTME 802	Refrigeration and Air conditioning	2	1	-	50	3	100
2K6PTME 803	Machine Design II	2	1	-	50	3	100
2K6PTME 804	Inventory and Supply Chain Management	2	-	-	50	3	100
2K6PTME 805	Elective III	2	1	-	50	3	100
2K6PTME 806(P)	Seminar	-	-	3	50	-	-
2K6PTME 807(P)	Project and Industrial Training	-	-	3	100*	-	-
2K6PTME 808(P)	Viva Voce	-	-	-	-	-	100
TOTAL **Aggregate marks for 8 semesters =8300**		**10**	**4**	**6**	**400** **2900**	**-**	**600** **5400**

*** 25 Marks is allotted for Industrial Training**

ELECTIVE-111

2K6PTME 805(A) : FINITE ELEMENT ANALYSIS

2K6PTME 805(B) : NEURAL NETWORKS AND FUZZY LOGIC

2K6PTME 805(C) : COMPUTATIONAL FLUID MECHANICS AND HEAT TRANSFER

2K6PTME 805(D) : SYSTEM SIMULATION AND MODELING

2K6PTME 805(E) : QUALITY ENGINEERING AND MANAGEMENT

2K6PTME 801 : GAS DYNAMICS

2 hours lecture & 1 hour tutorial per week

Module 1

Basic equations of fluid flow. Continuity, Momentum, Energy equations. Navier-Stokes equations. Introduction to compressible flow. Equation of state. Entropy Equation, The Stagnation Concept, Stagnation Pressure and Temperature, Consequences of Constant Density. Speed of sound. Mach number and Mach angle.

Module 11

Equations for compressible, one-dimensional duct flows. Sonic Velocity and Mach Number, Wave Propagation, Equations for Perfect Gases in terms of Mach Number, h-s and T-s Diagrams. Steady one dimensional isentropic flow with area change – Governing equations, effect of area change on flow properties, limiting conditions (choking), governing equation for the isentropic flow of a perfect gas, isentropic flow tables for a perfect gas, effect of area change on the flow properties, the converging nozzle. Effect of varying the back pressure and inlet pressure. Converging diverging or De Laval nozzle

Module 111

Shock waves – normal shock waves in perfect gas – governing equations, normal shock wave tables, the Rankine – Hugoniot equation for a normal shock wave, Prandtl's velocity equation, entropy change and shock strength. Oblique shock waves in perfect gas Governing equations, property ratios across an oblique shock wave, Rankine – Hugoniot equation. Expansion waves

Module 1V

Steady one dimensional adiabatic flow with friction in a constant area duct – governing equations, Fanno line, Fanno line equation for perfect gas, friction parameter, relationship between duct length and Mach number, entropy change caused by friction, effect of friction on flow properties, Fanno line tables.

Steady one dimensional flow with heat transfer in a constant area duct – governing equations, Rayleigh line, intersection of Fanno line and Rayleigh line, Rayleigh line equations for a perfect gas, relationship between heat transfer, stagnation temperature and Mach number, effect of heat transfer on flow properties, Rayleigh line tables.

Text books

1. Rathakrishnan. E., Gas dynamics, Prentice Hall India, New Delhi, 1995.
2. Shapiro, A.H., Dynamics & Thermodynamics of Compressible fluid flow, Ronald Press.
3. Zuckrow. M.J. & Hoffman, D.H., Gas Dynamics, McGraw Hill, New York.
4. Zucker R. D. and Biblarz Oscar, "Introduction to Gas Dynamics", John Wiley and Sons. Inc., Second Edition

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6PTME 802 : REFRIGERATION AND AIR CONDITIONING

2 hours lecture & 1 hour tutorial per week

MODULE I (12 hours)

Introduction to refrigeration-unit of refrigeration-refrigerator and heat pump-coefficient of performance-reversed Carnot cycle-pressure enthalpy diagram-vapour compression refrigeration cycle-analysis of practical vapour compression cycle-non conventional refrigeration systems-thermo electric refrigeration-vortex tube-pulse tube refrigeration-refrigerant mixtures-cooling by adiabatic demagnetization

MODULE II (12 hours)

Steam jet refrigeration-analysis of steam jet refrigeration system-components-advantages and limitations-air refrigeration systems-thermodynamic analysis of bell coleman cycle-application to air craft refrigeration-absorption refrigeration systems-principle and operation of aqua ammonia and lithium-bromide water systems-electrolux system-comparison between vapour compression and absorption systems-introduction to adsorption refrigeration system-MEMS cooling systems

MODULE III (14 hours)

Refrigerants-thermodynamic physical and chemical properties of refrigerants-selection criteria of refrigerants-refrigerant compressors-reciprocating compressors-single and multi stage compression-effect of clearance-effect of inter cooling-optimum pressure ratios-efficiencies-rotary compressor-screw-vane type compressor-centrifugal compressor-hermetic-semi hermitic and open compressors-condensers-air cooled condensers-water cooled condensers and evaporative condensers-expansion devices-purpose and types-capillary tube-automatic expansion valve-thermostatic expansion valve-evaporators-flooded evaporators-dry expansion systems-natural convection evaporators-forced convection evaporators-shell and tube evaporators-shell and coil evaporators

MODULE IV(14 hours)

Psychrometry-psychrometric properties and relations-psychrometric chart-psychrometric processes-summer air conditioning system-winter air conditioning system-year round air conditioning system-central air conditioning system-unitary air conditioning system-direct

expansion system-all water system-all air system-air water system-design procedure for air conditioning systems-estimation of air conditioning load-noise and noise control-refrigeration and air conditioning controls-high pressure and low pressure cutout-high side and low side float valve-flow regulating devices-thermostats-humidstats

Text Book:

1. Stoecker, “Refrigeration and Air Conditioning.”, Mc Graw Hill

Reference Books:

1. Roy J Doosat, “ Principles of Refrigeration.”, Pearson Education
2. C.P Arora, “Refrigeration and Air Conditioning.” TMH
3. Ananthanarayanan, “Basic Refrigeration and Air Conditioning.”, Mc Graw Hill
4. McQuston, “Heating, Ventilating and Air Conditioning” John Wiley

Sessional work assessment

Two tests	= 30
Two assignments	= 20
Total marks	= 50

University examination pattern

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

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

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

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

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

2K6PTME 803: MACHINE DESIGN-11

2 hours lecture and 1 hour tutorial per week

Module I (13 Hours)

Design of clutches & brakes –friction clutches and brakes – uniform pressure and uniform wear assumptions – design of disc and cone types of clutches and brakes – design of external contracting and internal expanding elements – band type clutches and brakes – centrifugal clutches

Design of belts and chain drives – belt and chain drives of common types – design of flat and V belt drives Selection of roller chains

Module II (13 Hours)

Design of gears – spur, helical, bevel and worm gears – tooth loads – gear materials – design stresses - basic tooth stresses – stress concentration – service factor - velocity factor – bending strength of gear teeth - Buckingham's equation for dynamic load – surface strength and durability - heat dissipation - design for strength and wear.

Module III (13 Hours)

Lubrication & Journal bearing design – types of lubrication and lubricants – viscosity – journal bearing with perfect lubrication – hydrodynamic theory - design considerations – heat balance – journal bearing design – rolling contact bearings – bearing types - bearing life – static and dynamic capacity - selection of bearings with axial and radial loads – selection of tapered roller bearings – lubrication seals, shaft, housing and mounting materials

Module IV (13 Hours)

Product design for manufacturing – general design considerations for rolled sections – forgings – screws machine products –turned parts – machined round holes – parts produced on milling machine – welded parts and castings – modification of design for manufacturing easiness for typical products – preparation of working drawings – working drawings for manufacture of parts with complete specifications including manufacturing

details like tolerance – surface finish etc. – computer applications in the preparation for working drawings.

Text book

Shigley J.E., *Mechanical Engineering Design*, McGraw Hill Book Company

Reference books

1 Siegel, Maleev & Hartman, *Mechanical Design of Machines*, International Book Company

2 Phelan R.M., *Fundamentals of Mechanical Design*, Tata McGraw Hill Publishing Co. Ltd.

3 Doughtie V.L.& Vallance A.V., *Design of Machine Elements*, McGraw Hill Book Company

4Juvinall R.C. & Marshek K.M., *Fundamentals of Machine Component Design*, John Wiley

5Bralla J.G., *Handbook of Product Design for Manufacture*, McGraw Hill Book Company

Data hand books (allowed for reference during examinations)

1 Prof. Narayana Iyengar B.R. & Dr Lingaiah K., Machine Design Data Handbook

2 P.S.G., Tech., *Machine Design Data Handbook*

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6PTME 804 :_ INVENTORY & SUPPLY CHAIN MANAGEMENT

2 hours lecture per week

Module I (12 hours)

Supply chain management (SCM) - concept of logistics and SCM - decision phases - design, planning and operation - decision areas - type of supply chain views - flows in supply chain - supply chain and competitive performance - performance measures for SCM - strategic fit - drivers of supply chain

Module II (12 hours)

Sourcing and procurement - sourcing - factors in source selection - vendor rating - qualitative and quantitative methods - purchasing - objectives and procedure - purchasing systems - tender method - computer based systems/EDI - inventory concept - functions of inventory - selective inventory control techniques - structure of inventory problem - costs associated with materials management - relevant costs

Module III (14 hours)

Independent demand items - probabilistic - single order quantities - payoff matrix - incremental analysis - mathematical formulation of discrete and continuous cases - independent demand items - deterministic and dynamic - deterministic inventory models without and with backordering - sensitivity analysis - quantity discount - all units and incremental discounts

Module IV (14 hours)

Independent demand items - probabilistic and dynamic inventory models - Q and P system models - dependent demand items - deterministic models - lot sizing models - lot by lot - EOQ - part period balancing - wagner-whitin method - concept of just-in-time - kanban - introduction to distribution requirement planning

Text books

1 Dobler D.W. & Burt D.N., *Purchasing and Supply Management: Text and Cases*, Tata McGraw Hill Publishing Company Limited

2 Tersine R.J., *Principles of Inventory and Materials Management*, Prentice-Hall Inc

3 Starr M.K. & Miller D.W., *Inventory Control: Theory and Practice*, Prentice Hall of India

4 Chopra S. & Meindl P., *Supply Chain Management: Strategy, Planning, and Operation*, Pearson Education Asia

Reference books

1 Christopher M., *Logistics and Supply Chain Management*, Pitman Publishing Company

2 John Mortimer (Editor), *Logistics in Manufacturing: An IFS Executive Briefing*, IFS Publications, U.K. & Springer-Verlag

3 Narasimhan S.L., Mcleavy D.W. & Billington P.J., *Production Planning and Inventory Control*, Prentice Hall of India

4 Raghuram G. & Rangaraj N., *Logistics and Supply Chain Management: Cases and Concepts*, Macmillan India Limited

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6PTME 805(A): FINITE ELEMENT ANALYSIS

2 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Linear vector spaces - linear transformations and functionals - linear, bilinear and quadratic forms - theory of normed spaces - theory of inner product spaces - concepts from variational calculus - variational methods of approximation - Ritz method - weighted residual method - Galerkin method - subdomain method - collocation method

Module II (11 hours)

Finite element analysis of one dimensional problems - procedure - one dimensional elements and interpolation functions - analysis of one dimensional second and fourth order equations - approximation errors in the finite element method - computer implementation

Module III (15 hours)

Finite element analysis of two dimensional problems - two dimensional elements and interpolation functions - second order equations involving a scalar valued function - comments on mesh generation and composition of boundary conditions - analysis of plane elasticity and incompressible fluid flow problems - time dependent problems (transient heat transfer) - isoparametric elements and numerical integration

Module IV (13 hours)

Alternative formulations - least square formulation - mixed formulation - Eigenvalue problems - nonlinear problems - three dimensional elements and interpolation functions - formulation of three dimensional problems (two and three dimensional Navier-Stokes equations - three dimensional heat transfer equations)

Text books

1 Reddy J.N., *An Introduction to the Finite Element Method*, McGraw Hill International Edition

2 Reddy J.N., *Applied Functional Analysis and Variational Methods in Engineering*, McGraw Hill, International Edition

Reference books

1 Huebner K.H., *The Finite Element Method for Engineers*, John Wiley

2 Zenkiewicz O., *The Finite Element Method*, McGraw Hill International Edition

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6PTME 805(B): NEURAL NETWORKS & FUZZY LOGIC

2 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 system

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 Ross T.J., *"Fuzzy Logic with Engineering Applications"*, McGraw Hill

5 Bart Kosko. *"Neural Network and Fuzzy Systems"*, Prentice Hall, Inc., Englewood Cliffs

6 Goldberg D.E., *"Genetic Algorithms in Search Optimisation and Machine Learning"*, Addison Wesley

7 Suran Goonatilake & Sukhdev Khebbal (Eds.), *"Intelligent Hybrid Systems*", John Wiley

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6PTME 805(C): COMPUTATIONAL FLUID MECHANICS

2 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Classification of partial differential equations - system of first and second-order partial differential equations - initial and boundary conditions - finite difference formulations - finite difference equations - finite difference approximation of mixed partial derivatives

Module II (12 hours)

Parabolic partial differential equations - explicit methods - implicit methods - parabolic equations in two-space dimensions - consistency, stability, and error analysis of finite difference equations - artificial viscosity

Module III (12 hours)

Elliptic equations - finite difference formulations - solution algorithms - hyperbolic equations - finite difference formulations -splitting methods - multiple-step method

Module IV (16 hours)

Scalar representation of the navier - stokes equations - model equations - numerical algorithms - incompressible navier - stokes equations - primitive variable and vorticity - stream function formulations - poisson equation for pressure - numerical algorithms - boundary conditions - staggered grid

Text book

Hoffmann Klaus A., "*Computational Fluid Dynamics for Engineers - Volume I*", Engineering Education System, Wichita

Reference books

1 Patankar Suhas V., "*Numerical Heat Transfer and Fluid Flow*", Taylor & Francis

2 Fletcher C.A.J., "*Computational Techniques for Fluid Dynamics I,* Springer Verlag

3 Anderson Dale A., Tannehill John C. & Pletcher Richard H., "*Computational Fluid Mechanics and Heat Transfer*", Taylor & Francis

Sessional work assessment

Computer run assignments	= 20
Two tests	= 30
Total	= 50

University examination pattern

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

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

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

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

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

2K6PTME 805(D): SYSTEM SIMULATION AND MODELING

2 hours lecture and 1 hour tutorial per week

MODULE I (14 hours)

System concepts-systems and system environment-component of a system-discrete and continous systems-types of system study-system analysis-system design and system postulation-system models-types of models-system simulation-steps in a simulation study-comparison of simulation and analytical models-Monte Carlo simulation –examples of simulation of single server queuing system and simple inventory systems-concepts in discrete event system simulation-event scheduling/time advance algorithms-modeling world views.

MODULE II (12 hours)

Random number generation-techniques for generating random number-linear congruential method-test for random numbers-frequency tests-Kolmogorov-Smirnov test and the Chi-square test-random variate generation-inverse transformation method-exponential, uniform, and empirical discrete and empirical continuous distributions-input modeling for simulation-data collection-identifying the distribution using histograms-parameter estimation-Chi-square goodness of fit test.

MODULE III (13 hours)

Verification and validation of simulation models-verification of simulation models-calibration and validation of models-face validity-validation of model assumption and validating input output transformations-output analysis for a single model-types of simulation with respect to output analysis-measures of performance and their estimation-output analysis for terminating simulation-confidence interval estimation for a fixed number of replication-confidence interval with specified precision-output analysis for steady state simulation-initialization bias-replication methods-sample size determination for a specified precision-batch means method.

MODULE IV (13 hours)

Simulation modelling and analysis of manufacturing systems-objectives-performance measures-issues in simulation of manufacturing systems-simulation of simple job shop manufacturing systems-introduction to simulation software for manufacturing applications-salient features of simulation languages such as general purpose simulation systems(GPSS),

and simulation language for alternative modelling(SLAM)-salient features of simulators such as WITNESS and Arena.

Text book

Banks J., Carson J.S. & Nelson B.L., *Discrete-Event System Simulation,* Prentice Hall of India

Reference books

1 Askin R.G. & Standridge C.R., *Modelling and Analysis of Manufacturing Systems,* John Wiley

2 Deo N., *System Simulation with Digital Computer*, Prentice-Hall of India Private Limited

3 Gordon G., *System Simulation,* Prentice Hall of India Private Limited

4 Law A.W. & Kelton W.D., *Simulation Modelling and Analysis*, Third Edition, McGraw Hill International Editions

5 Kelton W.D., Sadowski R.P. & Sadowski D.A., *Simulation with ARENA*, WCB/McGraw Hill International Editions

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6PTME 805 (E): QUALITY ENGINEERING AND MANAGEMENT

2 hours lecture and 1 hour tutorial per week

Module I (10 hours)

Introduction to the concept of quality - quality control - quality assurance - quality management - quality and total quality - small q and big Q - concept of total quality management - TQM axioms - major contributions of deming, juran and crossby to quality management - enablers for total quality - strategic quality management

Module II (10 hours)

Quality costs - analysis of quality costs - loss function - taguchi methods - total quality tools - pareto chart - fishbone diagram - checksheet - histograms - scatter diagrams - run charts - flow diagram - survey - implementing - total quality - ISO 9000 certification - quality circles- motivation theories

Module III (10 hours)

Customer needs and product quality - market research - product design - quality function deployment - reliability - reliability goals - failure mode, effect, and criticality analysis - design for safety - error proofing design for manufacturability - manufacturing planning for quality - quality responsibilities on the factory floor - total employee involvement and empowerment - benchmarking - continuos improvement strategies - kaizen approach

Module IV (11 hours)

Statistical tools in quality - making predictions using the normal, poisson and binomial probability distributions - statistical process control - control charts for variables - $\overline{X}$, R and σ charts - process capability indices - control charts for attributes - P, np, c and u charts

Module V (11 hours)

Acceptance sampling - lot by lot acceptance using single sampling by attributes - OC curve - average outgoing quality and the AOQL - double sampling - multiple and sequential sampling - dodge - romig sampling tables - ATI and AFI - introduction to life testing and reliability

Text books

1Juran J.M., Gryna F.M., "*Quality Planning and Analysis*", Tata McGraw Hill Publishing Company

2Grant E.L. & Leavenworth R.S., "*Statistical Quality Control*", McGraw Hill International Edition

3 Geoetsch D.L. & Davis S.B., "*Introduction to Total Quality: Quality Management for Production, Processing and Services",* Prentice Hall International, Inc.

4 Logothetis N., "*Managing for Total Quality*", Prentice Hall of India Private Limited

Bharat Wakhlu, "*Total Quality*", Wheeler Publishing

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

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

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

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

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

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

2K6PTME 806(P): SEMINAR

3 hours per week

Individual students should be asked to choose a topic in any field of mechanical 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 specialised in different fields of mechanical engineering) will assess the presentation of the seminars and award the marks to the students - each student should be asked to submit two copies of a write up of his seminar talk - one copy should be returned to the student after duly certifying it by the H O D and the other kept in the departmental library

Sessional work assessment

Presentation	= 30
Report	= 20
Total marks	= 50

2K6PTME 807(P): PROJECT AND INDUSTRIAL TRAINING

(3 hours per week)

The project work can be a Modeling and Simulation, Case study, Design or Experiments in the field of Mechanical Engineering. It can be allotted as a group project with groups consisting of 3 to 4 students. The project work started in the seventh semester (mini project) may be continued in this semester - the students should complete the project work in this semester and present it before the assessment committee

The assessment committee will assess the various projects, fix the relative grading and group average marks - the guides will award the marks for the individual students in a project maintaining the group average - each group should submit the copies of the completed project report signed by the guide (in the format prescribed by the department) to the department - the Head Of the Department will certify the copies and return them to the students - one copy will be kept in the departmental library

All students should undergo Industrial Training Programme either by attending a training programme for a minimum of 5 days in a Registered Industry / Research Institute or by visiting at least 5 reputed Industries / Engg Establishments. They have to submit a report of the Industrial Training Programme.

A maximum of 25 marks will be awarded for the Industrial Training.

Sessional work assessment

Project Work = 75

Industrial Training = 25

Total marks = 100

2K6PTME 808(P): VIVAVOCE

There is only university examination for VIVA VOCE - the university will appoint examiners for conducting the viva voce examination - the examiners will ask questions from subjects studied for the B.Tech. Course, Mini Project, Project and Industrial Training and Seminar etc. The relative weightage will be as follows :

Subjects	= 30.
Mini Project	= 20
Project and Industrial Training	= 30
Seminar	= 20
Total marks	= 100