Courses & Syllabus for Mechanical Engineering

ME 3.1 Engineering Mathematics

ME 3.2 Applied Thermodynamics

ME 3.3 Engineering Materials Science and Metallurgy

ME 3.4 Machine Drawing

ME 3.5 Electrical Technology

ME 3.6 Fluid Mechanics

MEL-1 ENGINEERING MATERIALS SCIENCE AND METALLURGY AND ELECTRICAL ENGINEERING

MEL-2 FLUID MECHANICS

ME 3.1 ENGINEERING MATHEMATICS

Total no of questions to be answered :5(At least one question from each module with two compulsory questions from any one module)

MODULE 1 (15+5)

Matrices:- Types of matrices, Determinant, adjoint, inverse of matrix, Elementary transformation, Elementary matrices, Rank of matrix, Reduction to normal form, canonical form. Rank using Elementary transformation, Linear independence and dependence. System of the form AX = 0, and AX = B, and their solutions, Eigen values, Eigen vectors with properties, Caylay Hamilton theorem with its applications, minimal polynomial, Diagonalization.

MODULE 2 (10+4)

Fourier Series :- Periodic functions, Trigonometric series, Euler's formulas, Dirichlets condition, Even and Odd functions , Half-Range-Series, Paseralis identity.

Fourier transform:- Fourier transform, inverse Fourier transform, applications convolution.

MODULE 3 (12+4)

Laplace transform:- Definition, Existence condition, properties, inverse Laplace transform. Laplace transforms of periodic functions, convolution theorem. Laplace transforms of Dirac-delta function, Applications of Laplace transforms is storing linear differential. Equations with initial conditions, system of Linear simultaneous differential equations.

MODULE 4 (11+3)

Z-transforms, properties, convolution and applications to differential equations, wave equations:- Derivation and solution of one dimensional wave equation using separation of variable method. Heat equation, its derivation, solution using separation of variable method.

TEXT BOOKS AND REFERENCES

1. Grewal B.S: Higher Engineering Mathematics -., Khanna publication
2. Erusing Kryszig:Advanced Engineering Mathematics-: New international Limited.
3. Fraank Ayres: Theory and problems of matirces-:- Schaum outline series.
4. Datta K.B: Matrix and Linear Algebra-:PHI
5. Kandasamy P: Engineering Mathematics-Vol III S.Chand and Co.NewDelhi.

ME 3.2 APPLIED THERMODYNAMICS

Total no of questions to be answered :5(At least one question from each module with two compulsory questions from any one module)

MODULE-1 (13+5)

BASIC CONCEPTS OF THERMODYNAMICS:-

Thermodynamic system, and control volume, Macroscopic Vs Microscopic point of view, Properties and state of substance, Processes and cycle, Thermodynamic equilibrium, Quasi-static process, Equality of Temp, Zeroth Law of Thermodynamics and Temp scales.

WORK AND HEAT :-

Thermodynamics definitions, Displacement work, Other types of work transfer, Comparison of heat and work.

THE FIRST LAW OF THERMODYNAMICS FOR NON-FLOW PROCESS :-

First Law of thermodynamics for control mass undergoing a cycle, First Law of Thermodynamics for change of state of control mass, Internal – Energy a Thermodynamic property, constant volume and constant pressure specific heats, Internal Energy, Enthalpy and specific heats of an ideal gas, Energy of an isolated system PMMI.

FIRST LAW OF THERMODYNAMICS TO FLOW PROCESS :-

Control volume, Steady flow energy equation, Adiabatic machines and heat transfer equipments, Adiabatic nozzles and throttling devices, Comparison of SFEE with Euler's and Bernoulli equation.

MODULE- 2 (11+3)

SECOND LAW OF THERMODYNAMICS :-

Cyclic heat engine, Kelvin – Planck statement of II Law, Clausius – statement, Carnot cycle, Reversed heat engine, Carnot theorem, Corollary of Carnot's theorem, Absolute Thermodynamic temperature scale, Efficiency of reversible heat engine.

ENTROPY :-

Clausius Theorem, Entropy a property of system, Entropy a pure substance, Clausius – inequality, Entropy change in irreversible process, Principle of increase in entropy, Entropy generation, First-Second Law combined, Reversible Adiabatic work in steady flow system, Entropy and Direction.

MODULE-3 (13+5)

INTRODUCTION TO WORK PRODUCING AND WORK CONSUMING DEVICES

Simple steam power plant, fuel cells, vapour-compression Refrigeration, thermo-electric Refrigerator, The Gas turbine

PROPERTIES OF PURE SUBSTANCES

Definition, P-V, P-T, T-S, diagrams of pure substance, P-V-T surface, H-S diagram or Mollier diagram for a pure substance, Quality or dryness fraction, Steam tables, Saturated and super heated state, Liquid – vapour mixtures, superheated vapour.

VAPOUR POWER CYCLE

Ideal ranking cycle, Effect of pressure and Temperature on ranking cycle, Reheat cycle, Regeneration cycle, Deviation of actual cycle from ideal cycle, co-generation.

MODULE-4 (11+3)

AIR STANDARD CYCLES

Basic consideration in the analysis of power cycles, The Cornot cycle, and value in Engineering, Air standard assumptions, An overview of Reciprocating engines, Analysis of air standard cycles, Otto Cycle, Diesel cycle, Dual cycle.

GAS TURBINE CYCLE

Brayton cycle, Simple open and closed gas turbine cycle, Air standard cycle for jet propulsion.

REFRIGERATION CYCLE

Vapour compression refrigeration cycle, Cop and properties of Regrigerants.

TEXT BOOKS AND REFERENCES:-

1. WanWylen, Gordon J and Sonntag :Fundamental of Classical thermodynamics, John Wiley International
2. . Nag P.K: Engineering Thermodynamics Tata McGraw Hill
3. .Yunus A Cengel: Introduction to Thermodynamics and Heat Transfer McGraw Hill
4. Robert Balmer: Thermodynamics , Jaico Publication
5. Russell & Adebiyi: Classical Thermodynamics Saunders College Publication
6. Rayner Joel: Basic Engineering Thermodynamics Addison Wesley

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ME 3.3 ENGINEERING MATERIALS SCIENCE AND METALLURGY

Total no of modules :4

No of questions drawn from each module :2
Total no of questions to be answered :5(At least one question from each module with two compulsory questions from any one module)

MODULE-1 (12+4)

CRYSTAL STRUCTURE AND DEFECTS: Unit cell, space lattices and crystal structures, crystal directions and planes. Point defects-vacancy, interstitial and foreign impurities, Schottky and Frenkel defects. Line defects- edge and screw dislocations, burgers vector, energy of dislocations. Surface defects- low and high angle grain boundaries, tilt, twist and twin boundaries.

MECHANICAL TESTING OF MATERIALS: Tensile, impact, hardness, fatigue, creep and formability tests.

PLASTIC DEFORMATION: Deformation by slip and twinning, mechanism of slip, dislocation multiplication, work hardening, recovery, recrystallisation and grain growth.

FRACTURE: Ductile and brittle fracture, ductile-brittle transition temperature, fracture toughness.

MODULE-2 (12+4)

PHASE DIAGRAMS: Solid solutions, intermediate phases, intermetallic compounds, solidification, dendritic growth, phase rule, binary phase diagrams, lever rule.

IRON – CARBON PHASE DIAGRAM: Phases in iron-carbon diagram, definition of structures, invariant reactions, changes in microstructure during slow cooling, critical temperature lines, isothermal transformations diagram, transformation on continuous cooling.

HEAT TREATMENT: Heat treatment of steels – annealing, normalising, hardening, tempering, hardenability, Jominy end quench test. Case hardening of steels – carburising, cyaniding, nitriding, induction and flame hardening. Heat treatment of non-ferrous metals and alloys, age hardening, thermomechanical treatment.

MODULE-3 (12+4)

METALLOGRAPHY: Microstructural study of steel, cast iron, brass and bronze, sample preparation, etching, optical microscope, TEM.

POWDER METALLURGY: Process description – powder manufacture, blending or mixing, compacting, sintering and secondary operations, applications, advantages and limitations.

NDT TECHNIQUES: Radiography, magnetic particle inspection, fluorescent penetrant test, ultrasonic inspection, eddy current inspection.

MODULE-4 (12+4)

ENGINEERING MATERIALS:

COMPOSITE MATERIALS: Synthetic fiber reinforced composites, wood natural timber reinforced composites, aggregate composites. Averaging- loading parallel, perpendicular to reinforcing timber, loading uniformly dispersed aggregate composites, mechanical properties of composites.

STEELS AND CAST IRONS: Properties and applications of alloy steels, tool steels, stainless steels and cast irons.

NON FERROUS ALLOYS: Composition, properties and applications of brassses and bronzes and aluminum alloys.

TEXT BOOKS AND REFERENCES:

1. Sydney H. Avner: Introduction to physical metallurgy, TMH, II Edition.
2. . Raghavan V: Elements of material science and engineering, PHI, IV Edition.
3. . Higgins R. A: Engineering metallurgy, Viva Books Pvt. Ltd., VI Edition.
4. William D. Callister: Elements of material science and engineering, John Wiley & Sons, New York, IV Edition.
5. Lawrence H. Van Vlack: Elements of material science and engineering, Addison Wesley Publishing Company, New York.
6. Manaschanda: Science of engineering materials, vol.1, 2 & 3, Macmillan Company of India Ltd.
7. Shackleford J.F: Introduction to materials science for engineers, Prantice Hall International.
8. John Vernon: Introduction to engineering materials, Macmillan Company Press Ltd., 3rd edition.

ME 3.4 MACHINE DRAWING

Duration of paper :4 hours
Total no of modules :4
No of questions from each module :2
Total no of questions to be answered :5(At least one question from each module with two compulsory questions from any one module)

MODULE- 1 (5+5)

Introduction and Definition of Working Drawing / Production Drawing, Assembly Drawing, Detail Drawing.

Limits, Fits and Tolerances. Definition and Introduction to Limits, Fits, Tolerances, Allowances, Machining Grades, Types of Fits, Selection of Fits. Simple Problems related to Limits, Fits and Tolerances. Manufacturing precision in different process.

Dimensioning and Tolerancing: Conventional practice for Dimensioning, Functioning Dimensions, Importance of Datum Line, Tolerance Buildup.

Freehand Sketches: Cotter Joints, Knuckle Joints, Keys, Couplings, Bearings and Pulleys.

Intersections of solids.

MODULE-2 (4+4)

Assembly Drawing with bill of materials: Units having not more than eight parts (excluding fasteners) e.g.

Screw Jack.

Tail Stock of Lathe.

Tool Post of Lathe (Single Point.)

Tool Head of Shaper.

Ramsbottom Safety Valve.

Blowoff Cock.

Three way stop valve.

I.C. Engine Piston and Connecting Rod.

Milling Fixture.

MODULE-3 (4+4)

Disassembly (Given Assembled / Pictorial View with dimensions.) e.g.

Footstep Journal Bearing.

Simple Eccentric.

Stuffing Box.

Plummer Block.

Non Return Valve.

Drill Jig.

Crosshead.

Problems based on Unit – I.

MODULE-4 (3+3)

Introduction to Computer Aided Drafting.

Demonstration of Drafting Software viz. Auto-Cad Mechanical Desk Top.

TEXT BOOKS AND REFERENCES.

1.. Bhatt N. D: Machine Drawing by. (Charotar Publications.)
2. Gopal Krishna K. R. :Machine Drawing by (Subhash Publications.)
3. Siddheshwar N.: Machine Drawing by et al. (Tata McGraw Hill.Publications)
4. Parkinson A. C .:Intermediate Drawing
5. Jones & Jones :Engineering Drawing
6. Gill P. S :Machine Drawing
7. Laksminarayana V. & Mathur M. L.:Machine Drawing
8. Narayana K. L . Kaniah P :Machine Drawing et al. (Tata McGraw Hill.)
9. Bertoline, Wiebe, Miller, Mohler : Technical Graphics Communication (McGraw Hill Publications.)

PRACTICAL SHALL CONSISTS OF AT LEAST,

4 assembly drawing (**MANUAL DRAWING**),

1 assembly drawing & 1 de-assembly drawing (**AUTO CAD**),

2 de-assembly drawings (**MANUAL DRAWING),**

1 production drawing, and **FREE HAND SKETCHES** based on Module – I.

ME3.5 ELECTRICAL TECHNOLOGY

Total no of modules :4

No of questions drawn from each module :2

Total no of questions to be answered :5(At least one question from each module with two compulsory questions from any one module)

MODULE 1 (10+4)

DC GENERATORS:

Generator principle, practical generator, types, emf equation ,losses, basic concept of armature reaction, commutation,, methods to improve commutation, characteristics of generators.

DC MOTOR:

Motor principle ,voltage equation, torque-equations, motor characteristics, losses, speed control, methods of starting-types of starters.

MODULE 2 (10+5)

THREE PHASE INDUCTION MACHINES:

Principle of operation, construction, equations of torque, slip, torque-slip characteristics, equivalent circuit of induction motor, speed control, methods of starting of induction machines.

SYNCHRONOUS MOTORS:

Principle of operation, methods of starting, motor on load with constant excitation, synchronous motor with different excitations, effect of increased load with constant excitation, effect of changing excitation at constant load., effect of excitation on armature current and power factor, v curves, applications.

MODULE 3 (14+4)

General Measurement techniques, errors, types of errors

working principle, construction, torque equations of the following analog instruments a) PMMC b) Moving iron c) Induction type d) Electrodynamometer type e)Electrostatic type. Shunts and multipliers for PMMC type instruments and extension of range.

Q meter, galvanometers-working principle, construction and torque equations for a) Ballistic galvanometer b) Flux meter c) Vibration galvanometer.

MODULE 4 (14+3)

Measurement of power and watt meter: single phase electrodynamometer type wattmeter, measurement of three phase power by two wattmeter method,

measurement of energy: working principle and construction of single phase induction type energy meter.

DC potentiometers-slide wire type and crompton type potentiometers, AC potentiometers Drysdale polar type AC potentiometer.

AC bridges for measurement of inductance, capacitance and frequency: Maxwells bridges, Hays bridge, Owens bridge, Scherings bridge Desauty bridge, Weins bridge, Wagners earth bridge.

TEXT BOOKS AND REFERENCES

1. Theraja B.L. vol I & II: A text book of electrical technology
2. Sawhney A.K.: A Course in electrical and electronics measurement and instrumentation
3. Nagrath Kothari: Electrical Machines

ME 3.6 FLUID MECHANICS

Total no of modules :4

No of questions from each module :2

Total no of questions to be answered :5(At least one question from each module with two compulsory questions from any one module)

MODULE 1 (12+4)

PHYSICAL PROPERTIES OF FLUIDS, Principle of continuum, Newton's Laws of viscosity, Types of fluids, Thermodynamics properties, Surface tension & capillarity, Compressibility & bulk modulus, vapor pressure.

FLUID STATICS*:* Definition- Liquid pressure and its types. Measurement of pressure - Manometers- Gauges.

HYDROSTATIC FORCES ON SURFACES: Total pressure and center of pressure for horizontal, vertical &inclined immersed surface.

MODULE 2 (14+5)

FLUID KINEMATICS& DYNAMICS*:* Definitions: Steady & unsteady flow, uniform & non uniform flow, One , Two & three dimension flows , Rotational & irrational flow, Laminar & turbulent flow, compressible & incompressible flows, Discharge. Types of heads, continuity equation, energy equation with and without heat transfer, Euler's equation. Practical application of Bernoullie's equation - horizontal and inclined venturimeter- Pilot tube. Impulse momentum equation, Kinetic energy & momentum correction factor.

FLOW THROUGH PIPES*:* Loss of head in pipes - major & minor losses, Equivalent pipe -series &parallel pipes, Siphon , Flow through nozzle, water hammer.

MODULE 3 (15+4)

TURBULENT FLOW*:* Definition , Reynolds expt, Darcy weisbach’s equation, Prandtl’s mixing length theory, universal velocity distribution equation, Hydrodynamically smooth & rough boundaries, Velocity distribution for turbulent flow in smooth & rough pipes.

COMPRESSIBLE FLOW*:* Thermodynamics properties, Basic equation of compressible flow, Velocity of sound for adiabatic & isothermal process. Mach number & its variations , Mach angle , Zone of action, Zone of silence. Subsonic & Supersonic nozzle.

MODULE 4 (7+3)

BOUNDARY LAYER*:* Definitions: Laminar & turbulent boundary, boundary layer thickness & energy thickness. Total drag due to laminar & turbulent layers. Boundary layer separation & its control.

TEXT BOOKS AND REFERENCES:

1. .Modi P.N,.Seth S.M: Hydraulic &Fluid Mechanics Standard Book House
2. .Kumar D.S: Fluid Mechanics and Fluid Power Engineering S.K.Kataria & Sons
3. Jadish Lal: Fluid Mechanics and Hydraulics Metropolitian book company Pvt. Ltd.
4. .Subramanya K.: Theory & Applications of Fluid Mechanics , Mc Garw Hill
5. Streeter V. L &. Wylie E. B: Fluid Mechanics Mc Garw Hill
6. Evett & Cheng Liu: Fundamentals of Fluid Mechanics Mc Garw Hill
7. .Arora K.R: Fluid Mechanics & Hydraulic Machines, Standard Publishers distributors.
8. Giles,Evett & Chang Liu: Fluid Mechanics & Hydraulics – Schaum's Outline series, Mc Garw Hill

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MEL-1 ENGINEERING MATERIALS SCIENCE AND METALLURGY AND ELECTRICAL ENGINEERING

No of hours per week :4
Duration of examination :3hrs.
Max. marks for practical :50

Engineering materials Science and metallurgy. (at least 6 experiments are to be conducted)

1. To draw the stress-strain curve and calculate (a) the elastic limit (b) yield strength (c) ultimate tensile strength (d) % of elongation (e) % of reduction in area (f) toughness (g) resilience of the given metal.
2. To measure the hardness of the given material using Brinell/ Rockwell/ Vicker's Hardness tester.
3. To measure the impact strength and notch sensitivity of the given metal.
4. To determine the capacity of the material to withstand repeated cyclic stress.
5. To determine the continuing change in the deformation of the material at elevated temperature below the yield point.
6. To determine the ductile – brittle transition temperature of the given metal.
7. To find the ability of the given metal to be formed into different shapes.
8. To study the microstructure of (a) mild steel (b) brass (c) cast iron.
9. To detect the presence of cracks/flaws in the given metal piece by magnetic particle crack detection method.
10. To detect the presence of cracks/flaws in the given metal piece by dye penetrant test.
11. Joining End Quench test.
12. With the help of muffle furnace ≠ carry out annealing, normalising, hardening, operation.

Electrical Engineering (At least 4 experiments are to be conducted)

1. Speed control of DC machine

2. Braking (Rheostatic) of DC machine
3. Load Test on 3- phase Induction Machine
4. No load and blocked rotor test on 3 -phase Induction m/c
5. Open circuit characteristics of DC Generator.
6. Experiment on errors.
7. Hay's Bridge
8. Maxwell's bridge
9. Schering Bridge
10. Q-meter

MEL-2 FLUID MECHANICS

No of hours per week :2
Duration of examination :3hrs.
Max. marks for practical :50

1. Verification of Bernoulli's theorem.
2. Calibration of a Venturimeter.
3. Calibration of a orificemeter
4. Calibration V-notcher
5. Calibration of rectangular notch
6. Friction in pipes-Determination of coefficient of friction for a U.G.I. pipe
7. Frictional loss in pipe due to bend and nozzle
8. Determination of coefficient of friction for a P.V.C. pipe.
9. Reynold's Experiment.: Demonstration of Laminar and turbulent flow.
10. Losses in pipe due to sudden Enlargement and contraction.

At least 8 experiments are to be conducted from the above list.

Courses and Syllabus of Second Year Mechanical Engineering

ME 4.1 Numerical Techniques & Computer programming

ME 4.2 Theory of Machines

ME 4.3 Mechanics of Solids

ME 4.4 Digital Electronics and Microprocessors (FR)

ME 4.5 Energy Conversion-I

ME 4.6 Manufacturing Technology-I

ME 4.1 NUMERICAL TECHNIQUES & COMPUTER PROGRAMMING.

Total no of modules :4

No of questions from each module :2

Total no of questions to be answered :5(At least one question from each module with two compulsory questions from any one module)

MODULE 1 (12+4)

SOLUTIONS OF EQUATIONS : Solutions of non-linear equations of single variable using bisection method, (problem solving, algorithm and computer programming,

false position method, Newton-raphson's method, secant method, order of convergence of these methods comparison of the above methods

MODULE 2 (15+5)

FINITE DIFFERENCE AND INTERPOLATION: Forward and backward, central and divided differences, difference tables. Lagrange's interpolation formula Taylor's

operator -d, shift operator -e averaging operator u derivations.

Newton's forward & backward difference interpolation, Newton's divided difference interpolation. Stirling's and Bessel's interpolation formula. Solution of linear algebraic

equation using Gauss elimination. Jacobi's method, Gauss's iteration method.

Concept of ill conditioned and well conditioned system. comparison of the above methods.

MODULE 3 (10+3)

Differentiatial equations using Euler's method, predictor - corrector method.

Taylor's series method, Picard's methods, Runge Kutta methods.

MODULE 4 (11+4)

NUMERICAL INTEGRATION : trapezoidal rule Simson's rules, Richardson's method.

comparison of above methods.

ME 4.2 THEORY OF MACHINES-I

Total no of modules :4

No of questions from each module :2

Total no of questions to be answered :5(At least one question from each module with two compulsory questions from any one module)

MODULE-1

INTRODUCTION: Basic terminology, mobility criterion, Four-bar, slider-crank and Double slider-crank chains and their inversions, Grashoff's linkage.

KINEMATICS OF PARTICLE AND RIGID BODY: Position, displacement, velocity and acceleration of a particle, intrinsic co-ordinates and path curvature, motion relative to a moving frame, coriolis acceleration, Newton's law in noninertial frazme, Motion of a rigid body, angular velocity of a rigid body: a vector, Chassel's theorem.

DESCRIPTION OF SOME COMMON LINKAGE: exact and approximate straight-line mechanism, steering gears, pantograph, and universal joint.

MODULE-II

VELOCITY AND ACCELERATION ANALYSIS OF MECHANISMS:Analysis of mechanisms, having higher and lower pairs,by graphical and analytical methods. Instantaneous center of velocity, Aronhold-Kennedy theorem, body centrode and space centrode

MODULE-III

KINEMATIC SYNTHESIS OF PLANAR MECHANISMS: Task of synthesis and it's classification, synthesis of mechanism for three accuracy points using graphical and analytical techniques, Freudentein's equation, Four-bar coupler curves, cognate linkages, Bloch's synthesis method, Practical considerations in mechanism synthesis.

CAMS: Different types of cams and followers, terminology, uniform motion, uniform acceleration and retardation, SHM, cycloidal follower motions, graphical and analytical synthesis of cam profile for given follower and it's motion, polynomial cams, synthesis of follower motion from the given follower acceleration variations with cam angle, pressure angle and size of a cam, radius of curvature of the cam profile with roller follower to avoid undercutting , circular are cams and tangent cams.

MODULE-IV

TOOTHED GEARING: Motion transmitted bu two curved surfaces in direct contact, law of gearing , classification of gears, involute and cycloidal gears, spur gear terminology, involumetry, path of contact, interference and undercutting,

Methods of avoiding interference, non-standard gears.

Helical gears:terminology, tooth contact and contact ratio.

Spiral gears: Center distance, velocity ration, velocity of sliding , efficiency.

Worm and worm wheel: Terminology, application, efficiency.

GEAR TRAINS: Simple, compound and epicyclic gear trains.

TEXT BOOKS AND REFERENCES

1. Hamilton H. Mabie and Charles F. Mechanisms and Dynamics of Machinery, Reinholtz, John Wiley & Sons.
2. Joseph Edward Shigley and John Joseph Uicker Jr., Theory of Machines and Mechanisms, McGraw-Hill International Edition.
3. Amitabh Ghosh and Asok Kumar Mallik. Theory of Mechanisms and Machines, Affiliated east-west press pvt. Ltd.
4. Rao J.S. and Dukkipati R.V., Mechanism and Machine Theory, New Age International.

ME 4.3 MECHANICS OF SOLIDS

Total no of modules :4

No of questions from each module :2

Total no of questions to be answered :5(At least one question from each module with two compulsory questions from any one module)

MODULE I

INTRODUCTION: Review of mechanics, static analysis of rigid systems, stress, strain, Hooke's law, Poisson's ratio, modulus of rigidity, bulk modulus, relation between constants.

UNIAXIAL DEFORMATION: Uniaxial tension/compression, temperature stresses, statically indeterminate problems.

STRESS AND STRAIN ANALYSIS:2-D stress and strain analysis, Mohr's circle, strain gage rosettes.

MODULE II

PROPETIES OF AREAS: Centroid , moment of inertia, principal axes of inertia, parallel axis theorem and polar moment of inertia.

BEAMS: Bending moment and shear force, relation between them, sign convention, flexure formula, asymmetric bending, curved beams, stresses due to shear force, deflection of beams, statically indeterminate beams.

MODULE III

TORSION: Torsion of circular shafts, close and open coil springs.

STRUTS AND COLUMNS: Struts and core of section, stability of columns, Euler's critical load, for different end conditions of column, empirical formulas for buckling load.

MEMBERS SUBJECTED TO COMBINED LOADING: Shafts subjected to bending moment and twisting moment, members subjected to bending and direct tension/compression

MODULE IV

INTRODUCTION TO ENERGY METHODS: Strain energy under different loading conditions, Maxwell's theorem, Castigliono's theorems, deflection of structures using virtual load method.

THICK AND THIN CYLINDERS: Thin cylinders subjected to internal pressure, thick cylinders, Lamme's equation.

THEORIES OF FAILURE: Various theories of failures and their limitations and use.

TEXT BOOKS REFERENCES:

1. Timoshenko, Van Nostrand. Strength of Materials, Part I, East west press.
2. S. Ramamrutham and Narayanan. Strength of Materials.

ME 4.5 ENERGY CONVERSION -I

Duration of paper :3 hours

Total no of modules :4

No of questions from each module :2

Total no of questions to be answered :5(At least one question from each module with two compulsory questions from any one module)

MODULE-1 (12+4)

INTRODUCTION : Definition of Heat Engine, Classification & Basic Details of Heat Engines, Engine Components & its Nomenclature, Working principles of Engines, Comparison of S.I. and C.I. Engines, Comparison of Two Stroke & four Stroke Engines, Classification of I.C. Engines, Applications of I.C. Engines.

FUEL AIR CYCLES & THEIR ANALYSIS : Introduction, Fuel Air Cycles & their significance, Variable Specific heat, Dissociation, Effect of no. of moles, Comparison of Air Standard & Fuel Air Cycles, Effect of operating Variables.

ACTUAL CYCLES & THEIR ANALYSIS : Introduction, Comparison of thermodynamic & Actual Cycles, Time Loss factor, Heat loss factor, Loss due to rubbing friction.

MODULE-2 (12+4)

COMBUSTION IN SPARK IGNITION ENGINES : Stages of combustion in S.I. Engines, Flame front propagation, factors influencing the flame speed, Abnormal combustion, the phenomenon of knock in S.I. Engine, Effect of Engine variables on Knock.

COMBUSTION IN COMPRESSION IGNITION ENGINES : Stages of Combustion C.I. Engine, Factors affecting the Delay period, the phenomenon of knock in C.I. engines, Comparison of knock in S.I and C.I. Engines.

SUPER – CHARGING : General, Supercharging Systems, Turbo-charging, Characteristics of Supercharged Engines, Inertia Supercharging.

MODULE-3 (16+6)

MEASUREMENT & TESTING : Introduction, Measurement of frictional power – Willian's line method, Morse test, from I.P. & B.P., Retardation test, Measurement of Indication power, Measurement of Brake power – Prony Brake, Rope Brake, Hydraulic Dynamometer, Eddy Current Dynamometer, Swinging field DC Dynamometer. Measurement of Fuel Consumption, Measurement of Air Consumption, Speed Exhaust & Coolant Temperature, Emission.

HEAT BALANCE AND THERMAL CALCUALATIONS : Engine power, Engine Efficiencies, Engine Performance characteristics, Variables affecting performance characteristics, Methods of improving Engine performance, Heat balance, performance Maps.

MODULE-4 (8+2)

FUELS : Important Qualities of Engine Fuels, Rating of C.I. & S.I. Engine Fuels, Alternative Alcohol as Diesel Fuel, Alcohol Vs Gasoline as Engine Fuel, Vegetable oils as Diesel Fuel, Bio-Gas as a Diesel Fuel.

LUBRICATION AND COOLING SYSTEMS OF I.C. ENGINES & THEIR COMPARISON : Function of Lubrication, Lubrication Systems types : Mist, Wet Sump & Dry Sump. Need for Cooling system, Types of Cooling System : Liquid Cooled & Air Cooled.

AIR POLLUTION FROM I.C.ENGINES:S.I & C.I. engine emissions, and their comparison. Environmental effect of air pollution.

TEXT BOOKS AND REFERENCES :

1. . Ganesan V: Internal Combustion Engines Tata McGraw Hill
2. . Mathur M.L &. Sharma R.P: A Course in Internal Combustion Dhanpat Rai & sons.
3. Vasantani & Kumar:Heat Engines Khanna Publications
4. . Domkundwar V.M: I.C. Engines Dhanpat Rai & co.
5. Taylor: The Internal Combustion Engines Vol. I & II

ME 4.4 DIGITAL ELECTRONICS & MICROPROCESSORS (Further Revised)

ıo of modules :- 4

questions from each module :- 2

ıo of questions to be answered :- 5 (At least one question from each module with two compulsory questions from any one module)

MODULE 1

)Y OF LOGIC CIRCUITS:-

of basic NOT, AND, OR, NAND, NOR,XOR & XNOR gates with schematic symbol & truth table.

)Y OF BOOLEAN ALGEBRA:-

rules & theorems of Boolean algebra, Sum of products form (SOP), products of sum form (POS) of Boolean functions.

of Karnaugh Maps (K-maps) for 2, 3 & 4 variables only.

)Y OF NUMBER SYSTEMS & CODES:-

ıed binary numbers, signed binary numbers, Binary arithmetic- Addition & subtraction using 1's complement & 2's ement method.

uction to Decimal, Binary, Octal & Hexadecimal number systems & their conversion from one form to another.

uction to Gray codes, Excess-3 codes & ASCII codes.

MODULE 2

)Y OF FLIP FLOPS:-

of clocked Set-Reset (SR) flip flop, JK flip flop, Toggle (T) flip flop, Delay (D) flip flop & Master slave JK (MSJK) ɔp with their schematic symbol, truth table & excitation table.

)Y OF SHIFT REGISTERS:-

of Serial in serial out (SISO), Serial in parallel out (SIPO), Parallel in serial out (PISO),Parallel in parallel out (PIPO) egisters.

)Y OF COUNTERS:-

of Asynchronous counters with circuit diagram, truth table & waveforms (up counters, down counters & up/down ɛrs).

& design of Synchronous counters (up counters, down counters & up/down counters) using D or T flip flops only & of Ring counters.

MODULE 3

)Y OF MICROPROCESSOR ARCHITECTURE & MICROCOMPUTER SYSTEMS:-

uction to microprocessors, microcomputers, organization of a microprocessor based system, 8085 bus structure, processor architecture & Pin diagram of 8085.

)Y OF SEMICONDUCTOR MEMORIES & INTERFACING :-

:, memory addressing, Types of memories (RAM & ROM) & Interfacing with 8085 & Interfacing of memory along with 'P devices & peripherals.

MODULE 4

)Y OF 8085 INSTRUCTION SET:-

ransfer instructions, Arithmetic instructions , Logical , Branch control instructions & Conditional call instructions.

g of simple assembly language programs, concept of stacks & subroutines.

)Y OF MICROPROCESSOR APPLICATIONS:-

ning scanned displays, Interfacing a matrix keyboard, Memory design & Stepper motor.

BOOKS:-

R P Jain Modern digital electronics ,Tata Mc Graw Hill,.

Malvino & Leech Introduction to Digital Electronics, Tata McGraw Hill,.

Gaonkar R.S.Microprocessor Architecture, Programming & Application, Wiley Eastern

Mathur A.P :Introduction to Microprocessors, Tata Mc Graw Hill,.

Millman & Halkias :Integrated Electronics , Tata Mc Graw Hill,.

Morris Mano : Digital Logic & computer Design, PHI, India ,.

Floyd :Digital fundamentals ,.

ME 4.6 MANUFACTURING TECHONOLOGY-I

Max marks for practical work :50

Total no of modules :4

No of questions from each module :2 Total

Total no of questions to be answered :5(At least one question from each module with two compulsory questions from any one module)

MODULE-I

INTRODUCTION:

a) Introduction to welding – advantages, classification of welding & allied processes, position welding, types of welds, edge preparation for butt welds, weldability, metallurgical aspects of welding , weld inspection & testing, soldering & brazing.

b) Introduction to casting – advantages, basic steps in making sand casting, patterns-function, types, allowances. General properties of moulding sand, method of moulding, cupola, casting defects & remedies, inspection & testing of castings.

c) Introduction to metal forming – strain hardening, classification of forming processes – hot & cold working, conventional & nonconventional, based on stresses, primary & secondary.

MODULE-II

Welding processes :

a) Therm it welding – therm it crucible, therm it pressure (plastic), therm it non-pressure(fusion) welding.

b) Oxy- fuel gas welding-oxy-acetylene welding, flame cutting

c) Arc welding – submerged arc welding (SAW), tungsten inert gas welding (TIG).Metal inert gas welding (MIG), Metal active gas (CO_2) welding (MAG), Electroslag welding (ESW)

d) Resistance welding – spot, seam, projection, upset butt, flash butt, percussion, high frequency.

e) Solid state welding – smith, cold pressure, friction, explosive, ultrasonic, diffusion.

f) Radiant energy welding – Laser beam welding (LBW), electron beam welding (EBW).

MODULE-III

Casting processes :

Die-casting – advantages, limitations& applications.

Pressure die casting – hot chamber, cold chamber, goose neck.

Centrifugal casting – true, semi & centrifuging.

Shell Moulding (croning or “C” process)

CO_2 process, investment casting, continuous casting

Casting design – pouring & feeding, progressive solidification & Diectional solidification, design of gating system –

sprue, rummer , gates, risers ,etc.

MODULE-IV

Metal forming processes:

a) Rolling – types of rolling mills, roll product terminology, forces & geometrical relationship, torque & HP calculations.

b) Forging – classification – open die & closed die forging , hammer & press, hand & machine forging, equipments used, force calculation.

c) Extrusion – direct , indirect, side , hydrostatic & impact , equipment used.

d) Wire drawing – preparation of rod for wire drawing, equipment used, heat treatment of wire, coating of rods, protective metallic coatings.

REFERENCES –

1. Hiene, Loper, Rosenthall –Principles of metal casting – TMH.
2. Dieter G.E – Mechanical metllcergy – Mc graw Hill International.
3. Rao P. N – Manufacturing Technology –TMH.
4. Campbell J.S. – Priniples of manufacturing materials & processes TMH.
5. Davier – welding- Cambridge International.

MEL-3 ENERGY CONVERSION –I

No of hours per week :3

Duration of examination :3hrs.

Max. marks for practical :50

1. Performance test on Two-stroke petrol engine.
2. Performance test on Four-stroke petrol engine.
3. Performance test on Four-stroke diesel engine.
4. Willan's line method to find frictional power of an engine.

5. To find volumetric efficiency of an engine.
6. Morse Test on Multi-cylinder engine.
7. Heat balance test on Four-stroke petrol engine.
8. Heat balance test on four stroke diesel engine
9. Motoring Test.
10. Retardation Test
11. To draw valve timing diagram of four stroke engine.
12. To draw port timing diagram of two-stroke engine.
13. Exhaust gas analysis of I.C. engine.
14. To find flash point, cloud point and viscosity of lubricant.
15. To find calorific value of fuel.

At least 8 experiments are to be conducted from the list mentioned above.

MEL-4 MANUFACTURING TECHNOLOGY-I AND NUMERICAL TECHNIQUES & COMPUTER PROGRAMMING

No of hours per week :4

Duration of examination :3hrs.

Max. marks for practical :50

Manufacturing Technology-I(atleast 4 practicals)

1. Preparation of sand mould.
2. Preparation of casting.
3. Smith forging
4. Arc welding
5. Gas welding
6. Any one of special welding process such as TIG.MIG
7. A report on visit to a local Foundry.

Numerical techniques & Computer Programming (at least 4 practicals)

Writing the algorithm , converting them to source code and run the program on the following techniques.

1. False position method.

2. Newton-Raphson's method.
3. Secant method.
4. Newton's Forward and backward difference interpolation.
5. Lagrange's interpolation.
6. Euler's method.
7. Runge kutta method.
8. Simpson's rule.

Courses and Syllabus of Third Year Mechanical Engineering

ME 5.1 Machine Design-I

ME 5.2 Theory of Machines-II

ME 5.3 Heat and Mass Transfer

ME 5.4 Quality Management

ME 5.5 Manufacturing Technology-II

ME 5.6 Engineering Economics and Management

ME 5.1 MACHINE DESIGN – I

Total no. of modules :4

Total no. of questions from each module :2

Total no. of questions to be answered :5(At least one question from each module)

Use of Machine Design data hand book by Mahadevan and Balaveer Reddy is recommended.

MODULE 1

INTRODUCTION: Meaning of Design, Design considerations, codes & standards, factor of safety. Selection of Materials: Classification of solid materials, Introduction to properties of solid materials, Two-parameter materials charts such as stiffness versus weight, strength versus weight, stiffness versus strength, Wear rate versus limiting pressure, Young's modulus versus relative cost.

DESIGN OF SHAFTS AND LEVERS: Torsion of circular shaft, power transmitted, maximum static shearing stress. Design of shafts for fluctuating loads. Design of keys, stress concentration in shafts. Design of Crankshaft (basic level), Introduction to torsion of non-circular shafts, materials used for shafting, Design of levers.

COTTER AND KNUCKLE JOINT: Design of cotter joint, Gib and its use, gib & cotter joint. Designing the cotter with gib, knuckle joint, pin-joint & adjustable joint.

MODULE 2

SCREWS , FASTENERS & CONNECTIONS: Introduction to Mechanics of power screws, threaded fasteners, Bolts supporting tensile load only, static & dynamic stresses in screw fasteners. Bolts subjected to fatigue loading screwed boiler stays.

RIVETED & WELDED JOINTS: Strength of fusion welds, Eccentrically loaded welds: static load, stress concentration in welds, Residual stresses- weldability. Design for fluctuating loads. Riveted joints with central load. Stresses in rivets. Stresses in a cylindrical shell. Riveted joint with eccentric load. Introduction to adhesive bonding.

MODULE 3

SPRINGS: Stresses in helical springs. Curvature effect. Deflection of helical springs. Properties of spring materials, hot-formed springs. Extension springs, compression springs. Design of helical spring. Fatigue loading. Helical torsion springs Effect of end turns for compression springs. Helical springs of rectangular wire. Leaf springs. Energy stored by springs. Belleville springs. Rubber springs.

MODULE 4

ROLLING CONTACT BEARINGS: Bearing type, bearing life, bearing load, bearing survival, selection of ball & straight roller bearing. Selection of tapered roller bearing. Load cycle analysis. Lubrication, mounting & enclosure.

Lubrication & Journal bearing: Types of lubrication, viscosity Petroff's law, Stable lubrication, Thick-film lubrication, Introduction to hydrodynamic theory. Design considerations, the relation of the variables, clearance, pressure-fed bearings, heat balance, loads & materials. Thrust bearings

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Text books and references:

1. Shigley J.E., Mischke C.R.: Mechanical Engg. Design, McGraw Hill International.
2. Spotts M.F. Shoup T.E. Design of machine elements, Prentice-Hall International.
3. Hamrock B.J, Jacobson, Schmid S.R.: Fundamentals of machine elements McGraw Hill International.
4. Black & Adams: Machine Design, McGrawHill International.
5. Sharma P.C. & Aggarwal D.K. Machine Design , Kataria & sons.
6. Bhandari V.B.: Design of machine elements , Tata McGraw Hill .

ME 5.2 THEORY OF MACHINES-II

Total no of modules : 4

No of questions from each module : 2

Total no of questions to be answered : 5 (At least one question from each module with two compulsory questions from any one module)

MODULE-1

FORCE ANALYSIS OF PLANAR MECHANISMS:

(a) Static force analysis: Forces developed due to primary function of a machine, Forces transmitted by different types of joints, free body diagram of various links of a mechanism, conditions for equilibrium, Graphical and analytical techniques of force analysis of mechanisms, effect of friction, force analysis of direct contact mechanisms, cam-follower mechanism, spur and helical gear force analysis, straight-bevel-gear force analysis.

(b) Inertia force analysis: Newton's and Euler's equations for the motion of a rigid body, Inertia force and D'Alembert's principle, Inertia force analysis of mechanisms containing not more than four links, Virtual work principle and its application.

BALANCING: Balancing of rotating masses, Two-plane balancing, Determination of balancing masses, balancing of reciprocating masses, Balancing of Locomotives & effect of partial balancing, Balancing of multi-cylinder in-line engine, V-engine and rotary engine, Balancing machines.

MODULE-2

GYROSCOPIC ACTION IN MACHINES: Effect of gyroscopic action on automobiles, ships and aeroplanes.

GOVERNOR & FLYWHEEL: Types of governors, Characteristics of Centrifugal governors. Gravity controlled centrifugal governors (Porter and Proell governor). Spring controlled governors (Hartnell governor only). Flywheel: Need, Design and comparison of functions of flywheel and governor.

MODULE-3

FREE & FORCED VIBRATION OF SINGLE DEGREE FREEDOM SYSTEM:

Periodic motion and related concepts, Model of a single degree freedom system, governing equation for damped and un-damped free vibration, natural frequency and it's determination by equation of motion, energy method, Rayleigh's method,

Response to harmonic excitation, Whirling of shafts, vibration isolation, vibrometers and accelerometers, Response to transient excitation, Duhamel integral, Laplace transform and phase plane technique.

MODULE-4

SYSTEMS WITH MORE THAN ONE DEGREE Of FREEDOM: Properties of vibrating systems, Free vibration, Eigen values problem, Flexibility and stiffness matrix.

Numerical Methods for finding Natural frequencies: Rayleigh's method, Dunkerlay's method, Method of matrix iteration and Holzer's method).

TEXT BOOKS & REFERENCE BOOKS

1. **Ghosh A. & Mallik A.K.:THEORY OF MECHANISMS & MACHINES , EWP**
2. **Shigley J.E.,Uicher J.J.: THEORY OF MACHINISMS & MACHINES , McGraw-Hill Inc.**
3. **Ratan S.S.:THEORY OF MACHINES, Tata McGraw Hill.**
4. **Thomson W.T.:MECHANICAL VIBRATIONS, Prentice Hill India**

Rao J.S. , Gupta :THEORY & PRACTICE OF MECHANICAL VIBRATIONS ,

New Age International.

6. **Grover G.K: MECHANICAL VIBRATIONS, S. Chand & CO.**

M.E. 5.3 HEAT AND MASS TRANSFER

Total no of modules :4

No of questions from each module :2

Total no of questions to be answered :5(At least one question from each module with two compulsory que from any one module)

MODULE 1

1. INTRODUCTION TO HEAT TRANSFER AND CONCEPTS:-

(i) Engineering heat transfer (ii) Heat transfer mechanisms (iii) Simultaneous heat transfer mechani simple mechanisms (iv) Units, Dimensions and Conversion factors

2. CONDUCTION

(i) General heat conduction equation. (ii) Boundary condition and initial condition. (iii) Dimensionless g for conduction. (iv) One-dimensional steady-state conduction-simple plane walls & composite plane hollow & composite cylinders & spheres. (v) Thermal contact resistance. (vi) Critical radius of Insulatio Variable thermal conductivity. (viii) Thermal Insulation. (ix) Heat transfer from finned surfaces.

MODULE 2

3. TRANSIENT HEAT CONDUCTION

(i) Lumped system analysis,(ii) Transient heat conduction in large plane walls, long cylinders, and spheres using Heisler charts.

4. NUMERICAL METHODS IN HEAT CONDUCTION

(i) Finite difference formulation of differential equations (ii) Solution methods for systems of differential equations (iii)Two-dimensional steady heat conduction

5.) HEAT EXCHANGERS
i) Classification of Heat Exchangers (ii) Overall heat transfer coefficient iii)The LMTD Method for exchanger analysis (iv) Correction for LMTD for use with cross flow & multipass exchangers (v) ε – method for heat exchanger analysis

MODULE 3

6. FORCED CONVECTION

(i) Physical Mechanism of forced Convection (ii) Velocity boundary layer – laminar & turbulent flows , Reynolds number (iii) Thermal Boundary layer (iv) Flow over flat plates – laminar flow , turbulent flow, Combined Laminar & turbulent flow (v) Flow across Cylinders & spheres –the Drag coefficient, the heat transfer coefficient (vi) Flow in tubes

7. NATURAL CONVECTION

(i) Physical Mechanism of Natural Convection- Grashof's number (ii) Natural Convection over surfaces – natural convection correlations (iii) Natural Convection inside enclosures – effective thermal conductivity (iv) Natural convection from finned surfaces (v) Combined Natural & forced convection

MODULE 4

8. RADIATION HEAT TRANSFER(i) Thermal Radiation (ii) Black body radiation (iii) Radiation properti Atmospheric and solar radiation (v) The view factor (vi) Radiation heat transfer – black surfaces, diffuse and gray surfac Radiation shields & the radiation effect

9. MASS TRANSFER

(i) Introduction to Mass transfer (ii) Modes of Mass Transfer (iii) Fick's law of diffusion (iv) General diffusion equation in stationary media (v) Steady state diffusion through a plain membrane (vi) Steady equimolar counter diffusion (vii) Diffusion in Gases, liquids and solids (viii) The mass-transfer coefficie

Evaporation process in the atmosphere (x) Correlations for mass transfer

Text Books &References :

1. **Ozisik N.M: Heat transfer – A basic approach, McGraw-Hill**
2. **Holman J.P: Heat Transfer, McGraw-Hill**
3. **Taine & Petit: Heat Transfer : Prentice Hall**
4. **Yunus A. Cengel : Heat transfer – A Practical Approach : McGraw Hill**
5. **R.K. Rajput: Heat & Mass Transfer : S. Chand & Co.**

ME 5.4 QUALITY MANAGEMENT

Total no. of modules :4

Total no. of questions from each module :2

Total no. of questions to be answered :5(At least on question from each module with two compulsory question from any one module)

MODULE 1

Probability statistics

Definition, conditional events, Total probability, Barje's Theorem

Probability Distributions:

Bernoulli, Binomial, Geometric, Pascal, Hyper Geometric and Poisson Distributions, Uniform, Exponential, Gamma, Weibull, Normal and Lognormal Distributions

MODULE 2

Inferential Statistics

Sampling Distributions: Normal, Student t, Chisquare and F distributions.

Estimation: Point estimate and confidence interval estimation

Testing of Hypothesis:-

Test for process parameters, Test for Independence and Goodness of fit test.

Fundamentals of Design of Experiments:

One way ANOVA, Two way ANOVA.

MODULE 3

Quality Concepts: Definitions, Dimensions of product/Service Quality, Cost of Quality.

Statistical Process Control:- Control charts for variables and attributes Deciding sample size, frequency, Rational subgroups .

Process capability Analysis.

Acceptance Sampling

-Analysis of single, Double, and Multiple sampling plans.

Design of sequential sampling plan

Design of sampling plans using Cameron's table.

Dodge-Romig tables and MIL STD tables.

MODULE 4

Economics of Reducing Variance:

-Taguchi Loss Function, Concept of Robust Design

Reliability:-

-Reliability, Availability and maintainability, definitions, Standard Measures, Analysis for standard failure distributions, Bath tub curve, Reliability calculations for series, parallel and complex system, Reliability Testing, Reliability Allocation and Optimisation.

-Contribution of Deming, Juran, Crossby and Ishikawa.

-Quality Management system:- ISO-9000, QS-9000

-TQM, Kaizen Approach, Quality Function Deployment.

Text books and references

1. Grant E.l. , Leavenworth R.S., Statistical Quality Control , McGraw Hill.
2. Montgomery D.C., Statistical Quality Control, John Wiley & sons
3. Dale G.Berterfield etc. Total Quality Management, Pearson Education.
4. Phillip J.Ross, Taguchi Techniques for Quality Engg., (Chapter I & III), McGraw Hill.
5. Logothetis N., Managing for Total Quality, Prentice Hall.
6. Halpern S.,The Assurance Sciences, Prentice Hall
7. Dhillon B.S., Engineering Maintanability, Prentice Hall.

M.E. 5.5 MANUFACTURING TECHNOLOGY II

Total no. of modules :4

Total no. of questions from each module :2

Total no of questions to be answered :5(At least one question from each module)

MODULE I

METAL CUTTING

a) **Cutting tool materials**:-Basic requirements, selection, development in chronological order,study of high speed steel, cemented carbides, coated tools, ceramics and diamonds

b) Machinability-Measures, different criteria for assessing machinability,

machinability ratings.

c) **Cutting fluids**:-Objectives, requirements, nomencleature or classification, Selection of cutting Fluids.

d) Basic concepts: Wedge shaped tool and its features, orthogonal and oblique

cutting, thick and thin zone models, types of chips, built-up-edge, chip thickness ratio, velocity diagram, shear strain in metal cutting.

e) Economic of machining : Introduction , factors to be considered, criteria,

restrictions for feed choice, expressions under different criteria by optimizing the cutting conditions.

MODULE II

a) Merchants theory: Assumption and expressions for shear plane angle and

minimum energy in case of merchants circle and modified merchants circle.

b) Concept of feed, speed, depth of cut and cutting forces in turning, milling, drilling and grinding, effect of various parameters on cutting forces and surface finish. Expressions for effect of different parameters on surface finish and also for height of feed ridges.

c) Tool life and tool wear –Definitions, symptoms of end of tool life, Tool life equations, tool wear mechanisms, tool life criteria. Effect of built-up-edge and tool angle and tool life.

d) Dynamometers-requirements, different types of dynamometers for Turning milling, drilling and grinding operations.

MODULE-III

Lathe : Operations in clusive oftaper turning and thread cutting , taper and thread cutting calculations, estimation of

machining time.

Milling : operations, dividing heads and indexing methods, estimation of machining time.

Grinding : operations , standard marking system of grining wheel, estimation of machining time for cylindrical grinding.

Broaching : Introduction ,classification, advantages & limitations, applications

Other miscellaneous operations like shaping, planning , lapping , honing & super finishing.

MODULE-IV

TOOL DESIGN:

a) Single point cutting-tool geometry: Definitions and significance of various angles in plan view and its longitudinal, transverse, normal and other sections. Various derivations to establish the relationship between these angles .

b)Milling cutters and its classification, elements of plain milling cutter, influence of tooth angles on cutter performance.

c) Broach tool design (to decide upon size and number of each type of teeth)

d) Twist drill geometry and its design aspects.

e) Grinding wheel nomenclature and its selection.

References:-

1.Donaldson-ToolDesign-TMH

2.ASTME-Tool Design

3.Arshinov-Tool Design-MIR

4.Production Technology –HMT

5.Shaw.M.C.-Metal cutting principles –CBS Publishers and distributors

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M.E. 5.6 ENGINEERING ECONOMICS AND MANAGEMENT

Total No. of Modules : 4

Total No. of Questions from each Module : 2

Total No. of Questions to be answered : 5 (At least one question from each module with two compulsory questions from any one module).

MODULE 1

GENERAL ECONOMICS

Demand and Supply- Demand curve, Supply curve, National Income terms-GDP, GNP, National Income, Per capita income, Disposable Income, Price Index, Inflation.

Elasticity of demand, Price, Income and Cross Elasticity,

Applications of Elasticity, Estimation/Forecasting of Demand.

Economics and Diseconomies of Scale.

Mergers, takeovers and Acquisitions.

MODULE 2

COSTING, ACCOUNTING AND CAPITAL BUDGETING

Types and Classifications of costs- Fixed, Variable, Average/Unit cost, Average Fixed and Variable cost, Opportunity costs, Implicit and Explicit costs.

Basic Concepts- Contribution, Fixed Cost, Break even Analysis. Preparation of Income statement, Balance sheet, Fund Flow statement,

Working Capital Management.

Depreciation- Terminology, Straight line method, Declining Balance method, Sum of years digit method, Sinking fund balance method.

Capital Rationing.

Different Methods of Evaluation of Projects- Payback Period, Discounted Cash Flow methods- Net Present Value, Internal Rate of Return.

MODULE 3

GENERAL PRINCIPLES OF MANAGEMENT

Different schools of Management, Effectiveness, Efficiency, Productivity, Functions of Managers.

Nature of Objectives, MBO, Merits and Demerits of MBO.

Organisation, Purpose, Span of Management, Departmentation, Structure of Organisation, O.D process, Organisational culture, Matrix organisation, Unity of command, SBU, Line and staff function, Decentralisation.

MODULE 4

MANAGING PEOPLE

Motivation, Theories of Motivation, Maslow's Theory of Needs, Herzberg's Theory, Vroom's expectancy theory, Leadership, Leadership styles and behaviors, Human Resource Management, Staffing, Skills needed by Managers, Recruitment and Selection, Appraisal Methods,

Nature of Communication, Basic Communication Process, Barriers in Communication, Guidelines for improved communication, Informal and Formal communication, Principles of Effective communication, Controlling, Steps in Basic control process, Importance of Standards.

Textbooks and References:

Samuelson P.A., ECONOMICS, McGraw-Hill, 1998.

Koontz , Harold and Weihrich Heinz, ESSENTIALS OF MANAGEMENT, Tata McGraw-Hill, New Delhi, 1998.

Mazada, Fraidoon, ENGINEERING MANAGEMENT, Addison-Wesley, Singapore,

Stoner, James, Freeman, Edward R. and Gilbert, Daniel R. ., MANAGEMENT, Prentice-Hall, New Delhi, 1999.

Hicks, Philip E., INDUSTRIAL ENGINEERING AND MANAGEMENT, McGraw-Hill, New York, 1994.

Peterson, Lewis, MANAGERIAL ECONOMICS, P.H.I

Nellis, Parker, THE ESSENCE OF BUSINESS ECONOMICS, PHI

Samuelson, Nordhaus, ECONOMICS, McGraw-Hill, INC

Universal Publication Corporation, HOW TO READ A BALANCE SHEET, ILO Publication

Horngren, Foster, Datar, COST ACCOUNTING , PHI.

Lynch, Williamson, ACCOUNTING FOR MANAGEMENT PLANNING AND CONTROL, Tata McGraw Hill

Hampton, FINANCIAL DECISION MAKING, CONCEPT, PROBLEMS AND CASES , Prentice-Hall India

Riggs, Bedworth and Randhawa, ENGINEERING ECONOMICS, McGraw Hill

Chandra, Prasanna, FUNDAMENTALS OF FINANCIAL MANAGEMENT, Tata McGraw Hill

Barthwal, INDUSTRIAL ECONOMICS, New Age International Publishers.

Kotler, Philip, MARKETING , Prentice-Hall India

M.EL.5 THEORY OF MACHINES-II & HEAT AND MASS TRANSFER LAB

No of hours per week : 3

Duration of examination : 3 hours

Maximum marks for practicals :50

A. **Thoery of Machines –II(4 experiments are to be conducted)**

1.Static and dynamic balancing.

2.Characteristics of gravity controlled governor.

3.Characteristics of spring controlled governor.

4.Gyroscopic precession.

5.To find the natural frequency of compound & simple pendulum.

6. To find the natural frequency of forced damped vibration.

7.To find the natural frequency of bifilar suspension.

8.Whirling speed of shafts.

9.Free damped vibrations.

B. **Heat and mass Transfer (4experiments are to conducted)**

1.Heat transfer through composite wall.

2.Study of parallel and counter flow heat exchanger .

3.Heat transfer through a pin fin.

4.Heat transfer by natural convection.

5.Measurement of thermal conductivity.

6.Heat transfer by Radiation-Stefan Boltzmann's Apparatus.

7.Emmissivity measurement apparatus.

M.E.L.6 MANUFACTURING TECHNOLOGY-II

No. of hours per week:03

Duration of examination:-3 hours

Max. marks for practicals:-50

Min. no. of (four)jobs including the following :-

1.Operations on lathe including taper turning and thread cutting.

2.Operations on shaper /slotter.

3.Operation on milling machine including gear cutting

4.Operations on grinding machine.

Courses and Syllabus of Third Year Mechanical Engineering

ME 6.1 Machine Design-II

ME 6.2 Energy Conversion-II

ME 6.3 Industrial Engineering

ME 6.4 Engineering Metrology

ME 6.5 Mechatronics

ME 6.6 Operations Management

ME 6.1 MACHINE DESIGN – II

Lectures per week :(4+1)

Total no. of modules :4

Total no. of questions from each module :2

Total no. of questions to be answered :5(At least on question from each module with two compulsory question from any one module)

MODULE 1

1.CLUTCHES, BRAKES AND FLYWHEELS: Torque transmitted by a clutch single plate, multi-plate, cone and Internal expanding clutches. Design of clutch plate, pressure plate, springs & lever. Introduction to one-way clutch.

2.Brakes: Braking torque. Different types of brakes such as block-brake, band- brake, block and band brake, Internal expanding brake. Limiting pressure, heating of brakes, disc brakes.

3.Flywheel : Turing moment diagrams, Fluctuation of energy. Flywheel used for IC engine and punching press. Weight of flywheel, rim dimensions, stresses in flywheel rims, designs of arm, hub. Bolted flywheels.

MODULE 2

4.GEAR DESIGN: Introduction to spur gears, Gear force analysis, the Lewi's formula, surface desirability, AGMA standards for spur gears. Design calculations for helical gears: virtual number of teeth, force analysis, beam-strength & wear strength of Helical gears.

5.Design calculation for bevel gears: Force analysis, Beam strength & wear strength of bevel gears. Selection of material and lubrication, for above type of gears.

6.Worm gears: Force analysis, friction in worm gears, bending & wear strength of worm gears. Thermal consideration of worm gears. Selection of materials.

MODULE 3

7.FLEXIBLE MECHANICAL ELEMENTS: Flat & V-belts, belt materials, geometrical relationships. Belt slip & creep Length of open and crossed belt drive. Analysis of belt tensions, condition for maximum power, selection of flat and V-belts. Design of roller chains.

8.DESIGN OF I.C. ENGINE PARTS: Design of cylinder, cylinder head, piston & connecting rod.

9.Principles of form synthesis: principles, Exception to the form synthesis, principles, Design of joints.

MODULE 4

10.ENGINEERING DESIGN, PROCESS & PRACTICE: The design process, steps in design process, Concurrent Engineering, Re-engineering,Protection of Intellectual property: Patents, Copyrights, Trade marks, trade secrets. Technology licensing.Human factors in design. Creativity methods, Brainstorming, synectics.

Design for manufacturing: guidelines, specific design rules .Product liability: goals of product liability law, negligence, strict liability, design aspects of product liability,

Problems with product liability law.

Text books and references:

1.Shigle J.e. Mischke C.R.: Mechanical Engg. Designs, 5th edition. McGraw Hill International.

2.Spotts M.F. Shoup T.E. Designs of machine elements, 7th edition Prentice-Hall International.

3.Hamrock B.J, Jacobson, Schmid S.R.: Fundamentals of machine elements McGraw Hill International.

4.Black & Adams: Machine Design 3rd edition. Mc Graw Hill International.

5.Sharma P.C. & Aggarwal D.K. Machine Design 9th edition. Kataria & sons.

6.Bhandari V.B.: Design of machine elements TMH

7.George Dieter: Engineering Design. Mc Graw Hill International

ME 6.2 ENERGY CONVERSION – II

Lectures per week :(3+1)

Max. marks for theory paper :100

Duration of paper :3 hours

Total no. of modules :4

Total no. of questions from each module :2

Total no. of questions to be answered :5(At least on question from each module with two compulsory question from any one module)

MODULE 1

PRINCIPLES OF TURBOMACHINERY: The turbomachine, Positive displacement machines and turbomachines, Static and stagnation states Application of first and second laws to turbomachines, Efficiency of turbomachines.

ENERGY EXCHANGE IN TURBOMACHINES: The Euler turbine equation, Fluid energy changes, Impulse and reaction, Turbines- utilization factor, Compressors and pumps

FLOW THROUGH NOZZLES AND BLADE PASSAGES: Introduction, Steady flow through nozzles, Area changes in one- dimensional isentropic flow, Effects of friction in flow passages, Characteristics of converging – diverging nozzles, Flow of wet steam through nozzles, Diffusers.

MODULE 2

STEAM AND GAS TURBINES: Impulse staging, Velocity and pressure compounding, Effects of blade and nozzle losses, Reaction staging, Reheat factor in turbines, Problem of radial equilibrium, Performance characteristics of steam turbines.

ROTARY FANS, BLOWERS AND COMPRESSORS : Introduction, Centrifugal blower, Types of vane shape, Size and speed of machine, Vane shape and efficiency, Vane shape and stresses, Vane shape and characteristics, Actual performance characteristics, The slip coefficient, Fan laws and characteristics, Centrifugal compressor, Performance of centrifugal compressor, Compressibility and pre-whirl, The axial flow compressor, Compressor cascade performance, Axial- flow compressor performance, Preheat in compressor.

MODULE 3

HYDRAULIC TURBINES: Hydraulic power utilization, Hydrograph and water power, Classification of water turbines, The Pelton wheel, Velocity triangles, Turbine efficiency and volumetric efficiency, Working proportions of Pelton wheels, Francis and Deriaz turbines, Velocity triangles and efficiencies, Design of Francis turbine, The draft tube, Propeller and Kaplan turbines, Application of aerofoil theory to propeller blades.

CHARACTERISTICS OF HYDRAULIC TURBOMACHINES: Introduction, The main characteristics, Operating characteristics, Constant efficiency curves, Cavitation in hydraulic machinery.

POWER TRANSMITTING TURBOMACHINES: Introduction, Theory, Fluid of hydraulic coupling, Torque converter.

MODULE 4

CENTRIFUGAL AND AXIAL- FLOW PUMPS: The centrifugal pump, Some definitions, Pump output and efficiencies, Multi-stage centrifugal pumps, Axial flow pump.

RECIPROCATING PUMPS: Introduction, Principle of working , slip and coefficient of discharge, Classification, Variation of velocity and acceleration in suction and delivery pipes due to acceleration of the piston, Effect of variation of velocity on friction in the suction and delivery pipes, Ideal & Actual Work done, Effect of acceleration and friction on indicator diagram, Air vessels, Maximum speed of a reciprocating pump, Operating characteristics of reciprocating pumps

TEXT & REFERENCE BOOKS :

1.KADAMBI V. , MANOHAR PRASAD : An Introduction to Energy Conversion vol III, New Age International Publishers

2. DR. BANSAL R.K.: Fluid Mechanics and Hydraulic machines, Laxmi Publications

3.GANESHAN V. : Gas turbines , Tata Mcgraw Hill Publications

4.YAHYA S.M. :Turbines , Fans and Compressors, Tata Mcgraw Hill Publications

5.YADAV R: Steam and Gas Turbines, Central Publishing House

6.SHEPHARDS D.G. : Principles of Turbomachinery, Macmillan Publications

7.SOM S.K., BISWAS G. Introduction to fluid mechanics and fluid machines ,Tata Mcgraw Hill Publications

ME 6.3 INDUSTRIAL ENGINEERING

Lectures per week **3 hours**

Tutorials per week **1 hour**

Max marks for theory paper **100**

Max marks for sessionals **25**

Total number of modules **4**

Total number of questions to be answered —5 (at least one question from each module)

Duration of Theory paper **3 hrs**

MODULE I

a) PRODUCTIVITY: Brief history and evolution. Meaning of the terms out put, production, input, wastivity, effectiveness, efficiency, productivity index in connection with productivity. Basic definition of productivity — partial, total factor and total productivity. Advantages and limitations of each type. Productivity cycle. Work study and productivity.

b) WORK STUDY: Brief history and evolution. Definitions of work study, method study, work measurement & motion study. Work study — purpose, aims/objectives, highlights, basic procedure. The human factor in the application of work study.

c) ERGONOMICS: Physiological basis of human performance, biomechanics, psychology of work and work and work load perception, physical work environment, ergonomics design of work system.

MODULE II

d) METHOD STUDY: Objectives, procedure design cycle. Selection of a problem. Formulation of a problem.

Recording techniques — models, diagrams (string and flow), photographic aids, process charts-symbols & construction of various process charts namely — outline, operation, flow, multiple activity, travel, two handed and simultaneous motion chart Critical examination- restrictions, search for alternative, evaluation of alternatives, selection of alternative.

e) MOTION STUDY: Principles of motion economy — use of human body, arrangement of the work place, design of tools & equipments. Macro motion, micro motion and memomotion study, their applications and uses. Cyclegraph and chroncyclegraph.

MODULE III

f) WORK MEASUREMENT: Techniques, aims/objectives, uses & application basic procedure. Stop watch time study performance studies. Normal & standard time. Production studies. Work sampling. Standard data. Predetermined motion time systems.

MODULE IV

g) INCENTIVES — Introductory ideas, various incentive plans.

h) JOB EVALUATION: Task, position, job, job analysis, job description, Job evaluation. Job evaluation methods ranking, job classification or grade description, point system, factor comparison, castellion, decision matrix, decision band, guide chart profile & time span.

i) VALUE ENGINEERING: Concept, principles, methodology and scope.

Text books and references.

I. Handbook of Industrial Engineering- By G. Salvandy

2. Industrial Engineering Handbook by Maynard H.B., McGraw hill

3. Methods Engineering by Krick ER. , John Wisley

4. Motion and Time Study by Mundel M.E. PHI

5. Introduction to Work Study by ILO, Universal Book Corporation

M.E. 6.4 ENGINEERING METROLOGY

Lectures per week : 4 hours

Max. marks for theory paper : 100

Max. marks for sessionals : 25

Duration of paper : 3 hours

Total no. of modules : 4

Total no. of questions from each module : 2

Total no. of questions to be answered : 5 (At least one question from each module with two compulsory questions from any one module)

MODULE 1

A) **STANDARDS OF MEASUREMENT**: Line, end and wavelength standards. Meter & Yard. Primary, secondary, tertiary and working standards. End bars Derivation of end standard from line standards. Subdivision of end standard by Brooke's level comparator. Comparison of end standard with line standard by displacement method. Calibration of end bars. Slip gauges: Manufacturing, generation, calibration and applications of slip gauges.

B) **ANGULAR MEASUREMENT**: Angle gauges, spirit level, sine bar, Clinometers.

C) **INTERFEROMETRY**: Introduction, optical flats and their application. Testing of flatness, contour, parallelism by interferometry. NPL flatness & NPL gauge interferometry.

MODULE 2

A) **COMPARATORS:** Principle and construction of mechanical pneumatic, optical, Electronics comparators and their applications.

B) Study of Autocollimator …

C) Straightness, flatness, squareness, parallelism and circularity.

MODULE 3

A) **INTERCHANGEABILITY**: Introduction, Advantages and Types

B) **LIMIT SYSTEMS**. Limit fit tolerances, tolerance built up, types of fits, selective assembly. In brief earlier limit system (Nowall and BS 164) ISO/Indian Standard limit fit system Selection of limit, geometrical tolerance. Limit gauging-Taylor's principle.

C) **GEOMETRIC DIMENSIONING AND TOLERANCING:** Introduction, Standard symbols and terminology, standard drawing, practice, and their interpretation.

MODULE 4

A) **SURFACE FINISH MEASUREMENT**: Introduction, surface texture, surface roughness, methods of measuring, surface finish, RMS and CLA Values

B) **METROLOGY OF SCREW THREAD:** Function and form of screw threads, simple effective diameter measurement Two and Three pin method. Error in threads, effect of pitch error, measurement of major, minor and pitch error.

C) **METROLOGY OF GEAR TEETH:** Involute gear tooth measurement Tooth profile measurement rolling gear testing, measurement of tooth thickness Constant chord method maximum cord method.

TEXTS & PREFERENCES:

1. Galyer J.F. and Shotbolt- Metrology for Engineers ELBS
2. Miller L.Engineering dimensional metrology- Arnold
3. Hume K.J. Engineering metrology- Macdonald
4. Wilson(Ed) – Hand book of Industrial metrology-ASTME
5. R.K.Jain- Engineering Metrology- Khanna Publisher
6. Gupta I.G. – Metrology- Dhanpath Rai Publication.

M.E. 6.5 MECHATRONICS

Total no. of modules :4

Total no. of questions from each module :2

Total no. of questions to be answered :5(At least on question from each module)

MODULE-1

1.INTRODUCTION TO MECHATRONICS: General system configuration, Systems-measurement systems, control systems, microprocessor based controllers.

2.CONCEPTS OF CONTROL ENGINEERING: Introduction to control engineering, types of control systems, closed-loop Vs open loop control system, Laplace transform, transform function, system representation,representation of control system,block diagram approach,state variable models, feedback control system

characteristics;stability,digital and other modern control systems.

3.SENSORS AND TRANSDUCERS: Sensors, performance terminology, Displacement, position and proximits sensors; Velocity and motion sensors, Force sensors, Pressure sensors, flow sensors, liquid level sensors, Temperature sensors, Light sensors, selection of sensors.

MODULE-2

4.SIGNAL CONDITIONING: Introduction, type of amplifier circuits, Protection Filtering, Analog & digital Signals, Analog to Digital Conversion, DAC, Multiplexers, Data Acquisition, DSP.

5.DATA PRESENTATION SYSTEMS: Introduction, Loading, data presentation elements, Analog recorders, Displays, Data acquisition systems, measurement systems.

6.PNEUMATIC AND HYDRAULIC ACTUATION SYSTEMS: Introduction, Advantages of Pneumatic/Hydraulic systems, the concept of Power Transmission, Pneumatic and Hydraulic systems, Control Values, Pressure control Valves, Electropneumatics, Rotary Actuators.

7.MECHANICAL ACTUATION SYSTEMS: Some Basic concepts, Mechanical Systems, Types of motion, Kinematic chains, cams, Gear Trains, Ratchet and Pause mechanism, Belt and Chain drives, Bearings, Mechanical Aspects of Motor selection

MODULE-3

8.ELECTRICAL ACTUATION SYSTEMS: Mechanical switches, Solid-State switches, Solenoids, Basics of Electrical Machines, A.C. motors, Stepper Motors.

9.PROGRAMMABLE LOGIC CONTROLLERS: Introduction to PLC,Elements of a PLC,PLC operation and programming, Mnemonics Timers, Internal Relays and

counters, shift registers,Master and jump controls, Getting and moving data I/O PLC Communication selection of PLC.

10. SYSTEM MODELS: Mathematical Models, Electrical system Building Blocks, Electrical and Mechanical Analogies , Fluid system Building Blocks, Thermal system Building Blocks

MODULE-4

11.INTERFACING OF I/O SYSTEMS: Introduction, I/OParts, Requirements of interface, peripheral interface, adapters, serial communication Interface

12.MECHATRONIC ELEMENTS: Introduction, Machine Structure, Guide warp, Feed Drives, Spindle and Spindle Bearings, Measuring Systems.

13. ASSEMBLY TECHNIQUES: Introduction, Guideways, Ballscrew and Nut, Feedback Elements, Spindle Bearings.

Text books and references:

1. **Bolton.W. Mechatronics,Addison Wesley Longmans, Delhi.**
2. **C.R. Venkatramana, Mechatronics 2nd edition, Sapna Book House, Bangalore**
3. **Devdas shetty:etal, Mechatronics system Design**
4. **HMT, Mechatronics. Tata- McGrawHill, NewDelhi.**
5. **Histand, etal, Introduction to Mechatronics, McGrawHill, Inc. USA**

M.E 6.6 OPERATIONS MANAGEMENT

Lectures per week 3 hours

Tutorials per week 1 hour

Max marks of theory paper 100

Max marks for sessionals 25

Total number of modules 4

Total number of questions to be answered 5

MODULE I

1 .Concepts in operations planning and concepts for various operational systems in manufacturing and service sectors.

2. Forecasting Techniques

3. Concepts and quantitative methods in plant location

MODULE II

4. Concepts and quantitative methods for plant layout.

5. Assembly line balancing and materials handling.

6. Aggregate planning and master production scheduling

7. Loading and expediting

MODULE III

8. Dependent and independent demand. Inventory control, EOQ models for purchasing and manufacturing situation with and without shortages, MRP and CRP

9. Sequencing and Scheduling single processor, two processor and multi-processor systems.

MODULE IV

10. Product mix situations using LP techniques

11. Project planning and control, CPM and PERT. Crashing of project.

Text and References

1. Monks J. G., Operations Management: Theory and Practical McGraw Hill, 1985.

2. Martin K Starr, Operations Management, Prentice Hall.

3. Vollman Thompson etal, Manufacturing Planning and Control Systems.

4. Fogarty Donald W and Hoffman Thomas R, Production and Inventory

Management, South Western Publishing Comp

5. Montgomery D C and Johnson L A Operations Research in Production Planning and Control.

6. William J. Stevenson: Production/operations Management.

MEL -8: METROLOGY & MECHATRONICS LAB.

No of hours per week :3

Duration of examination :3hrs.

Max. marks for practical :50

Metrology(4 experiments are to be conducted.)

1.Use of Slip gauges along with the accessories.

2.Calibration of Vernier/Micrometer.

3.Measurement of angle using Sine bar.

4.Checking of straightness of Straight edge.

5.Inspection and grading of surface plate with the help of spirit level/autocollimeter.

6.Measurement of different element of thread.

7.Tooth thickness measurement of a gear.

8.Use of comparator.

9.Using of optical flat for the inspection of different surfaces.

10.Metrological measurement with the help of profile projector/toolmakers microscope.

11.Vertical/Horizontal metroscope

12.Measurement of surface finish.

B.MECHATRONICS(4 experiments are to be conducted)

1.Calibration of pressure gauge

2.Use of Strain gauge for strain measurement, Force measurement.

3.Calibration of LVDT.

4.Calibration & measurement (Thermister, Thermocouple)

5.Using Data logger various outputs of the instruments are to be logged and processed.

MEL 7 MACHINE DESIGN-II &ENERGY CONVERSION-II LAB

No of hours per week :3

Duration of examination :3hrs.

Max. marks for practical :50

A. Machine Design

1.Complete design and drawing of any one type of clutch plate and clutch assembly.

2.Determination of bearing characteristic number and drawing of a Journal bearing.

3.Complete design and drawing of any one type of gear.

4.Comprehensive design of any one type of machine such as hand riveting machine, hand punching machine, screw Jack, hydraulic or pneumatic jack, etc.

B.Energy Conversion II(6 experiments are to be conducted)

1.CONSTANT SPEED CHARACTERISTICS OF PELTON WHEEL.

2.CONSTANT HEAD CHARACTERISTICS OF PELTON WHEEL.

3.CONSTANT SPEED CHARACTERISTICS OF KAPLAN TURBINE.

4.CONTANT SPEED CHARACTERISTICS OF KAPLAN TURBINE.

5.OPERATING CHARACTERISTICS OF RECIPROCATING PUMP.

6.MAIN AND OPERATING CHARACTERISTICS OF A CENTRIFUGAL PUMP.

7.CONSTANT HEAD CHARACTERISTICS OF A CENTRIFUGAL PUMP.

8.CONSTANT SPEED CHARACTERISTICS OF A GEAR PUMP.

9.CONSTANT HEAD CHARACTERISTICS OF A CENTRIFUGAL BLOWER.

ME 7.1 MANUFACTURING TECHNOLOGY – III

Total number of modules	4
Total number of questions to be answered	5 (at least one question from each module)

MODULE – I

a) SHEET METAL WORKING :- Introduction, Standard die set and its accessories.

b) PRESS WORKING OPERATIONS :- Shearing, Blanking, Punching and piercing, Notching and semi notching, Slotting, Trimming, Bending and drawing, Embossing.

c) TYPES OF DIES :- Simple, Compound, Combination, Progressive and transfer stock layout techniques.

d) SELECTION & CLASSIFICATION OF PRESSES.

e) Theory of cutting, Clearance, Force calculations, Bending forces.

f) DRAWING :- Theory of drawing, Shell blank calculations.

MODULE – 2

a) JIGS & FIXTURES :- Introduction, Definitions, Elements, Presentation of work piece in a jig/fixture drawing. Types of locators, Clamps, Jig bushes, Standard jigs and fixtures for turning, Milling and grinding. Design principles of location, Clamping and Jigs/fixtures. Design of jigs/fixtures for simple components.

MODULE – 3

UNCONVENTIONAL MACHINING

a) Ultrasonic Machining (USM)

b) Electric Discharge Machining (EDM)

c) Electrochemical Machining (ECM)

d) Abrasive Jet Machining (AJM)

e) Laser Beam Machining (LBM)

f) Electron Beam Machining (EBM)

Working principles, merits-demerits and application of the above processes.

MODULE – 4

a) GEAR CUTTING & FINISHING :- Gear shaping, Gear hobbing, Gear grinding.

b) PLASTICS :- Injection moulding and Blow moulding.

c) Wear mechanism of H.S.S. and carbide tools.

d) Machinability of Magnesium, Aluminium, Copper, Iron and Steel

REFERENCES :-

1. Joshi P. H. :- Jigs and Fixtures (TMH)
2. Kempster :- Introduction to Jigs and Fixtures (ELBS)
3. Juneja B. L. & Sekhon G. S. :- Fundamentals of metal machining and machine tools (Wiley Eastern Ltd.)
4. Trent E. M. :- Metal Cutting (Butterworths)
5. Eary and Reid :- Techniques of Pressworking Sheet Metal (Prentice Hall Inc.)

ME 7.2 CAD/CAM

Lectures per week	5 hours
Max. marks for theory paper	100
Max. marks for sessionals	25
Total number of modules	4
Total number of questions to be answered	5 (at least one question from each module)

MODULE – I

Fundamentals of CAD/CAM, CAD process, CAD/CAM Hardware, CAD/CAM Software, Geometric modeling & its techniques, Parametric & variational modeling, Feature based modeling, Finite element analysis procedure, Concurrent engineering, Artificial intelligence in design, CAD standards.

MODULE – II

Interactive computer graphics, 2D & 3D graphics concepts, Raster scam graphics, Line and circle drawing, Scan conversion, real time scan conversion, Run length encoding, Character display, Window clipping, Geometric transformation, Visible line and visible surfaces elementary 2D computer graphics algorithms.

MODULE – III

Numerical Control, N.C. part programming, Computer aided part programming, APT language, Computer controls in NC, Robot technology, Programming & applications, Rapid Prototyping (RP), Generative manufacturing processes, 2D layer by layer & direct 3D techniques for RP.

MODULE – IV

Fundamentals of Automation, CIMS, CAPP, Automated material handling and storage system, Group technology, FMS, Automated inspection and testing, Programmable controllers, Computer process control, Computer networks for manufacturing, Information requirements of manufacturing.

REFERENCES :-

1. Mikell P. Groover, Emory W ZimmersJr. - CAD/CAM --- Prentice Hall of India.
2. P.N. Rao – CAD/CAM Principals & applications --- Tata McGraw Hill (TMH)
3. Mikell P. Groover – Automation, Production Systems & Computer Integrated Manufacturing --- Pearsen Education Asia.
4. Ibrahim Zeid – CAD/CAM Theory & Practice --- (TMH)
5. Chris McMohan, Jimmie Browne – CAD/CAM principles, practice and manufacturing management --- Pearsen Education Asia
6. Amitabha Ghosh – Rapid prototyping --- Affiliated East West press Pvt. Ltd.
7. David F. Rogers – Procedural elements for computer graphics --- (TMH)
8. N. Krishnamurthy – Introduction to computer graphics --- (TMH)
9. C. S. Krishnamoorthy, S. Rajeev – Computer Aided Design Software & Analytical Tools --- Narosa Publishing House
10. T. K. Kundra, P.N. Rao, N.K. Tewari – Numerical control & computer aided manufacturing --- (TMH)
11. K.R. Nambiar – Computer aided design, production & inspection --- Narosa Publishing House
12. Schaum's outline series – Computer graphics --- (TMH)
13. William M. Newman, Robert F. Sproull – Principles of Interactive Computer Graphics --- (TMH)
14. Donald Hearn, M. Pauline Baker – Computer Graphics --- Prentice Hall of India
15. S. Kant Vajpayee – Principles of Computer Integrated Manufacturing --- Prentice Hall of India

M.E 7.3 REFRIGERATION AND AIR CONDITIONING

Total no. of modules :4

No. of questions from each module :2

Total no. of questions to be answered :5 (atleast one question from each module)

MODULE-I

Refrigeration: Basic concepts, Principles of Refrigeration. Methods of refrigeration. Applications of R and A/C. Reversed Carnot cycle, Air refrigeration cycles, air- craft refrigeration systems

Vapour compression systems: Types, Multistage compression and expansion systems with flash inter-cooling, actual vapour compression systems.

MODULE-II

Cascade systems of refrigeration, Cryogenics, Liquefaction of gases, manufacturing of Dry Ice. Commercial Ice making plants. Household refrigerators.

Vapour absorption systems: Principle, processes; Li-Br water vapour absorption system; Three- fluid absorption system; multistage absorption refrigeration.

MODULE-III

Working substance:-primary and secondary refrigerants, their properties and comparison of different working substances. Non – Conventional refrigerants, Environmental concerns.

Psychrometry: use of psychrometric charts for various A/C processes, Adiabatic mixing of air, streams. Reheating and bypassing of air, room apparatus dew point factor inside and outside design comfort air conditioning. Comfort chart, comfort zone, effective temperature, air conditioning load calculations.

MODULE-IV

Air distribution-high and low velocity Ducts. Duct design, fans and blowers. Applications of summer, winter and all weather air conditioning plants.

Cold storages- load calculations.: Optimum insulation. Design conditions for storage of various commodities, air circulation, types of evaporators, defrosting, controls in air-conditioning plants

Modern methods of Refrigeration and A/C: Thermo electric refrigeration systems, Solar refrigeration

TEXT BOOKS AND REFERENCES:

1. Arora C.P: Refrigeration and Air Conditioning, Tata McGraw Hill.
2. Stocker W.F. and Jones J.W.: Refrigeration and Air conditioning, Tata McGraw Hill
3. ASHRAE Handbook 1983.
4. Domkundwar Refrigeration and Air conditioning, Dhanpatrai & Sons.
5. Manohar Prasad: Refrigeration and Air conditioning, New Age Intl.

M.E 7.4E-1.5 INDUSTRIAL PRODUCT DESIGN

Max. Marks for oral examinations :50

Duration of theory paper :3 hours

Total no. of modules :4

No. of questions from each module :2

Total no. of questions to be answered :5 (atleast one question from each module)

MODULE I

INTRODUCTION: Characteristics of successful product development, Who designs and develops products, Duration and costs of product development, The challenges of product development.

DEVELOPMENT PROCESSES AND ORGANIZATIONS: A generic development process, Concept development: the front-end process, Adapting the generic product development process, The AMF development process, Product development organizations, The AMF organization.

IDENTIFYING CUSTOMER NEEDS: Step1: Define the scope of the effort, Step 2: Gather raw data from customers, Step 3: Interpret raw data in terms of customers needs, Step 4: Organize the needs into a hierarchy, Step 5: Establish the relative importance of the needs, Step 6: Reflect on the results and the process.

MODULE II

ESTABLISHING PRODUCT SPECIFICATION: What are specifications? When are specifications established? Establishing target specification, Refining the specifications.

CONCEPT GENERATION: The task of concept generation in product development, Step 1: Clarify the problem, Step 2: Search externally, Step 3: Search internally, Step 4: Explore systematically, Step 5: Reflect on the solutions and the process.

CONCEPT SELECTION: Overview of methodology, Concept screening, Concept scoring, Caveats.

MODULE III

PRODUCT ARCHITECTURE: What is product architecture? Implications of the architecture, Establishing the architecture, Related system-level design issues.

INDUSTRIAL DESIGN: What is industrial design? Assessing the need for industrial design, The impact of industrial design, The industrial design process, Management of the industrial design process, Assessing the quality of industrial design.

DESIGN FOR MANUFACTURING: Design for manufacturing defined, Estimate the manufacturing costs, Reduce the component costs, Reduce the assembly costs, Reduce the support costs, Consider the Impact of DFM decisions on other factors.

MODULE IV

EFFECTIVE PROTOTYPING: Prototype basics, Principles of prototyping, Planning for prototypes.

ECONOMICS OF PRODUCT DEVELOPMENT PROJECTS: Elements of economic analysis, Step 1: Build a base-case financial model, Step 2: Sensitivity analysis, Step 3: Use sensitivity analysis to understand project trade-offs, Step 4: Consider the influence of the quantitative factors on project success.

MANAGING PRODUCT DEVELOPMENT PROJECTS: Understanding and representing tasks, Baseline project planning, Accelerating the project, Project execution, Postmortem project evaluation

TEXT BOOKS AND REFERENCES

Karl T. Ulrich, Steven D. Eppinger, Product Design and Development, McGraw-Hill International Editions, Management and Organization Series.

M.E 7.4 E-1.6 ENGINEERING TRIBOLOGY

Max. Marks for oral examinations :50

Duration of theory paper :3 hours

Total no. of modules :4

No. of questions from each module :2

Total no. of questions to be answered :5 (atleast one question from each module)

MODULE I

Introduction, Lubricants & their properties, bearing materials

Engineering Surfaces: Nature of Surfaces, Techniques of surface examination , Tribological properties of surfaces.

Contact between surfaces: Geometry of non-confirming surfaces in contact , surface & sub surface stresses, surface transactions, loading beyond the elastic limit thermal condition in sliding contacts.

MODULE –II

The friction of solids: Stick-slip effects , measurement of friction, Wear & surface damage, mechanism of wear , third bodies & wear.

Hydrostatic bearings : Analysis of thrust bearing velocity effects , Hydrostatic journal bearing, material selection.

MODULE – III

Hydrodynamic bearing: Reynolds equation in one dimension. Pad bearing Reynolds equation in two dimension , Plain journal bearing. Thermal effects in lubricated bearing

Gas bearing: Lubrication by gasses & vapors

Non-Newtonian fluids, Elasto-hydrodynamic lubrication.

MODULE – IV

Boundary lubrication & friction: The Mechanism of boundary lubrication scuffing, Test methods in boundary lubrication, solid lubricants, Tribology in metal working ,

Rolling contact & rolling element bearings: Rolling element bearing, pneumatic tyres, shakedown in rolling.

TEXT BOOK & REFERENCES:

Williams J. A. Engg. Tribology OXFORD University Press.

ME 7.5 E-2.1 CRYOGENICS

Max. Marks for oral examinations	:50
Duration of theory paper	:3 hours
Total no. of modules	:4
No. of questions from each module	:2
Total no. of questions to be answered	:5 (atleast one question from each module)

MODULE I

Introduction : - Historical review, application areas, Temperature and temperature scales. First, Second and Third laws of Thermodynamics. Properties of state. Reversible and irreversible processes. Heat engines and phase transitions. Review of solid and fluid properties at low temperatures

MODULE II

Liquefaction systems: **liquefaction** Open and closed cycles; Effect of Component efficiencies as performance; Simulation of performance of different cycles.

Cryogenic Refrigerators: Recuperative and Regenerative cycles - Effect of Irreversibility on system performance.

MODULE III

Micro-miniature and miniature cryocoolers for space and defence applications

Design criteria for equipment associated with low temperature systems: heat exchangers, compressors, expanders

MODULE IV

Separation and purification systems, commercial air separation cycles

Industrial Storage and Transfer of Cryogens – Safety and handling of cryogens, cryogenic insulation.

TEXT BOOKS AND REFERENCES

1. Barron, R.F., Cryogenic Systems, Oxford University Press, New York, 1985.
2. Timmerhaus, K.D., and Flynn, T.M., Cryogenic Process Engineering, Plenum Press, 1989.
3. Haseldon, G., Cruogenic Fundamentals, Academic Press.

M.E 7.5 E-2.2 DESIGN AND OPTIMISATION OF THERMAL SYSTEMS

Max. Marks for oral examinations :50

Duration of theory paper :3 hours

Total no. of modules :4

No. of questions from each module :2

Total no. of questions to be answered :5 (atleast one question from each module)

MODULE I

Introduction: Engineering design, Thermal systems.

Basic Considerations in Engineering Design: Formulation of the design problem, Conceptual design, Steps in the design process, Computer aided Design, Material Selection.

MODULE II

Modeling of Thermal Systems: Types of Models, Mathematical Modeling, Physical Modeling & Dimensional Analysis, Curve fitting.

MODULE III

Numerical Modeling and Simulation: Numerical Modeling, Solution procedures, Numerical Model For a system, System Simulation, Methods for Numerical Simulation.

MODULE IV

Thermal System – Design Synthesis: Initial Design, Design Strategies, Design of Systems from different application areas,

Additional Considerations for large practical system.

TEXT BOOKS AND REFERENCES

1. JALURIA Y: Design and Optimization of Thermal systems, McGraw Hill International

ME 7.5 E2.3 OPERATIONS RESEARCH

Lectures per week :(4+1)

Max. marks for theory paper :100

Max. marks for sessionals :25

Duration of paper :3 hours

Total no. of modules :4

Total no. of questions from each module :2

Total no. of questions to be answered :5(At least on question from each module with two compulsory question from any one module)

MODULE I

Operations Research: Origin and development, Feature or OR, Methodology of OR

Linear Programming Model:

Formulation of real life situations

Solutions methodology: Graphical method, simplex method.

Special cases:- Unbounded, In-feasible, Alternate and degenerate solution

Two phase method

Duality Theory

Dual simplex method

Post Optimal Analysis

Transportation Model:

Formulation

Transportation algorithm
Developing initial BFS using North West corner Rule, Least cost cell method, VAM, Row/Column Minimum Method.

Testing the solution and improving using stepping stone method and MODI method.

Resolving unbalance, degeneracy

Transshipment Model

MODULE II

Assignment Model

Formulation

Hungarian Algorithm

Tackling Unbalance

Integer Programming

Classification

Introduction to Branch and Bound method

Gomory's Cutting Plane Algorithm for pure and mixed IP

Zero One programming by Bala's Additive Algorithm

Decision Theory

Pay off table, Regret Table

Various Decision Rules

Decision Trees.

Game Theory

Two person Zero Sum game

Formulation

Pure strategy and Mixed strategy

Solution methodology: Graphical method and LP method

MODULE III

Dynamic Programming

Decomposition stages, Recursive equations

Deterministic Discrete state DP applications.

Network Models

Shortest path problem

Minimum Spanning tree problem

Maximum flow problem

Project Management with PERT/CPM

Network construction

Scheduling with CPM/PERT

Time cost trade off.

MODULE IV

Queuing Theory

General structure of system

Analysis of M/M/1 with infinite and finite population

Self service system.

B. Simulation

Introduction to simulation

Advantages & Limitations

Discrete simulation, importance of Pseudo-random numbers

Letter of simulation

Simulation of Inventory system and queuing system.

TEXT BOOKS AND REFERENCES

.Vohra N.D.: Quantitative Techniques in Management, 2nd ed. Tata McGraw Hill Publishing co.Ltd., New Delhi.

Hamdy Taha: Operation Research , an Introduction, Mac Millan Publishing co.

Hiller, Liberman: Introduction to Operations Research, McGraw HIll International.

Gillet B.E.: Operations Research Tata McGraw Hill.

Gupta, Hira: Operations Research S. Chand & Co.

Sharma S.D.: Operations Research Kedarnath & Ramnath Publications.

ME 7.5- E 2.4 AUTOMOBILE ENGINEERING

Lecture per week: 3+1

Max. marks for theory paper: 100

Max. marks for sessiona1s: 25

Max. marks for orals: 50

Total no. of questions from each module 2

Total no. of questions to be answered: 5 (At 1east one question from each module.)

MODULE I

Frames: Construction, function, loading, location of engine and drive, front wheel drive, four wheel drive and rear engine construction.

Power Plant : Principles of Engine operation, Engine parts and their functions, multiple Cylinder engines, engine troubles and repairs, cooling systems, Lubrication systems, Fuel systems.

Gear Boxes: Necessity of gear box, sliding mesh, constant mesh, synchromesh and epicyclic, overdrives, and torque converter.

Clutches: Dry friction clutches, electromagnetic clutch, clutch material, clutch trouble shooting.

MODULE II

Wheels and Tyres: of wheels tyre constructional features and characteristics.

Front axles and steering : Types of front axles and their construction, front wheel drive, wheel alignment, steering geometry, steering gear requirement, wheel balance, steering mechanisms, and characteristics, types of steering gears, power steering, steering trouble shooting.

Final Drive

Differentials, rear axles, propeller shafts, couplings

MODULE III

Suspension: various suspension systems independent front and rear suspension shock absorbers, pitching, bouncing and rolling.

Brakes: Theory of shoe brakes, shoe factors, weight transfer, brake power ratio. Hydraulic, power, air and Vacuum brakes

Electrical system:

Vehicle performance: Resistance to the motion of vehicles -air, rolling, gradient resistances power requirement for acceleration and grade ability, selection of suitable rear axle & gear ratio.

MODULE IV

Basic features two wheelers and three wheelers

Recent advances in automobiles

Electronics in automobiles, automobile air-conditioning, safety considerations, emission standards, hybrid vehicles, heavy haulage vehicles

TEXT BOOKS AND REFERENCES

1. Heitner, Automotive Mechanics

2. Newton Steads, Motor Vehicle.

3. Kirpal singh,Vol I&II ,Automobile Engineering.

4. Crouse, Automotive Mechanics.

ME 7.5 - E 2.5 INFORMATION SYSTEMS

Lectures per week	3 hours
Tutorials per week	1 hour
Practicals per week	-
Max marks for theory paper	100 marks
Max marks for sessionals	25 marks
Max marks for Oral examination	50 marks
Total number of modules	4
Total no. of questions to be answered	5 (at least one from each module)

This course is aimed at providing an understanding of the concepts of Management Information Systems, Decision Making, Information, Databases, Database Management Systems and tools and methodologies for structural analysis and design of Information Systems and other related concepts. The students are expected to acquire competence in design of MIS in various functional areas of Management through case discussions and Project assignments.

MODULE I

Introduction to Information Systems, distinction between Data and Information. Growth of hardware. Classification of hardware and software. Basics of networking topology. Basics and discussions of intranet, internet and extranet. Discussion of the domain name classification systems in Internet.

Different storage media, different file storages, different file organisations - sequential, hashed, indexed, file organisations to support multi-attribute search. Different database structures- hierarchical, network, relational and object oriented.

MODULE II

Concepts of Decision making - Simon’s model of decision making, decision making under certainty, risk and uncertainty, maximin and minimax criteria, payoff matrices, decision trees, utiles, ranking, weighing and elimination of aspects.

Concepts of systems - classification, Coupling and decoupling, Negative entropy, handling of system stress.

Concepts of Data and Information - Value of Information, value of perfect information. Data Independence - physical and logical. Data dictionary.

MODULE III

Logical and physical modelling of data. Data Flow Diagrams - context diagrams and levelling.

Tools for analysis and modelling of processes - flow charts, structured english, pseudocode,

Decision Tables, IEDT and EEDT, Karnaugh Maps.

Concept of databases graphical tools in logical modelling Entity Relationship Diagrams (ER diagrams).

Introduction to Gnu / Linux O.S., Comparison of Free and Open source software with proprietary software.

Relational Database Management Systems (RDBMS): Data Definition, Data Manipulation and Query - Structured

Query Language (SQL). Relating between tables. Comparison of popular RDBMS packages.

MODULE IV

Semi Structured problems and Decision Support Systems.

Expert Systems - basics, classification and development. Evolution of MIS in an organization - Nolan's stage model. MIS development - life cycle and prototype approach. Information System audit. Long term MIS planning.

TEXT BOOKS AND REFERENCES:

1. Management Information Systems - Gordon Davis and Margrethe Olsen Tata McGraw

Hill, New Delhi.

2. Analysis and Design of Information Systems - V. Rajaraman, Prentice Hall India Ltd.

3. Management Information Systems - Parker and Case, McGraw Hill International.

4. http://www.gnu.org - concepts of Free software and Gnu / Linux OS.

5. http://www.postgresql.org – Postgre SQL tutorial

ME 7.5-E-2.6 OBJECT ORIENTED PROGRAMMING

Lectures: 3

Tutorials: 1

Theory: 100 marks

Sessionals: 25 marks

Oral:50 marks

MODULE 1

Basic Tools of C++: Types, declarations, pointers, Arrays, structures, expressions, statements, functions, namespaces and exceptions

MODULE 2

Object Oriented programming: concept and need

Classes: member functions and data members; public, private and public functions.

Constructors, static members, self-reference, constant members, mutable, overloading

functions. destructors.

Operator overloading: operator function, binary and unary operator, friend function.

Implementation of objects like Date, Complex numbers and matrices.

MODULE 3

Inheritance: concept and needDerived classes: Member function, construction, destruction, copyingClass hierarchy, Virtual function, Abstract classes and class hierarchiesMultiple inheritance, Virtual base class, Access control

Casting: static and dynamic, Run time type information.

Templates: Defining, instantiation, equivalence

Function templates and template class

MODULE 4

Standard Template Library: design and organization, Containers and Iterators.

Standard containers: Vector, list, deque, stack ,vectors, set , map, array

Iteration: operations, categories, reverse iterations, stream iterations,, checked iterations,,

Allocator: standard operations, Standard library algorithms, Streams.

Development and design: aims and means, the process and the cycle. Testing and

management

TEXT BOOKS AND REFERENCES

1. The C++ Programming Language by Bjarne Stroustrup, Addison Wesley

ME 8.1 MECHANICAL SYSTEM DESIGN

Lectures per week: **4+1**

Max marks for theory paper: **100**

Max. marks for sessionals **25**

Max. marks for orals: **50**

Total no. of questions from each module: **2**

Total no of quest to b answered: **(At 1east one question from each module.)**

NON LINEAR OPTIMIZATION

MODULE 1

Optimization in design, need. Concept of adequate. Optimum and Robust design. Formulation of design problem. Classification of design problems, Classification of Optimization in methods, Condition of optimality, Classical techniques, Single variable optimization techniques. Unrestricted search, Dichotomous search, Interval halving method, Golden Section method. Fibonacci search method, Bisection method, Secant method, Newton Ralph a method.

MODULE 2

Multi-variables optimization techniques without constraints: Random search

method, Univariate method, Patten search method, Powell's Conjugate

Gradient method. Simplex method for NLP.

Multi-variables optimization techniques with constraints; KTC conditions,

Variable elimination method, Lagrange's method, Cutting Plane method.

Introduction to Unconventional optimization techniques like Genetic

Algorithm, Simulated Annealing, Tabu Search.

RELIABILITY BASED DESIGN

MODULE 3

Need for Reliability based design, definition of reliability and its various measure, analysis of standard failure density function like Exponential Normal. Log Normal Gamma and Weibull distribution. Various methods to improve reliability, Redundancy, calculation of system reliability for series, parallel and Complex s Allocation and Optimization of system reliability.

MODULE 4

Probabilistic design methodology: Interference theory, calculation of reliability of with stress and strength having exponential, normal, lognormal, gamma and weibull distribution.

Design of mechanical components.

Concepts of maintainability, Availibility, serviceability.

TEXT BOOKS AND REFERENCES

1. Kalyanmoi Deb: Optimisation for engineering Design Prentice Hall India.

2. Ashok Belegundi, T Chandrauptala: Optimisation concepts and applications in engineering, Pearson education.

3. Rao S.S.: Optimisation theory and applications. Wiley Estern Ltd.

4. Kapoor K.C: Reliability in design.

ME 8.2 POWER PLANT ENGINEERING

Lectures per week	:4
Tutorials per week	:1
Max. marks for the theory paper	:100
Max. marks for sessional	:25
Duration of theory paper	:3 hours
Total no. of modules	:4
No. of questions from each module	:2

Total no. of questions to be answered :5 (atleast one question from each module)

MODULE – I

Introduction: Economics of power generation, load duration curve, location of power plant, power plant economics, Indian-Energy scenario, Introduction to non-conventional power plants, New energy technologies, renewable energy sources, Prospectus of renewable energy sources, Conventional versus non-conventional power generation.

Rankine Cycle: Introduction, Modified Rankine cycle with reheating , regeneration, efficiencies in steam power plant.

MODULE – II

Thermal Power Plant: Layout, and components, steam generators, mounting and accessories, boiler calculations, combustion systems-Gate fired, pulverised coal firing system, cyclone furnace, coal gasifiers.

Nuclear Power Plants: Introduction, Nuclear Fission, Nuclear Fusion, General components of Nuclear reactor, types of reactor, Pressurized water reactor Boling Water Reactor, Gas cooled reactor, Heavy water reactor, Nuclear Power stations in India, Comparison of nuclear power plant with thermal power plant, Nuclear waste and disposal.

MODULE –III

Introduction to Non conventional Power Plants: Wind power plant (Basic components of wind energy conversion system, site selection for wind turbine power plants), Geothermal power plant, Solar energy: solar thermal power generation, Solar cells, Tidal power plants, Ocean thermal energy conversion. Energy from Bio-mass -Thermal energy from biomass Thermal gasification of biomass, Bio-gas generation.

Wind Power Plants: Types, power generation & simple calculations

Geothermal Power plants: Types , Simple calculations dealing with power generation.

Analysis of Biomass Energy Conversion.

Solar Power Plants, Simple problems on Solar Power Plant, and Photovoltaic cells.

MODULE –IV

Introduction to Gas Turbine Power Plant : Bryton Cycle, Modified Bryton Cycle , components of gas turbine power plant, Gas turbine fuels and environmental impact, layout and components of diesel power plants..

Environmental Aspects of Energy: Introduction, Pollution from use of energy, Particulate of matter, Classification of pollutants based on health hazards, Green house effect and global warming, Mechanics of pollutants generation , Control of $S0_2$, Control of CO_2, Control of NO_2, Emission of Carbon monoxide and Nox, Acid rain.

TEXT BOOKS AND REFERENCES:

1. Nag.P.K.: Power Plant Engineering, TMH
2. Domkundwar V.S.: Power Plant Engineering. Dhanpat Rai & Sons
3. Rao G.D.: Non Conventional Energy Sources. Dhanpat Rai & Sons
4. Sukhatme S.P.: Solar Energy, TMH

M.E 8.3 E 3.1 FINITE ELEMENT METHOD

Lectures per week: **4+1**

Max. marks for theory paper; **100**

Max. marks for sessionals.: **25**

Max. marks for orals: **50**

Total no. of questions from each module: **2**

Total no. of questions to be answered: **5 (At least one question from each module.)**

MODULE I

1.1. Introduction Brief history of the development of the subject of F'EM, Over view of the method, range of applications.

11 Basic Equations from linear theory of elasticity: Stress and strain tensors and their properties, (3eneralised Hooke's law, Eh constants for isotropic m Equilibrium equation Compatibility equations, Cauchy's equations. Plane stress and plane strain problems. A problem of theory of elasticity, Bi-harmonic equation. Airy's stress function

1.3 Energy Methods to sob problems in Mechanics of solids: Strain energy of a point under the given state of stress) Maxi reciprocal theorem, Castigliano's theorems, Virtual work principle, Rayleigh-Ritz method , Applications.

MODULE II

2.1 Basic Equations from Fluid Mechanics

21 Basic Equations from Heat Transfer

23 Variational Calculus: Introduction, Functional and it's minima

2.4 Analysis of Truss by matrix methods,

MODULE III

3.1 Mathematical Approach.: Variational approach, FEM and Ritz method, element equations from Variational Principle, Finding variational principles for the problem, Methods of Weighted re Gelarkin Collocation techniques. Least square methods to solve the differential equations.

3.2 Elements and interpolation functions stiffness, matrix and the equilibrium equations: Formulation based on generalised co-ordinates, Convergence requirements. Natural Co-ordinates. Numerical integration, Newton-Cotes and Gauss-Legendre quadrature.

33 Assembly of global stiffness matrix and inserting boundary conditions and solution of linear system of equation Gauss elimination Gauss-Siedel, Cholesky's decomposition, Crout's factorisalion to solve the linear system of equation, Nature of the stiffness matrix.

MODULE IV

4.1 Application of FFJM to Problems: Structural dynamics, General field problems such as torsion, heat conduction, irrotational flow.

4.2 Subject project (To be presented at the time of oral exam.): Formulation and development of FEM code to solve problem from the topics such as stress analysis, Dynamic Heat Transfer etc. Exposure to FEM software such as ANSYS.

TEXT BOOKS AND REFERENCES:

1. Reddy J.N., 'An Introduction to the Finite Element Method', McGraw-Hill Company.
2. Belegundu Chandraupatla, Introduction to Finite Element, in Engineering, Prentice Hall of India Pvt. Ltd New-Delhi.
3. Desai and Abel, FEM
4. Bathe K.J., Finite Element Procedure Prentice-Hall of India Pvt. New-Delhi
5. Krishnamoorthy.: Finite Element Analysis,

M.E.8.2 E. 3.2 ROBOTICS

Lectures per week: 4+1 Max marks for theory paper: 100 Max. marks for sessionals: 25 Max. marks for orals: 50 Total no. of questions from each module: 2 Total no. of question to be answered: 5 (At least one question 1n each module.)

MODULE I

1.**Planar Mechanisms**: Advanced synthesis of planar mechanisms for ISP, MSP and FSP, Burmester theories and analytical techniques Applications:

2**. Mechanism Dynamics**: Newtonian and Lagrangian techniques Energy methods, Spatial mechanisms. Axodes, kinematics of open and closed loop mechanisms.

MODULE II

3. **Basic Concepts in robotics**: Automation and robotics, robot anatomy, basic structure of robots, resolution, accuracy and repeatability.

4. **Classification and structure of robotic systems**: Point to point and continuous path systems, control 1oo of robotic systems, the manipulators, the wrist motions and grippers.

5**. Drives arid Control systems :** Hydraulic systems DC servo motors h control systems concepts and models, control system analysis, robot activation and feed hack components, positional and velocity sensors, actuators, power transmission systems, robot joint control design

MODULE III

6. **Robot arm kinematics and dynamics**: The direct kinematics problem, the inverse kinematic solution, Langrange-Euler formation, generalized D'Alembert equations of motion, Denavit Hartenherg convention and its applications.

7. **Sensors in Robotics**: Tactile sensors, proximity and range sc force and torque sensors, uses of sensors in robotics.

MODULE IV

8 **Robot Programming**: Methods of robot pro lead through programming methods, a robot program as a path in space, motion interpolation, WAIT, SIGNAL and DELAY commands., branching capabilities and limitations of lead through

methods.

9. **Robot Language** :The textual robot languages, generations of robot programming languages robot languages structure, constants, variables and other data objects, Motion commands end effectors and sensor commands computations and operations, programming control and subroutines, communications and data processing, monitor mode commands, Introduction to artificial intelligence.

10. **Robot applications in manufacturing**: Material transfer and machine loading/unloading, processing operations assembly and inspection, concept of safety in robotics.

TEXT BOOKS AND REFERENCES:

1. Yoram Korean :Robotics for engineers, , McGrew Hill Co.
2. M.P.Groover, M.Weiss, R.N.Nagel,N.G.Odrey Industrial Robotics Technology, programming and Applications,.
3. K.S.Fu, R.C.Gonzalex ,C.S.G.Lee: Robotics Control Sensing,Vision and Intelligence, ,McGrew hill Book co.
4. Hartenberg and Denavit,: Kinematics and Synthesis of linkages, McGrew HillBook Co.
5. A.S.hall : Kinematics and Linkage Design, , Prentice Hall.
6. J.Hirchhorn : Kinematics and Dynamics of Machinary, , McGrew HillBook Co.

ME 8.3-E 3. 3 MATERIALS MANAGEMENT

Lecture per week: 3+1

Max. marks for theory paper: 100

Max. marks for sessiona1s: 25

Max. marks for orals: 50

Total no. of questions from each module 2

Total no. of questions to be answered: 5 (At 1east one question from each module.)

MODULE I

Importance, objective & functions of materia1s management; integrated materials managements approach, organization of materials management materials planning & budgeting, purchasing, Import - export policies, source selection.

MODULE II

Make. or buy decisions) contract management & legal aspects, cost control various materials cost reduction techniques, stores management, spare parts management, warehousing & packaging, obsolete, surplus & scrap management, inspection & quality control, materials handling.

MODULE III

Forecasting & market analysis, forecasting techniques, fixed order size systems (Deterministic & probabilistic) models, service levels, fixed order interval systems.

MODULE IV

MRP, In-process inventory, inventory management, inventory control systems, inventory evaluation computerization & performance evaluation economic & financial aspects, information system in material management, concept & importance of chain management

TEXT BOOKS AND REFERENCES

1. P. Gopalkrishnan- *Purchasing And Materials Management* -TMH

2. Ammer Dean .S. - Materials Management - Richard D Irwin, Illinois,

3. Bailey Peter & Farmer David Managing Materials in Inventory Gower Press, London

4. Richard J. Tersine – Principles of inventory and Material management- North-Holland (Elsevier Science publishing Co.Icn.)

5. Gary J. Zenz - Purchasing and The management Wiley & sons.

6. Sunil Chopra & Peter M ind1- Supply chain management - strategy Planning & Operation - Person Education Asia.

M.E 8.3 E-3.4 AUTOMATIC CONTROL SYSTEMS

Max. Marks for oral examinations :50

Total no. of modules :4

No. of questions from each module :2

Total no. of questions to be answered :5 (atleast one question from each module)

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MODULE I

Feed back control systems: Historical development, systems representation, modern control systems

Representation of control components : Operational notations, mechanical components, electrical components , series & parallel law- analogies, scale factors. Representation of Thermal systems and fluid systems.

Representation of control systems: Linearisation of non linear functions, Linearisation of operating curves, hydraulic systems , pneumatic systems, DC motors ac motors, Block-diagram algebra, speed control systems.

MODULE II

Steady state operations: Steady stat analysis, equilibrium, proportional control systems, integral control systems & their combination.

Laplace transforms: Classical methods , Laplace transform method , transforms properties, initial conditions, general procedures, convolution integral , error coefficients.

MODULE III

Transient response: Inverse transformations, complex conjugate zeros, damping ratio & natural frequency, computer solution, transient response specification, general form of transient response , response to an external disturbance, Routh's stability criterion.

The Root-Locus Method: Significance of root loci, construction of loci, general procedure, loci equations , variations of parameters,

MODULE IV

System representation, signal flow graph, solution of state- space equations, transfer functions, multi variable system

Frequency response method: Logarithmic representation , Evaluation of gain, polar plots, correlation between transient & frequency response,

TEXT BOOKS & REFERENCES:

1. Benjamic C Kuo –Automatic Control Systems, PHI.
2. Raven F. H. - Automatic Control Systems, Engineering MGH.

Ogata Modern Control Engineering, PHI.

M.E 8.3 E-3.5 COMPUTATIONAL FLUID DYNAMICS

Total no. of modules :4

No. of questions from each module :2

Total no. of questions to be answered :5 (atleast one question from each module)

MODULE I

Introduction: Philosophy of CFD , CFD as a research tool, CFD as a design tool, Impact of CFD.

The Governing Equations of Fluid Dynamics: Models of flow, Substantial Derivative , Divergence of the velocity, Continuity equation , Momentum equation, Energy equation, Physical boundary conditions.

MODULE II

Mathematical behavior of partially differential equations: Quasi linear differential equations , Eigen Value Method, General behavior of different classes of partial differential equations.

Basic Aspects of Discretization: Introduction to finite differences, Explicit and Implicit approaches, Errors and analysis of stability.

MODULE III

Grids with appropriate transformation: General transformation of equations , Matrices and Jacobians, Form of governing equations, Compressed grids, Boundary fitted co-ordinate systems, adaptive grids, modern developments in grid generation and in finite – volume mesh.

MODULE IV

Computational Fluid Dynamic techniques: Comments on Viscous flow, Conservation form and space marching. Relaxation techniques and its use with low speed inviscid flow, Aspects of numerical dissipation and dispersion, Alternating direction Implicit, Pressure correction technique, Computer graphic techniques used in CFD.

TEXT BOOK AND REFERENCES:

1. JOHN D. ANDERSON: Computational fluid dynamics, McGraw Hill International.

ME 8.3-E.3.6 MAINTENANCE MANAGEMENT

Lectures per week **4+1**

Max. marks for theory paper: **100**

Max marks for sessionals: **25**

Max. marks for orals: **50**

Total no. of questions from each module: **2**

Total no. of questions to be answered: **5 (At least one question from each module)**

MODULE I

Necessity of maintenance management, Objectives, importance & functions of maintenance, Type of maintenance, Condition based maintenance. Economic aspects of in maintenance, Organization of maintenance department, Categories of maintenance! Selective control, Evaluation of maintenance performance, TPM, Management techniques used in plant in maintenance, inspection & Lubrication, Computers in maintenance, Maintenance budget. New trends in maintenance.

MODULE II

Fundamental of reliability, Failure distribution, Reliability measures. Constant failure rate model (exponential), Time dependent failure models (normal, lognormal weibull), Reliability of systems (series, parallel, complex), Stand by system.

MODULE III

State dependent systems, Reliability allocation, Fault tree analysis, in maintainability, analysis of downtime, repair time distribution, Reliability under preventive maintenance, State dependent system with repair, Standby system with repair,

MODULE IV

Replacement policies, Maintenance requirements, Maintainability design methods, Maintainability prediction & demonstration, Maintainability allocation.

Availability, it's concepts & definitions, Availability in odds, System availability, Standby system availability, Steady state availability.

M.E 8.3 E-3.7 PRECISION ENGINEERING

Lectures per week :4

Tutorials per week :1

Max. marks for the theory paper :100

Max. marks for sessional :25

Max. Marks for oral examinations :50

Duration of theory paper :3 hours

Total no. of modules :4

No. of questions from each module :2

Total no. of questions to be answered :5 (atleast one question from each module)

MODULE-I

Design of Precision Machines and Instruments: Basics in the design of precision machines and instruments, Mechanical design Vs Precision Engineering design. Design process, Sources of error in Instruments, Error compensation, Signal flow diagram and four-quadrant diagram for instruments, precision design considerations in Machine frames, sliding and rolling element bearings

MODULE-II

Precision Manufacturing: Review of Non-conventional production techniques- spark erosion; electrochemical operation; ultrasonic and abrasive. Introduction to Micro-machining and Nano-machining, Precision manufacturing processes viz. Extrude honing; Magnetic abrasive machining; Water jet machining, Electrochemical Grinding; Etching and Joining techniques for electronic components, Sensors and Controls in manufacturing.

MODULE-III

Precision Metrology: Analog and digital measuring techniques, Laser interferometry, Applications of machine vision in measurements, Coordinate measuring machines(CMM) Abbe's principle, Types of CMM, Components of CMM, measurements on CMM.

MODULE-IV

Micro Engineering: Introduction to Micro electro mechanical systems (MEMS), Micro system technology(MST), Design of Microsystems, Micro sensors and micro actuators, Piezo electric actuators, magnetostrictive actuators, shape memory alloys (SMA).

TEXT BOOKS &REFERENCES:

1. Alexander H.: Slocum, Precision Machine Design, Prentice Hall, 1992
2. Davidson A.: Handbook of Precision Engineering
3. Raman R.: Elements of Precision Engineering

M.E 8.3 E - 3.8 FLUID POWER CONTROL

Lectures per week :4

Tutorials per week :1

Max. marks for the theory paper :100

Max. marks for sessional :25

Max. Marks for oral examinations :50

Duration of theory paper :3 hours

Total no. of modules :4

No. of questions from each module :2

Total no. of questions to be answered :5 (atleast one question from each module)

MODULE I

Introduction: Fluid power, Power hydraulics, Comparison of Fluid Power system with Mechanical and electrical systems, Components of fluid power system, Types of fluid power control system.

Fluid hydraulics: Properties of hydraulic fluids, Types of fluids, Fire resistant fluids, foam resistant fluid, Pascal's law and its application.

Distribution system: Introduction, Conductor sizing for flow rate requirements, pressure rating of conductors, steel pipes, steel tubing, plastic tubing, flexible hoses, quick disconnect couplings.

MODULE II

Hydraulic pumps: Classification of pumps, Gear pumps, piston pumps, pump performance, pump selection, pump performance ratings.

Fluid power actuators: Linear hydraulic actuators, Mechanics of hydraulic cylinders, loading. Limited rotation hydraulic actuators, Gear motors, vane motors, Piston motors, Hydraulic motor transmission, hydrostatic transmission, Electro-hydraulic stepping motors, low- speed high- torque motors, hydraulic motors, Performance rating of motors.

Control components in hydraulics: Direction control valves, Pressure control valves, flow control valves, servo valves, cartridge valves, hydraulic flues, pressure and temperature switches, shock absorbers.

MODULE III

Hydraulic circuit design: Control of single acting and double acting hydraulic cylinder, Regenerative circuit, design of hydraulic circuit for specific application, hydraulic cylinder sequencing circuit, hydrostatic transmission system, accumulators and accumulators and accumulator circuits, Mechanical-hydraulic servo system.

Fluid logic control systems: Moving past logic (MPL) control systems, MPL control of fluid power circuits, Principles of fluidic logic control, Basic fluidic devices, fluidic sensors, fluidic control of fluid power systems. Introduction to Boolean algebra.

Electrical controls for fluid power circuits : Electrical components , control of cylinder using circuit switches , dual cylinder using circuit switches of regenerative circuits, counting timing and reciprocation of hydraulic cylinder, programmable logic controllers (PLC's)

MODULE IV

Pneumatics : properties of air, air preparation, air control valves, pneumatic activators.

Pneumatic circuits: Circuit design considerations, pressure losses in pipelines , basic pneumatic circuits, pneumatic vacuum system , Accumulator system analysis.

Fluid power maintenance: Sealing devices, reservoir systems, Filters & strainers, Trouble shooting of fluid power circuits, safety considerations.

TEXT BOOKS & REFERENCES:

1. Anthony Esposito : Fluid Power with Applications, Prentice Hall
2. Peter Rohner : Fluid Power Logic Circuit Design, McMillian Press

M.E 8.3 E-3.9 MACHINE VISION AND SENSORS IN MANUFACTURING

Lectures per week :4

Tutorials per week :1

Max. marks for the theory paper :100

Max. marks for sessional :25

Max. Marks for oral examinations :50

Duration of theory paper :3 hours

Total no. of modules :4

No. of questions from each module :2

Total no. of questions to be answered :5 (atleast one question from each module)

MODULE-I

Introduction to machine vision: Machine Vision System Component, Cameras, Histogram Manipulations, Basics of image processing, Filtering, Sampling, Image Enhancements, Edge Detection, Filtering, Thresholding, edge detection, feature extraction, image transforms.

MODULE-II

Basic pattern classification techniques: Artificial Neural Networks for pattern recognition, Applications of machine vision- quality inspection, Study of surface finish, Sorting and counting of objects. Tool Wear measurement, Robot applications.

MODULE-III

Introduction to automated manufacturing: Study of wide range of sensors currently employed in modern industrial environments viz. laser, optical, inductive, piezo-electric and ultrasonic.

MODULE-IV

Role of sensors in Computer Integrated Manufacturing (CIM): Design of CIM with sensors and control system, Advanced sensor technology in production manufacturing applications, Sensors in Flexible Manufacturing systems.

TEXT BOOKS &REFERENCES

1. Jain, R., Kasturi R., and Schunck B.G., Machine Vision, McGraw-Hill.
2. Ramesh C John , Introduction to machine vision ,Tata Mc Graw Hill.
3. Freeman, H., Machine Vision for Inspection and Measurement, Academic Press, Boston.
4. Soloman, Sabrie, Sensors and Control Systems in Manufacturing, McGraw-Hill Inc.

E 3.10 ADVANCED METAL FORMING (ELECTIVE)

Lectures per week	4+1 hours
Max marks for theory paper	100 marks
Max marks for sessionals	25 marks
Max marks for Oral	50 marks
Total number of question form each module	2
Total no. of questions to be answered	5 (at least one from each module)

MODULE - I

Introduction to metal forming Process and it usefulness in the industry. Introduction to the theory to plasticity. Stress and its components, Stress — Strain and Stress-Strain analysis, Plane Strain and Plane-Stress analysis and its application. Axisym metric Compression.

MODULE - II

Introduction to metal forming Processes. Cold and Hot forming.

Rolling: Layout of tropical rolling mills, Sequence of operations, time cycles, Productivity, Economical in dices. Defect in rolling, Main parameters in rolling, Rolling mills equipments.

MODULE III

Forging: Forging operations are the technology of hammer forging presses. Inspection and tolerances in forging. Forging equipments.

MODULE - IV

Extrusion : Parameters in hot and cold extrusion, metal flow, selection of presses extruction equipment.

Wire Drawing: Principals and parameters, Technology of' various operations.

TEXT BOOKS &REFERENCES

1. Rawe G. W, introduction to the principle of Metal Working, Edwardd Arnold Publishers, London.

2. Avitzur B, Metal forming Processor and analysis, McGraw Hill, New York, 1958.

3. Johnson W and Mellor P b, Plasticity for Mechanical engineers, Van Nostrant, London, 1972.

ME 8.3-E-3.11 System Simulation

Lectures : 4 hours

Tutorials: 1hour

Theory: l00marks

Sessionals: 25 marks

Oral: 50 marks

MODULE I

Definition, need, modeling concepts. Types of system studies. Random numbers: Need, Importance and desirable properties Generation of random numbers with Bernoulli's Trial, Binomial, Geometric, Pascal, Exponential, Uniform, Normal, Erlang distribution.
Next event approach, Fixed time increment approach and Process oriented approach for system simulation.

MODULE II.

Simulation of inventory system, queuing system, project network Application of simulation for solving deterministic model like evaluation of definite integral, finding value of root, area of circle.

Application of simulation in simple simulation of simple games.

MODULE III

GPSS: Introduction to various block statements and control statements: generate, advance, seize, release, queue, depart, enter, depart, transfer, mark, tabulate, terminate, savevalue, priority, assign, gate, logic, function, start, reset, job, simulate

Various Standard Numeric attributes. Modeling of various systems using GPSS.

MODULE IV

Testing the random numbers for various distributions. Estimation of parameters Analysis of simulation output: determining the length of simulation, effect of initial bias, effect of auto-correlation, Variance Reduction techniques. Introduction to continuous simulation and CSMP

TEXT BOOKS AND REFERENCES:

1 . Geoffrey Gorden :System Simulation , , Prentice Hall of India, New Delhi.

2. Fred J. Maryanski : Digital computer simulation, , CBS Publishers and Distributors

3. Narsingh Deo :Digital Simulation , PHT

ME 8.3 - E 3.12 Supply Chain Management

Supply Chain Management (SCM) is about the management of material and information flows in multi-stage production distribution networks. Intense and fierce global competition and advances in information Technology have

motivated companies to take initiatives to reduce costs and increase responsiveness to changes in the marketplace. This course will provide students with the knowledge and tools necessary to develop, implement and sustain strategies for managing supply chains.

Lectures per week 4hours

Tutorials per week 1 hour

Practicals per week

Max marks for theory paper 100 marks

Max marks for sessionals 25 marks

Max marks for Oral examination 50 marks

Total number of modules 4

Total no. of questions to be answered 5 (at least one from each module)

MODULE I.

Introduction to Supply Chain Management (SCM), Classification of Inventory Systems. Basics of SCM,. Managing Supply Chain inventory - pitfalls and opportunities. Planning demand and supply in Supply Chains, Managing economy of scale and uncertainty in Supply Chains, Lead times, Understanding impact of uncertainty of demand and supply on supply chains.

MODULEII

Supply Chain design appropriate for mass customisafion. Design for localisation and Design for customisation. Managing transportation in Supply Chains, links between transportation and inventory costs in the design of transportation networks, Issues in facility location in Supply Chains.

MODULE III

Network Design in Supply Chains, framework for facility location decisions. Operational issues in Supply Chains, effect of demand and leadtime uncertainty on the total costs of the Supply Chains. Playing the Beer Distribution game of the Supply Chain of the retailer, distributor, wholesaler and the manufacturer of a beer distribution Supply Chain. Information Distortion / Bullwhip Effect in Supply Chains. Different performance measures of Supply Chains.

MODULE IV

Information technology and E-business in Supply Chain Management. Impact on sourcing of raw materials, distribution ctc.

Studying and analysing the supply chains of local industries like mining, tourism etc. and identifying the strong and weak points of each. Case studies of supply chains of the UP DeskJet, Dell Computers or any other major companies and one or two local industries.

TEXT BOOKS &REFERENCES:

1. Sunil Chopra, Peter Meindl,: Supply Chain Management - Strategy, Planning and Operations, Pearson Education Asia.

2. Simchi-Levi, Kaminsky, Simchi-Levi :Designing and Managing the Supply Chain, ,

McGraw Hill International edition.

3. Douglas Lambert, James Stock and Lisa Ellram, Irwin :Logistics Management -

McGraw Hill International edition.

4. G. Raghuram and N.Rangaraj (Ed.): Logistics and Supply Chain Management - Cases and Concepts, McMillan India Ltd, New Delhi.

5. Harvey M. Wagner: Principles of Operations Research - with applications to managerial decisions, Prentice Hall India Ltd., New Delhi.
