

Barkatullah University Institute of Technology, B.U., Bhopal

ENGINEERING MATHEMATICS (M-101)

Unit I

Maclaurin's and Taylor theorem, Roll's theorem, mean value theorem, application to rates small increments approximations and errors.

Unit II

Tangents and sub tangents normal and subnormal differential and coefficient of arc length in Cartesian. Polar and parametric coordinates curvature definition formula in intrinsic Cartesian and polar coordinates, radius of curvature and center of curvature.

Unit III

Asymptotes, envelopes, evolutes, Indeterminate forms partial differentiation, Euler's theorem application of partial differentiation in approximately and errors of Taylor's series of two variables maxima and minima of functions of one and two variables.

Unit IV

Definite integrals and their properties Integral as the limit of a sum application to summation of series Area, length of curves volume and surface of solids of revolutions.

Unit V

Beta and gamma function multiple integral, double integral and triple integral application to problem in area, volume center of gravity moment of inertia and center of pressure.

Books:

Higher engineering mathematics by B.S. Garewal

Text book of Engg. Mathematics by Shrivastava and Dhawan.

Engineering mathematics by chandrika prasad

Engineering Mathematics Volume I by Ashok Ganguly, R.S Chandel Ram Prasad & Son.

Advanced Engineering Mathematics by H.K.Dass

ENGINEERING CHEMISTRY (M-102)

UNIT-I

WATER

Sources & impurities, Alkalinity & pH Hardness of water, Degree of hardness, Dissolved oxygen and their determination, standards of water for drinking purposes, purification of water for domestic use, methods of sterilization. Methods of water softening, Lime Soda process, Zeolite & ion exchange resin processes, Sludge & scale formation causes, effects and prevention, Caustic embrittlement. priming, foaming, boiler Corrosion and deaeration, simple numerical problems on water softening and water analysis.

UNIT – II

FUELS

Classification of fuels and their Comparison. Calorific values, fuel resources in India, analysis of coal, clinker formation, pulverized coal as fuel, methods of manufacture of coke and its uses, petroleum distillation, Cracking, Cracked gasoline, Varieties of fuel oils, their properties and uses, knocking, anti knocking Compound!, Problems based on combustion, Air and oxygen calculation.

UNIT-III

MATERIALS:

Composition engineering properties and uses of alloys of Al, Fe, Ni, Cu and Zn.

Refractories: Definition, Classification. Properties and uses, Types of Cements, manufacture, properties and uses of Portland cement, Chemistry of setting and hardening of Cement.

Polymers: Polymerization, different types of Polymers, plastics their preparation, engineering properties and uses, Silicones, Natural and Synthetic rubbers, their properties and uses, Adhesives.

UNIT – IV

LUBRICANTS

Types and classification of lubricants, mechanism of lubrication. Physical and Chemical properties, testing of lubricants, Types of greases, application. of lubricants.

Corrosion and Corrosion reactions, types and theories of Corrosion, factors affecting the rate of Corrosion, protection of metals, Iron Corrosion by Various measures, important Inorganic metallic and non-metallic Coatings and organic-Coatings.

UNIT-V

BASIC ENVIRONMENTAL CHEMISTRY

A. Pollution: Causes of pollution, Air pollution and its types, Green House

Effect importance of ozone layer, control of air pollutions, water pollution sources, methods of prevention, soil or land pollution and its control radioactive pollution and its control.

B. Instrumental techniques in chemical analysis. Introduction, Infrared Ultra violet, Nuclear magnetic, Resonance, Spectrophotometry, Chromatography, Gas- Chromatography, Colorimetry, Lambert's Beer's law.

Books:

1. Engineering chemistry by Jain & Jain
2. Engineering chemistry by S S Dara

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3. Engineering chemistry by B K Sharma
4. Applied chemistry for engineers by E.S. Gyngell.
5. Chemistry of engineering materials by Robert B. Leighu- Mcgraw Hill Book Co.

ENGINEERING CHEMISTRY (M-102)

LIST OF EXPERIMENTS

I. Qualitative Analysis:

(Preparation of standard solution)

1. Oxidation-reduction titration. Estimation of percentages of iron using Potassium dichromate, internal and external indicator methods.
2. Iodometric Estimation of
 - (i) Copper Sulphate
 - (ii) Potassium dichromate.
3. Water Analysis:
 - a. Determination of carbonate and bicarbonates in water.
 - b. Determination of total hardness in water using soap or EDTA Titrations.
 - (iii) To determine the chloride contents in water.

II. FUELS:

- (i) Determination of percentage of moisture on coal.
- (ii) Determination of percentage of Ash in coal or coke.
- (iii) Determination of percentage of Volatile matter in coal.
- (iv) Determination of carbon residue in lubricating oils by Conrad-son Apparatus.

III. LUBRICANT TESTING:

- (i) Determination of Viscosity index of lubricating oils.
 - (a) Red Wood Viscometer No. 1.
 - (b) Red Wood Viscometer No. 2.

BOOKS:-

1. A text book on experiments and calculations in Engineering Chemistry-S.S. Dara.
2. Lab manual –S.Amlathe.

COMMUNICATION SKILLS (M-103)

Unit I

Languages as a skill of communication linguistic techniques, modern usage & style comprehension skills, English phonetic symbols, Oral presentation, audition.

Unit II

Application of linguistic ability, writing of definitions of engineering terms, objects, processes and principles.

Unit III

Letter writing, Application, Enquiry, calling Quotations, Tenders, Orders & Complaint, Company structure and systems.

Unit IV

Precise writing, noting and drafting, technical descriptions of simple engineering objects & processes, slogan writing, advertising, book review.

Unit V

Writing technical reports of the type of observation – report, survey report , report of trouble, laboratory report and project report on the subject of engineering, debates, speech, discussion.

Books

1. Business correspondence & Report writing- by R. C. Sharma & Krishna Mohan
2. Living English Structure – By W. Stannard Allen, Longmans.
3. Students Grammar- By Dev Willys Collins (Harper)
4. Spoken English For India – R K Bansal & Harrison (Orient Longman)

Engineering Mechanics (M-104)

Unit – I

Coplanar forces, free body diagram, varignon's theorem. Condition of equilibrium force polygon and funicular polygon of forces. Equivalent force system. Analysis of forces in the members of perfect trusses. Method of joints, Methods of sections.

Unit – II

Centroid, moment of inertia of plane areas, perpendicular axis and parallel axis theorems, product of inertia. Radius of gyration principal axes and principal of inertia. Mass moment of inertia.

Unit – III

Friction on inclined plane, screw jock, Ladder and wedge friction. Transmission of power through belt and rope. Gear trains, simple compound and epicyclic.

Unit – IV

Kinematics and kinetics of particle, conservation of momentum and impulse, D'Alembert's principle, work energy principle, collision of elastic bodies. Rigid Body dynamics kinematics and kinetics of rigid body, flywheel.

Unit – V

Shear force and bending moment diagram in cantilever and simply supported beams subject to concentrated and uniformly distributed loads and couples, over hanging beams point of contra-flexure, Relation ship between load, shear force and bending moment.

Suggested Text Book and References

1. Applied Mechanics by S.B. Junnarkar – S. Chand Publication
2. Engg. Mechanics by R.K. Rajput. – Dhanpat Rai Publication
3. Engineering Mechanics by Singer. – AWL Publication
4. Applied Mechanics by I.B. Prasad. - Dhanpat Rai Publication
5. Mechanics of Engg. (Statics) by Bear and Johnson. – TMH Publication
6. Engineering Mechanics by T J Prabhu – Scitech Publication

ENGINEERING MECHANICS LABORATORY EXPERIMENT (M 104)

1. To verify the law of polygon of forces and the law of funicular polygon of forces by using force table.
2. To verify principal of lever by using Bell Crank lever.
3. To determine the Centroid of plane areas experimentally and verify analytically.
4. To find the coefficient of friction between glass wood and glass brass by using inclined plane.
5. To find the moment of inertia of flywheel by falling weight method.
6. To find the reactions in parallel force apparatus experimentally and analytically.
7. To determine bending moment at the centre of the beam for various load position and verify analytically.
8. To verify law of triangle of forces by using Jib-Crane model.
9. To find coefficient of friction between belt & pulley and rope & pulley.
10. To find velocity ratio, efficiency, mechanical Advantage and law of machine for a screw Jack.

BASIC CIVIL ENGINEERING (M-106)

Unit – I

Engineering Materials

Stones, Bricks, Mortar and concrete – Types, properties and uses, proportioning mixing curing and tests with reference to RCC.

Unit – II

Building Construction

Foundation – Types of foundation, investigations of soils. Bearing capacity of soils, foundation failure and remedial measure. Masonry types and construction of masonry walls.

Unit – III

Principles of building planning, orientation floors, roofs, doors windows, lintels and staircases types and suitability, plastering and pointing dampness and its protection.

Unit – IV

Surveying

General principles of surveying – chain survey, compass survey, plane table surveying – principles accessories and various methods.

Unit – V

Leveling: Types of Leveling and various methods Theodolite Introduction.

Suggested Text books and references

1. Engineering Materials by surendra singh.
2. Building construction by Sushil kumar
3. Surveying vol-I by B.C. Punmia
4. Surveying vol – I by T.P. kanetkar.

BASIC CIVIL ENGINEERING (M-106)

LIST OF EXPERIMENTS

1. To find out the area of closed field through cross staff survey.
2. To perform traverse survey by using surveyor's compass.
3. To perform traverse survey by using Prismatic compass.
4. To perform leveling by Height of instrument method.
5. To perform leveling by Rise and Fall method.
6. To plot a closed traverse by plane table survey.
7. Study of Theodolite.

Engineering Drawing (M-105)

UNIT I

Scales: representative fraction, plain scales, diagonal scale, scale of chords, conic section ; construction of ellipse, parabola and hyperbola by different methods, normal and tangent

UNIT II

Special curves cycloidal , epicycloids, hypocycloid, involutes, Archimedean spiral.

UNIT III

Types of projection, orthographic, first angle, third angle projection, projection of point, lines. True inclination and true length of straight lines, traces of straight lines. Projections of planes and traces of planes, auxiliary planes.

UNIT V

Orthographic projection of cylinder, cone, pyramid, prism in simple positions

UNIT V

Screw threads: various parts of a screw thread, forms of threads,
Screwed fastenings: temporary and permanent fastening, hexagonal nut and its standards, hexagonal headed bolts and its standard dimensions.

Reference books:

Engineering Drawing : N.D. Bhatt

Engineering Drawing : by Venugopal

Engineering Drawing : by Gujral and Shende

Engineering Drawing : by P.S. Gill

Machine Drawing : by N.D. Bhatt and V.M. panchal.

A text book of machine drawing: by Lakshminarayanan and Mathur

Machine Drawing : By G.R. Nagpal

WORKSHOP PRACTICE (M-107)

1. FITTING SHOP & ADVANCE FITTING

- a) Metal bench work
- b) Measuring instruments, engineers steel rule, surface gauges calliper, Hermaphrodite caliper (Jenny Calliper), dividers, height gauges; feeler gauges, try square and micrometer.
- c) Use, care and maintenance of hand tools such as hammers, cold chisel of different types, center punch, hack-saw, dot punch, drift, different types of files, file cuts, files grades. Use of surface gauge, surface gauges, types of drills, taps and dies for drilling tapping and screw threads.
- d) Fitting operations: Chipping, Filing, Drilling, and Tapping.

Two jobs to cover above course such as:

- 1) Preparation of job piece by making use of filing, sawing, and chipping operation.
- 2) Job having combined practice of drilling and tapping.
- 3) Job having combined practice of drilling and reaming.

2. BLACKSMITHY SHOP

- a) Smithy maintenance, control of fire and fuel used in smithy shop.
- b) Uses of various smithy tools such as Swage block, Anvil, different types of Hammers, Tongs, Flatters, Coldset, Hotset, Herdicswages, fullers, set Hammers, Punches, Drifts and Rivet headers (revet snaps) etc.
- c) Use of measuring foot rule, Calipers (outside and inside) Templates and used in forging.
- d) Introduction to Forging and Forging methods
- e) Heating metals for forging.
- f) Forging Operations.

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Upsetting, Drawing Down, Fullering, Swaging, Platening, Cutting Down, Forge welding, Punching and Drifting.

Two jobs to cover above courses such as:

- 1) Forging of chisel.
- 2) Forging of Ring.
- 3) Forging of Pan hook (s-shaped).
- 4) Forging of screw driver
- 5) Forging of Hexagonal nuts & Drifting

3. MEASUREMENT & QUALITY INSPECTION.

Construction and uses of measuring tools and gauges, surface plates, dial gauge, sine bar, Calliper, micrometers, comparators.

Fundamental of interchangeability, limits, fits and tolerances.

4. CARPENTARY SHOP

1. Timber: Type, qualities of timber, timber dries, timber grain, structure of timber, timber seasoning, timber preservation. Approximate conversion & Market forms of timber.
2. Wood working tools: Wood working machinery, & joints & joinery.
3. Various operations of planning various carpentary planes sawing and making of various carpentary joints.

Two jobs to cover above courses such as

- a) Name Plate
- b) Carpentry joints such as cross halving joint, mortise and tenon joint, Dovetail joint etc.
- c) Dwelling Plates
- d) Wall Bracket.

COMMUNICATION SKILLS (M-103)

LIST OF EXPERIMENTS:

1. Speech test
2. Audition
3. Neuro-linguistic programming
4. Personality assessment center
5. Prometric tests

SEMESTER - II

ENGINEERING PHYSICS (M-201)

UNIT -1: WAVE OPTICS

Theory of Biprism and Newton's Rings experiments, Michelson's Interferometer. Diffraction at single slit, double slit and diffraction grating. Resolving power, Rayleigh criterion, Resolving powers of telescope, microscope, grating and prism, concept of polarized light. Nicol prism. Idea about circularly & elliptically polarized light.

UNIT - 2 : QUANTUM PHYSICS

Matter waves, group and particle velocity, uncertainty principle, Schrödinger wave equation and its application. Characteristic and background X-rays, Duane Hunt Limit. Mosley's Law. Bragg's diffraction and Bragg's spectrometer, Compton Effect Stimulated and spontaneous emission, principles of Laser action. Properties of solid state (Ruby & Nd YAG) and gas (He-Ne & CO₂ type lasers and their engineering applications. Fundamental ideas about fiber optics.

UNIT – 3: NUCLEAR PHYSICS

Static properties of Nuclear shell model and liquid drop model. Particle accelerator. Cyclotron, Synchrocyclotron & Betatron, Nuclear reactions and Q values. Nuclear cross-section. Nuclear Fission, Fission energy. Theory of fission process. Chain reaction. Critical size. Principles of Nuclear reactor and nuclear fusion. Control fusion and fusion reactor.

UNIT - 4: RAY OPTICS

Cardinal points of a co-axial lens system. Nodal slide and its application in the verification of lens formula for the combination of two lenses and in the determination of cardinal points. Spherical and chromatic aberrations. Ramsdon & Huygen's eye pieces. Galileian telescope, Sextant and its uses.

UNIT -V: THERMAL PHYSICS

Liquification of gases. Porous plug experiment and Joule-Thomson effect. Rectilinear flow of heat. Theory of Ingen-Hauz's experiment. Forbes method, Lee's disc method for bad conductors and liquids.

Solar Constant Stefan's radiation law and its verification. Radiation Pyrometer. Principles of harnessing solar energy. Fundamental ideas about superconductivity Meissner effect, Isotope effect, Josephson Effect.

Books:

1. A text book of engineering physics, by M.N. Avadhanulu & P.G. Kshirsagar, pub. S.chand & Company LTD
2. Optics by Ajay Ghatak, pub. Tata Mcgraw Hill.
3. Engineering physics by S.K. Srivastava & R.A. Yadav., Pub. New age International (p) ltd.
4. A Textbook of engineering physics by Naveet Gupta & S.K. Tiwari, Pub. Dhanpat Rai & Co.
5. Physics for Engineers by M.R. srinivasan pub. New age international Publishers

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6. Heat and Thermodynamics by Brij Lal & N. Subrahmanyam Pub. S.chand.

BASIC ELECTRICAL AND ELECTRONICS ENGG. (M- 202)

Unit - I

Introduction to Electrical Engg. Generation, transmission, Distribution, & utilization.
DC circuits: Maxwell's loop & node equations, Source conversion, Network theorems, Super position theorem, Maximum power transfer theorem, Millman's theorem. Reciprocity theorem, Star/ Delta transformation.
Magnetic circuit and electrostatics: Fundamental definition, Ampere's law, Lenz's law, calculation of MMF, Comparison of electric, magnetic & electrostatic fields, statically & dynamically induced emfs, Lifting power of magnet

Unit - II

Single phase AC. Circuits:
Average value, RMS value, Form factor, Peak factor, Alternating waves, power and power factor, single phase series-parallel circuit, Resonance, Phase diagram.
Polyphase AC circuits: Phase sequence, Concept of line & phase quantities, star-delta. Connections, three phase power and power measurement

Unit - III

Transformer: Construction, principle, types, emf equation, phasor diagram of transformer on no-load and on-load, equivalent circuit, efficiency, regulation, open-circuit and short circuit test welding transformer, three-phase transformer. Rotating

Unit- IV

Electric Machines:

DC Machines & generators ,construction and principle of operation, classification, emf equation, armature reaction characteristics.
Motor-Principle of operations, Torque Equation, Load characteristics, control Efficiency. Application

Unit V

Electronic devices: Principles and construction of semi conductor devices, zone diodes, photo diodes, BJT, UJT, Photo transistors, CRO, UJT Relaxation Oscillator

BOOKS:

1. Electrical Engg. Fundamentals - V. Deltoro (Prentice Hall of India)
2. Electrical Machines - Nagrath Kothtri (Tata McGraw Hill)
3. Electrical Machines - P.S.bhimbhra.(Khanna Publishers)
4. Basic Electrical Engg. - V.N.Mfttte.
5. DC Machines & transformers - K. Murugesh Kumar (Vikas Publication)

BASIC ELECTRICAL AND ELECTRONICS ENGG. (M- 202)

LIST OF EXPERIMENTS

- A. Study of various measuring instruments.
- B. Study of various parts of D.C. machine.
- C. Study of 3-point and 4-point D.C. motor starters
- 1. a. To study the variation of resistance with temperature,
 b. To study fuse law and determination of fusing current
- 2. Calibration of M.C. Ammeter and M.I. voltmeter.
- 3. Verification of super position theorem
- 4. To study speed-control of D.C. shunts motor
- 5. To perform open-circuit and short-circuit test on a 1.5 transformer, hence to plot equivalent circuit
- 6. Determination of magnetization characteristic of separately excited D.C. Generator
- 7. To perform ratio, polarity and load test on a single phase transformer.
- 8. Study of A.C. series RLC circuit, and power and power factor measurement
- 9. Measurement of power by three voltmeter method.

FUNDAMENTALS OF COMPUTER AND PROGRAMMING (M- 203)

UNIT I

General organization of typical computer, classification of computers, generation of computer.,Input-output devices, Storage devices, System software like assemblers, Compilers.

UNIT II

Operating systems, Introduction to UNIX. Simple UNIX commands like date. Who, Cal, tty, Is etc. file commands like .me, cp, cat. etc. Directory commands like pad, Mkdir, Rmdir, cd etc. other commands like echo. Man etc. Modifying files using vi editor, compare UNIX and DOS, Generation of programming language.

UNIT III

Problem specification, Flow chart and algorithm development, structured, programming, object oriented programming and its advantages. Data types. Assignment statements, unary, binary and tertiary operator Input-output statements. Developing simple C programs, If statements, loops (for, while, do while), Break & continue, Switch statements, Development of C Programs using above statements.

UNIT IV

Array, functions, Parameter passing. Recursion. Programming in C using these statements Preprocessors directives and. 1 macros storage classes, scope, of variables.

UNIT V

Structures, Pointers, Files handling using init86() function, union. Enumerated data type, command line argument, working with user defined header file.

Books:-

1. Unix by Summitabha Das.-TMH
2. " C "programming by E Balaguruswamy -TMH
3. Complete reference of "C".—Herbert Schildt- TMH
4. Fundamental of computer by V Rajaraman TMH

BASIC MECHANICAL ENGINEERING (M- 204)

UNIT - I

Boilers- Names and functions of principal parts, Cochran, Locomotive, Lancashire, Babcock and Wilcox boilers, boiler mountings and accessories.

Steam-Sensible heat, latent heat, super heat, internal energy, dryness fraction and its determination, Processes-constant pressure, constant volume, hyperbolic and throttling.

UNIT- II

IC engines -Classification of IC Engines, description and working of four stroke cycle petrol and diesel engines, two stroke cycle petrol engine and their working cycles, indicated power, brake power and efficiencies.

Thermodynamics-system, properties and processes, zero, first, second and third law of thermodynamics.

UNIT-III

Modes and applications of heat transfer, unidirectional steady state heat conduction, heat transfer through composite slab, Air conditioning-need and application, description of summer and winter air conditioning.

WORKSHOPTECHNOLOGY:-

UNIT - IV:-

Introduction to materials, machine tool and metrology:

Engineering Materials: Classification, composition, mechanical properties and uses of. Cast iron, mild steel, high carbon steel and high speed steel corrosion and prevention

Machine tool: Introduction specification and uses of lathe, drilling, shaper, milling and grinding machines.

Measurement: construction and uses of measuring tools and dial gauge, surface plate sine bar, caliper, micrometer, comparators.

UNIT – V

FOUNDRY AND FABRICATION:

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Foundry: - Basic steps involved in foundry. Introduction to patterns, types, material allowances, mould making, composition of molding sand i.e. green sand, dry and loam carting defects sand, classification of welding, edge prep joint design welding symbols.

Fabrication: Welding and weld ability of metals. Introduction to gas and arc welding - TIG, MIG and submerged, resistance welding, soldering and brazing and related processes welding defects.

Books:

Manufacturing Technology – Vol-I and Vol-II – Raghuwanshi

Workshop Technology Vol-I & Vol-II – Hazara chaudhary

Workshop Technology Vol-I & Vol-II P.N. Rao

Workshop Technology – Vol – I & Vol-II by Waj chapman

Thermal engg. By Pandey & Shah

Thermal engg. By R.K. Rajput.

Thermal engg. By Domkundwar.Dhanpat Rai & Co.

Thermodynamics-By P.K.Nag-Tata Mcgraw Hill

BASIC MECHANICAL ENGINEERING (M- 204)

List of experiments

1. Study of Boilers.
2. Study of Boiler Mountings & Accessories
3. Study of Cochran boiler
4. Study of Locomotive Boiler.
5. Study of Lancashire Boiler.
6. Study of Babcock & Wilcox Boiler.
7. Study of Two-Stroke Petrol Engine.
8. Study of Four-Stroke Petrol Engine.
9. Study of Four-Stroke Diesel Engine.

Engineering Graphics (M- 205)

Unit – I

Projection of solids:

Types of solids, orthographic projection (first angle projection) of cylinder, cone, polyhedra with axes inclined to one of the reference planes and parallel to other and with axes inclined to both the H.P. and the V.P.

Unit – II

Section of solids:

Section of cylinder, cone & polyhedra with section plane inclined to H.P. or V.P. true shape of a section.

Intersection of surface;

Intersection of prisms, cylinder, cone, line method cutting plane method.

Unit – III

Development of surfaces:

Methods of development of surfaces:

Development of lateral surfaces of cylinders, cone, cube, pyramids, prisms and of their parts, development of transition pieces.

Isometric projection:

Isometric axes, lines and planes. Isometric scale, Isometric views and Isometric projection, isometric projection of planes or plane figures. Isometric projection of cylinder, cone, pyramids, prisms, sphere and combination of various parts of solid.

Unit – IV

Machine Drawing: (One compulsory question of 40 marks)

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Assembly drawings of Bushed Bearing, Foot Step Bearing, Plummer Block, Knuckle Joint, Cotter Joint, Flanged Coupling & Stuffing Box.

Books

Engineering Drawing : N.D. Bhatt

Engineering Drawing : by Venugopal

Engineering Drawing: by Gujral and Shende

Engineering Drawing: by P.S. Gill

Machine Drawing: by N.D. Bhatt and V.M. panchal.

A text book of machine drawing: by Lakshminarayanan and Mathur

Machine Drawing: By G.R. Nagpal

WORKSHOP PRACTICE (M-206)

FOUNDARY:

1) Pattern Making:

Students are required to prepare four jobs related to pattern making and moulding and know about:

- (a) Pattern materials, pattern allowances and types of patterns.
- (b) Core box and core prints, color codes.
- (c) Use and care of tools used for making wooden patterns.

2) MOULDING:

- (1) Properties of good moulding and core sand. Composition of green sand, dry and loam sand.
- (2) Methods used to prepare simple green sand bench and pitch mould, dry sand bench mould using single piece and split patterns.]
- (3) Care and use of mouldings tools.

WELDING

Students are required to make three jobs related to brazing, soldering and welding and to know about:

- 1) Equipments used for brazing, soldering and gas and arc welding.
- 2) Selection of material flux used in brazing, soldering.
- 3) Selection of gas welding rods, flux and pipe for gas welding.
- 4) Selection of welding machine, electrodes and for arc welding.
- 5) Use of tools and equipments, safety precautions.

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POLISHING & PAINTING: Students are required to make two jobs related to Polishing & Painting

ENGINEERING PHYSICS (M-201)

List of Experiments

- (1) Transistor characteristics.
- (2) Semi conductor diode characteristics.
- (3) Band gap in semiconductor diode.
- (4) A.C. Mains.
- (5) Stoke's law.
- (6) N.S. Assembly.
- (7) L.B. Photometer.
- (8) Newton's Ring.
- (9) λ -by grating.
- (10) μ -by Prism.

FUNDAMENTALS OF COMPUTER AND PROGRAMMING (M- 203)

List of Experiments

- (1) Write a function that will scan a character string passed as an argument and convert all lower case characters into their upper case equipments.
- (2) Write a program to replace a particular word by another word in a given string.
- (3) Write a program to generate the Fibonacci number series 0,1,2,3,5,8,13,21.....(20 such terms).
- (4) Using pointers write a function that receives a character string and a character as argument & delete all occurrences of this character in the string.
- (5) Two files DATA1 & DATA2 contain sorted file DATA which holds a single sorted, merged list of these two lists. Use common link arguments to specify the file names.
- (6) Write a program that will read a positive integer and determine & print its binary equivalent.
- (7) Write a program to read two numbers n and as inputs and then calculate the value of $nCr = \frac{n!}{r!n-r!}$; $nPr = \frac{n!}{n-r!}$. Use factorial function for this purpose.

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- (8) Write a program to read two matrices. A and B and then calculate the product of the matrix in C. Finally print the C matrix.
- (9) Write program for some Engineering Formulae.
- (10) Generating graphics from formula for parameters study.

SEMESTER – III

ENVIRONMENTAL ENGINEERING (M-301)

Unit—I

Environmental problem and issue Ecosystem, global warming, Green House Effect, Depletion of ozone layer Human activity and meteorology, Genetic and plant biodiversity, EL-Nino phenomenon and its effects, land and soil pollution.

Unit—II

Aquatic environment standard of water for different uses, B.O.D. and C.O.D. and their determination, characteristics sewage deflouridation , water pollution, Sources and effects and inorganic water pollutants. Introduction of domestic and industrial waste water treatment, basic concepts aerobic and anaerobic treatment process.

Unit—III

Air Pollution

Introduction, structure of the atmosphere, chemical and photochemical reactions in the atmosphere, effects of air, pollution sources & classification of air pollutions harmful effects of CO,CO₂,CH₄,SO_x,NO_x, H₂S,Ozone & particulate, basic concepts for air samplings techniques, Photochemical smog & Acid Rain.

Unit—IV

- (A) Noise pollution and radioactive pollution, Noise pollution-sources, general introduction of noise pollution and its effects, and control, radioactive waste sources, characteristics and disposal.
- (B) Solid and Hazardous waste management sources types and composition of solid waste.

Unit—V

Collection of base line data, Introduction and concepts of Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA), Environmental Impact statement (EIS), Environmental Audit (EA), Risk Assessment (RA),etc.

Regulatory Responses:

Review of national and international developments related to environmental issues, law and legislation.

Reference Books:

1. Chemistry in engineering & Technology Vol 2 Tata Mc Graw Hill
2. Chemistry of environmental Engineering Sawyer and Parking Tata Mc Graw Hill
3. Environmental pollution monitoring and control khopkar S.M New age international publication.
4. S.R.Shirsagar sewage and sewage treatment.
5. D.N.May_nandbook of noise assessment van nostrand.
6. Introduction to environmental engineering & science gillbert M.MASTERS,PHI
7. Standard methods for the examination of water and waste water. American public Health association, Washington,DC.

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ELECTRICAL MACHINES AND ELECTRONICS ENGINEERING (M- 303)

Unit I

Rotating magnetic fields, 3-phase induction motors-principle of operation, equivalent circuit, construction, Slip-torque characteristics, Starting, Single- phase induction motor- principle of operation and methods of starting.

Unit - II

Synchronous machines - alternator, basic definitions, emf equation, regulation, parallel operation & load sharing, synchronous motor-principle of operation, vector diagram, V-and inverted V-curves, Power-angle characteristics

Unit - III

Transmission and distribution - transmission of power by different systems, influence of voltage on cost & efficiency, short & medium lines- A, B, C, D parameters, vector diagram, towers and insulator types

Unit - IV

Power Electronics -thyristor - characteristics, turn-on turn-off methods, triac, IGBT, MOSFET- application and characteristics, braking & speed-control using power electronic devices.

Unit - V

Measuring instruments-classification, operation, torque equation, merits & demerits. Regulated power supply, different types of amplifiers OP AMP, power amplifiers-class -A, Class -B, push-pull amplifiers, and applications.

BOOKS-

1. Electrical Machines, Nagrath- Kothari (Tata McGrawHill)
2. Electrical Machines, J.B. Gupta(S K Kataria&Sons)
3. Power Electronics P.S. Bimbhra (Khanna Publishers)
4. Generation, Distribution and utilization of electrical energy ,C. L. Wadhwa
5. Electrical measurements & Instrumentation, A.K. Sawhaney (Dhanpat Rai& Sons)

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6. OP AMP & linear integrated circuits, R. A. Gayakwad (Prentice-Hall of India)

7. Power electronics Rashid (Prentice Hall of India)

Mechanics of Materials (M- 302)

Unit – I

Mechanical properties of materials: Ductility, malleability, hardness, toughness etc. Contact stresses and residual stresses simple and complex stresses: Elastic constants, composite section temperature stresses complex, principal planes and principal stresses, Mohr's circle.

Unit – II

Theory of Bending, Modulus of section, Bending stresses in beams, Combined direct & bending stress, Shearing stresses in beams

Unit – III

Deflection of Beams: Equation of elastic curve, Macaulay's method, Area moment method. Bending moment and shear force diagram of fixed beams. Strain energy in tension, compression shear bending and torsion.

Unit – IV

Shafts and springs: Shear stress and angle of twist of shafts of circular section hollow shaft. Power transmitted by shafts open and closed coil helical springs, leaf spring.

Columns and struts: Buckling of columns Euler's and Rankine formulae.

Unit – V

Pressure vessels: Thin and thick walled cylindrical and spherical shells. Stresses due to external and internal pressure. Rotating rim and Discs Stresses in thin rotating rims stresses in solid and hollow circular discs of uniform thickness due to rotation. Disc of uniform strength.

Books

1. Strength of Materials by R.K. Rajput. – S. Chand Publication
2. Strength of Materials by Sadhu Singh. – Khanna Publication
3. Strength of Materials by G.H. Ryder. – MGH Publication
4. Strength of Materials by Singer. – AWL Publication
5. Strength of Materials by S. Ramamurtham – Khanna Publication
6. Mechanics of materials by E.J. Hearn.
7. Advanced strength of materials by Shiley and Smith.

Engineering Design and CAD (M- 306)

2. Introduction to design, problem formulation and problem analysis specification of a solution, search for alternative solution. Design cycle different design models and process.
Study of aspects of mechanical electrical chemical and other problems in engineering design.
3. Concept of computer aided drafting role of computers in drafting general purpose graphical software, plotting technique, elementary command of Auto CAD, practice of simple drawing with the help of CAD software.

Reference:

1. CAD/CAM by Sadhu singh
2. CAD-CAM by Grover and Zimmer.
3. Machine design by Sharma and Agrawal.
4. Machine design by Bhandari.
5. Machine design by Shigley (TMH)
6. Machine Drawing by N.D.Bhatt.

ENGINEERING MATERIALS (M- 305)

Unit – I

Metal structure and crystallization, electronic structure of atoms, bonding crystal structure, defects in crystal, point line and surface, dislocations edge and core, burgers vectors, slip plane, correlation of crystal structure and properties super conductivity yielding and strain hardening.

Unit – II

Element of physical metallurgy: Theory of alloying, phases in metals and alloys, solid solution, ordered and disordered, substitutional and interstitial solution. Hume Rothery's rules of substitution solid solution, correlation between microstructure and mechanical properties, binary equilibrium diagram, complete solid solution type eutectic, peritectic hypereutectic, phase rule, lever rule.

Unit – III

Heat treatment and surface treatment;

Iron carbon phase diagram, T.T.T. diagrams, continuous cooling curves, application of heat treatment of steel, classification, annealing normalizing, Hardening spheroidizing, austenite transformation, tempering transformation during tempering austempering martempering, precipitation hardening malleabilisation, case carburising Nitriding cyaniding, carbonitriding, Induction Hardening flame hardening, Age hardening and hardenability.

Unit – IV

Metal alloys and testing: Structure properties and application of important. Alloys of Fe-Fe₃C, Cu-Zn, Ni-Cu, Al-Si, Al-Cu systems, alloy steel with special reference to tool steels, heat resistant steel, corrosion resistant steels. A brief discussion of the properties and application of rare metal such as platinum, uranium, Beryllium and Zirconium.

Testing : Non Destructive Testing , Radiography Ultrasonic test, Eddy current testing, Die Penetrate testing and Magnetic particles Inspection testing.

Unit – V

Ceramics polymers and powder metallurgy: Behaviors of glasses, fabrication of ceramic bodies' strength of ceramics reinforced structures, types of polymers, crystallinity of polymers, polymerization properties of polymers introduction and application of composite material.

Powder metallurgy: Theory of powder metallurgy, manufacturing of metal powders, Sintering secondary operation, and properties of finished parts design consideration and applications.

Books:

1. Metallurgy for engineering Nayak S.P.
2. Engineering physical metallurgy Lakhlin
3. Metallurgical testing. Dr. Abdul mubeen: Agrawal S

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4. The science of engineering materials Gold man J.E.
5. Material Science by William D. Callistre
6. Material Science by O. P. Khanna
7. Material Science by Narula & Narula
8. Advance in Material Science by A. k.Sharma & Rakesh Dogra

Industrial Economics & Business Organization (M-304)

Unit-1

INTRODUCTION TO ECONOMICS:

Introduction to Economics, its importance approaches and uses of study, engineering and economics. Economic Problem-Economic, Good and Wealth, Demand and Supply. Competition, Monopoly, Theory of firm ,money and its function, theory of money and choice, bank and its functions, employment and income, gross national product, net national product-consumption, saving and investments.

Unit-II

FEATURES OF INDIAN ECONOMY :

Broad features of Indian economy, Natural resources and economic development, Infrastructure in the Indian economy, Agriculture development, green revolution, population, Population theories, Unemployment, poverty and balanced regional development, Economic growth and economic development, Indian industries, industrial policy, Industrialization in India, Role, plan and pattern of Industrialization, Public Vs Private Sector. Economic reforms in India, India's five year plans.

Unit-III

INDIAN ECONOMY &GLOBAL TRANSACTIONS

The indigenous and modern banking system in India, reserve bank of India, Monetary and Fiscal policies, Financial Institutions and SEBI, Free Trade and protection, india's Foreign trade and WTO, Balance of payments, Indian currency system and foreign exchange, Foreign Capital Investment, Foreign aid and FEMA.

Unit-IV

INTRODUCTION TO BUSINESS ORGANIZATION:

Concept nature and scope of business, business and its environment, economic, legal social and political environment of business, business ethics.

Forms of business organization-Type and their functions roles and responsibilities, HUF, Partnership, joint stock Companies, private and public limited Companies, cooperatives, joint stock and public sector Entrepreneurship, promoters and financial institutions, concept of business growth, profit maximization Vs social responsibility, role and problems of small business joint Ventures, multinationals.

Unit-V

INTRODUCTION TO MANAGEMENT:

Evolution, development and modern philosophy, management in India, scientific management, Rationalization and quality circles. Principles of management-Nature and Function of management, Management By Objective(MBO), Management By

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Exception(MBE) Importance, characteristics, applications, Management theory
Jungle, school of Management thought, management Information system(MIS).

BOOKS:

1. Indian economy: Rudder dutt & KPM Sundaram.
2. Indian economy: A.N. Agrawal
3. Managerial Economics: Joel Dean.
4. Organization & Management: Koontz, O'Donnel.
5. Essentials of Management: Koontz, O'Donnel
6. Principles & practice of Management: Chhabra & singh

ELECTRICAL MACHINES AND ELECTRONICS ENGINEERING (M- 308)

LIST OF EXPERIMENTS

- a. Study of various parts & working of synchronous machines.
- b. Study of various starting methods of an induction motor.
- c. Study of different types of insulators.
- d. Study of semiconductor devices.
 1. To verify the voltage & current relations in star & delta connected 3 phase system.
 2. No load & block rotor test on 3 phase Induction Motor
 3. To find voltage regulation of an alternator by direct loading method
 4. Speed control of 3 phase induction motor using thyristors
 5. Study of light dimmer
 6. To find voltage regulation by an alternator using synchronous impedance method.
 7. Load test on 3 phase slip ring induction motor by belt & pulley method.
 8. Synchronizing of alternator by two bright and one dark lamp method
 9. Study Of SCR characteristics

Mechanics of Materials (M- 307)

List of Experiments

1. Study of universal testing machine.
2. Determination of yield point stress ultimate stress, Breaking elongation for mild steel specimen under tension.
3. Study of various hardness tests.
4. To determine the brinells hardness number of mild steel, cast iron and aluminium brass.
5. To determine the Rockwell hardness number of mild steel, cast iron, Aluminum.
6. To perform the charpy impact test and find the impact toughness for CI, MS, and AL specimens.
7. To find the modulus of rigidity of mild steel using torsion apparatus.
8. Determination of modulus of elasticity by detection method.
9. To perform the torsion test on mild steel and cost iron specimens.
10. To find the modulus of rigidity on spring material using spring apparatus.
11. To perform compression test on wooden/method specimens.

Engineering Design and CAD (M- 310)

List of Drawings.

1. Boiler Mountings and accessories.
2. I.C. engine parts i.e. connecting rod crank shaft, and piston heads.
3. Tool head of shaper machine.
4. Crane hook.
5. Centrifugal pump assembly.
6. Pipe Joints, Welding joints, Rivet joints.

ENGINEERING MATERIALS (M-309)

LIST OF EXPERIMENTS

1. Study of Geometry of Close Packing .
2. Study of various crystal Structure Model's.
3. Study of Dislocations and imperfection of materials.
4. Study of metallurgical microscope.
5. Study of micro specimen preparation methods .
6. Study of microstructure of metals.
7. Study of different heat treatment processes.
8. Study of powder metallurgy.

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9. Study of non destructive testing methods.
10. Study of Alloy Analyzer.

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Semester - IV

Engineering Mathematics-II (M- 401)

Unit – I

Differential equation of first order and first degree, linear and exact differential equation. First order and higher degree differential equations and solvable for P, X, and Y including Clairaut's form.

Unit – II

Second and higher order differential equation. Simultaneous differential equations of both types. Second order differential equation with variable coefficients.

Unit – III

Solution by series method with emphasis to Legendre's and Bessel's equation and properties of Legendre's and Bessel's function.

Unit – IV

Laplace transformation of elementary functions, unit step function, Dirac-delta function, properties, Inverse Laplace transformation. Solution of ordinary differential equations using Laplace transformation.

Unit – V

Fourier series including half range series. Harmonic Analysis.

P.D.E. of first order, linear and non linear, linear P.D.E. of second and higher orders. Boundary value problems separation of variables methods, application to heat transfer and vibration in one and two dimensions.

BOOKS:

Higher engineering mathematics by B.S. Grewal

Text book of engg. Mathematics by Shrivastava and Dhawan.

Engineering mathematics by Chandrika Prasad

Applied mathematics-vol-I by R.D. Sharma

Advanced Engineering Mathematics H. K. Dass

Engineering Mathematics Volume I Ashok Ganguly Ram Prasad & Sons

Engineering Mathematics Volume III V Sundaram R. Balasubramaniam

Vikas publishing house PVT. LTD.

Applied Thermodynamics and Heat Engines (M- 403)

Unit – I

Thermodynamics: Systems, properties and processes Zeroth law of thermodynamics statement and significance, Heat and work transfer, First law of thermodynamics, first law applied to closed system, limitations of first law of thermodynamics.

Second law of thermodynamics, Heat Engine, Heat reservoir, Refrigerator, Heat pump, coefficient of performance (COP), EPR Carnot's theorem, Carnot's cycle, reversible and irreversible processes, Entropy, Entropy change for ideal gas, Available energy, Third law of thermodynamics.

Unit – II

(A) Properties of gases: Equation of state, expansion and compression of gases constant volume, constant pressure, isothermal, adiabatic and polytropic process calculation for change of enthalpy, entropy, internal energy etc.

(B) Steam condensers: Classification and working, Effect of air leakage, calculation of dry and wet air pump capacities, cooling water requirements, Vacuum and condenser efficiency, various components of condensing plant, requirements of a good condenser, important design parameters.

Unit - III

Air standard cycles: Otto, Diesel, Dual and Joule cycle analysis, efficiency and m.e.p, I.C. engine performance and heat balance analysis.

Unit – IV

(A) Reciprocating Air Compressor: classification, working, work requirement, volumetric efficiency, multistage compression, condition for minimum work and calculation for size of compressor cylinders.

(B) Centrifugal compressor: Elementary theory, velocity diagrams, work done and pressure rise in stages, losses in impeller and diffuser, performance characteristics, Axial flow compressors-velocity diagrams, work required and pressure rise in stages degree of reaction, stage efficiency and overall efficiency.

Unit – V

Gas Turbines: Open and closed cycles, constant pressure and constant volume, cycles with inter cooling, reheating and heat exchangers, turbine and compressor efficiencies.

Jet Propulsion – Calculation for thrust power, speed and efficiency, turbojet and turbo propulsion system.

Books and References

1. Thermal Engg. – R.K. Rajput—Laxmi Publications
2. Thermal Engg. – S. Domkunduar—Dhanpat Rai & Co.
3. Thermodynamics – P.K. Nag—Tata-Macgraw Hill
4. Gas Turbine – Cohen and Roger—Addition Wesley Longman Ltd.
5. Thermodynamics – Gordon J. Van Wylen—John Wiley & Sons.

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Thermodynamics & Heat Power Engg.--Mathur & Mehta--Jain Brother, New
Delhi.

Applied Thermodynamics and Heat Engines (M- 407)

List of Experiments

1. Load test on petrol engine
2. Load test on diesel engine
3. Calculation of volumetric efficiency of reciprocating air compressor.
4. Study of Fuel injection system of diesel engines
5. Study of surface condenser
6. Study of cut-model of cylinder 4-stroke petrol engine.

Design of Machine elements (M-404)

Unit – I

Design and Drawing of Temporary fasteners: Knuckle, cotter, threaded Joints. Design and Drawing of permanent fastener's e.g. riveted joints bolted joints and threaded fasteners, eccentric loading of riveted joints, welded and bolted joints. Learn the use of Design Data book and hand books.

Unit – II

Different theories of failure, Graphical representation and comparison. Concept of creep and fatigue, Design of shafts and shafts couplings such as Muff Coupling, Flange Coupling, flexible Coupling , affect of stress concentration, design for power transmission (including combined bending and torsion) .

Unit – III

Spring design: Helical springs, closed and open coiled tension and compression springs and their ends. Design of Leaf Spring

Belt Rope and Chain drive: Power transmission modes, selection of flat belt and pulley design, formacle method, selection of Vee belts and sheeve design. Design of chain drive, roller chain and its selection, Rope Drives, Rope drive Design. Hoist rope.

Unit – V

Computer Aided Drafting and Design. Introduction of CAD, coordinate system, translation rotation and scaling transformation, point specification plotting technique dimensioning, 2D and 3D drawing concepts, drawing practice, elementary design calculation e.g. Area, Moment of Inertia, Volume etc

Books

Mechanical Engg : Design by J.E. Snigley TMH

Machine Design by A.Mubeen khanna Publishers

Computer Aided Analysis and Design by Goshal.

Design Data book by P.S.G. Coimbatore

Design of machine elements by V.B. Bhandari TMH

Design of Machine elements by Vallance and Doughter

CAD/CAM by Groover and Zimmer

Design of Machine element by spots – Prentice Hall .

Design of Machine elements (M-404)

MACHINE DRAWING PRACTICE

- 1.Design a wall bracket ,which is being used in real life by actual measurement of load
A)Welded Joint B)Riveted joint and Bolted Joint and Justify your findings.
- 2.Select a flange Coupling in the college lab and justify its design by actual measurements.
- 3.Design a shaft used in practical application , actual working and actual loading conditions.
- 4.Design a Spring used in practical application by actual working and loading conditions.
- 5.Design a software in some high level language or excel sheets for design of components .
6. Find a assembly containing the belt and pulley mechanism and do the complete design calculations and then Justify the design .
7. Computer Aided Design of atleast one Joint.
8. Computer Aided Design of atleast one Coupling .
9. Computer Aided Design of atleast one Spring.

Kinematics of Machines (M- 402)

Unit I

Kinematics : types of plane motion , kinematics concept of links, types of pairs, kinematics chains, mechanism and machines , equivalent linkages diagram , constraints and degree of freedom, inversions , conversions and transformations of mechanisms.

Unit II

Motion analysis, absolute & relative motion, kinematics quantities and their relationship, vector diagram , instantaneous centre and Kennedy's theorem , velocity analysis , relative and absolute velocity method, methods of instantaneous centers resolution & orthogonal velocity method.

Acceleration analysis, acceleration polygon corolis acceleration, slider crank mechanism, mathematical analysis, graphical method, motion graphics in determination of displacement, velocity and acceleration of reciprocating parts.

Unit III

Dimensional synthesis of linkages – introduction graphical method, four position synthesis, dead centre problem, branch and order defects, special straight line mechanism, chebyshev spacing of precision points, coupler curves, and computer aided synthesis of mechanisms.

Unit IV

Flywheel and governors: fluctuation of energy & speed, design of flywheel, application of flywheel.

Force analysis of governors, controlling force curves, sensitivity, stability, effort power of governor.

Unit V

Force analysis of machines- concept of free body and its equilibrium. Static force analysis including force of friction. D'Alembert's principle, dynamic force analysis.

Friction devices – brakes and dynamometer, plane & cone clutches.

Reference books:

1. Mechanism of machine theory : J.S. Rao & R.V. Dukkupati, New Age Publication
2. Theory of machines : S.Rattan , TMH
3. Theory of machines: Thomas Bewan, CBS Publication
4. Theory of machines: Ghosh & Malik – EWP New Delhi
5. Theory of machines: Dr. P. L. Balani – Khanna Publication
6. Theory of machines: Green W.G. Blackin London
7. Kinematics & dynamics of machines: Martin G.H.
8. Mechanism of machine theory: Ambedkar A.G., Jain brothers New Delhi.
9. Mechanics and Dynamics of Machinery by Srinivas – Scitech Publications

Kinematics of machines (M- 406)

List of experiments:

1. Study of different kinematics pair.
2. Study of four bar kinematics chain
3. Measurement of break power by rope break dynamometer
4. Measurement of break power by torsion dynamometer
5. Study of different types of governor & measurement of range of speed for porter governor
6. Study of different types of breaks.
7. To determine the velocity and acceleration of different mechanism graphically & verify analytically.

Manufacturing Process – I (M- 405)

Unit I

Metal removal: Lathe mechanisms study and uses of centers, mandrels, chucks, collets, face plates, rests, tool holders, Lathe operations and attachments for turning and thread cutting calculations.

Hole Reaming, Boring spot facing, Counter boring, Counter sinking surface machining principles of generation of surface classification and working principle of Shaping, Planning and slotting machines, quick return mechanism, hydraulic system for shapes.

Unit II

Welding : Gas welding Arc welding – TIG welding, MIG welding, Electro slag welding, Plasma arc welding, Electron beam welding, Laser welding Thermit welding, Resistance welding, Friction welding, Cold welding . Related operations: Pre heating, Post heating, Stress relieving, welding defects and remedies, Brazing, soldering and related operations.

Unit III

Foundry : Moulding and core sand and its testing, moulding methods and machines, core making & types melting furnaces , design and operation of Cupola, Electric furnaces, Arc furnaces, Casting processes, types of castings, casting design, solidification, casting defects and remedies. Gravity / die or Permanent mould casting, Pressure die casting; Centrifugal die casting, CO₂ moulding, Investment mould casting, Shell moulding, Continuous casting, Planning and layout of modern mechanized foundries.

Unit IV

Cold Working of Metals : Concept of metal working, recrystallization temp, press working – classification specification equipment and operations cutting actions, clearances on dies, calculation of press capacity, Design of press dies, Component of dies blanking, shearing, drawing, spinning, stretch forming, wire drawing, embossing squeezing swaging, coining and bending operations.

Unit V

CNC machines: Introduction and History of CNC Machines, Classification of CNC Machines, Constructional details, Basic operations, Introduction to Computer-Machine interface and common CNC controller.

Books:

1. Materials and processes in manufacturing-E.Paul Degarmo J.T. Black & Kosher-PHI
2. Manufacturing Technology – Vol-I and Vol-II – Raghuwanshi
3. Workshop Technology Vol-I & Vol-II – Hazara & Chaudhari

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4. Manufacturing Technology Vol-I & Vol-II P.N. Rao-TMH
5. Workshop Technology – Vol – I & Vol-II by W.A.J. chapman
6. Production Engineering-Suresh Daleta & Ravisankar-Galgolia pub.
7. Production Technology- P.C.Sharma-S.Chand

Manufacturing Processes – I (M-408)

1. Plumbing – Bending etc job.
2. Sand Testing.
3. Study of different molding processes – Shell molding, investment molding.
4. Study of Permanent moulds and core preparation.
5. Layout of modern mechanized foundry.
6. Machining of bar stock for Plain turning, Taper turning, Thread cutting, Knurling etc.
7. Machining of bar stock for Shaping and Drilling.
8. Study of different Electric arc welding processes, Resistance welding processes etc.
9. Study of CNC controllers.

SEMESTER -V

Manufacturing Process – II (M 505)

Unit – I

Mass production lathes: concept and requirement of mass production, Turret & capstan lathes, ram types and saddle type, vertical Turret lathe, screw machines, single and multispindle screw machine, Automatic lathes single and multi spindle automatic lathes, cycle time, Introduction to special purpose machines (APMS).

Unit – II

Milling : Types and operation of milling machine, types of milling cutter, geometry of milling cutter, Milling machine accessories dividing heads, simple, compound differential and angular indexing, Up and down milling, Broaching : types of broaching machines and geometry of broaching tools.

Thread& gear manufacturing processes and their cutting types & properties.

Unit – III

Surface finishing operations: Grindings: abrasives Types & properties , grinding wheels nomenclature and their selection grinding machines cylindrical and surface grinders, centre less grinding, Grinding fluids.

Super finishing processes: Surface finish and measurement principle and operation of Buffing ,Polishing, Lapping, Honing, Acceptance test of machine tools.

Unit – IV

Hot working of metals: Forging: types, equipments, drop, horizontal, press and upset forging. Forging hammer and presses, extrusion, piercing, drawing, cupping. hot rolling, pipe and tube production.

Unit – V

CNC operation: Comparative study of CNC lathe and CNC milling machines, Introduction to Fanuc and Siemens controllers. Basics of CNC part program programming codes and their applications; CNC tolling, concept of DNC.

Books:

1. Campbell J.S., Principle of Manufacturing materials and processes.
2. Chapman W.A.J., Workshop Technology Vol – II and III.
3. Raghwanshi – Workshop Technology Vol-I and II.

NUMERICAL ANALYSIS (M 501)

Unit – I

Algorithm and its basic properties like effectiveness and efficiency. Examples of polynomials evaluation, Searching largest number in a set etc. Iterative and recursive loops in flow charts. Errors and approximations types of errors, sources of errors problem in computational safeguards against errors.

Unit – II

Solution of equation Newton defected, Newton Raphson methods. Bairrtow's method of complex roots. Efficiency of these methods.

Unit – III

Interpolation: Forward Backward, central and divided difference formula Lagrangian interpolation, inverse interpolation. Numerical interpolation: Newton cote's formula, weddle's $3/8^{\text{th}}$ rule Simpson's as a special case of Newton cote's Gauss legendre open quadrature.

Unit – IV

Ordinary differential equation, Euler's modified method, Euler's method, Picard and Taylor series method, Runga Kutta 3^{rd} and 4^{th} order, predictor and corrector method.

Unit – V

Linear simultaneous Equation: Partial and complete pivoting triangularization., Gauss reduction, Jacobi, Gauss siedel iteration methods, Relaxation methods.

Books:

Higher engineering mathematics by B.S. Garewal
Text book of engg. Mathematics by shrivastava and dhawan.
Engineering Mathematics by chandrika prasad
Numerical Methods P.kandasamy K.Thilagavathy
Numerical Methods Gupta & Malik
Engineering Mathematics by H. K. Dass.

INTERNAL COMBUSTION ENGINE (M 503)

Unit – I

Internal Combustion: Engine S.I. and C.I. engines of two and four stroke cycles, real cycle analysis of S.I. and C.I. engines, Determination of engine dimensions, speed, fuel consumption, output, mean effective pressure, efficiency, Factors affecting volumetric efficiency, Heat balance, performance characteristics of SI and CI engines, Cylinder arrangement, firing order, power balance for multicylinder engines.

Unit – II

Combustion in SI engines, Flame development and propagation, ignition lag, effect of air density, temperature, engine speed, turbulence and ignition timings, physical and chemical aspects of detonation, Effect of engine and fuel variables on knocking tendency, knock ratings of volatile fuels, octane number, H.U.C.R., action of dopes, Pre-ignition, its causes and remedy, Salient features of various types of combustion chambers, valve timing.

Unit – III

Combustion in CI Engines: Time base indicator diagrams and their study, Various stages of combustion, delay period, diesel knock, Cetane Number, knock inhibitors, salient features of various types of combustion chambers.

Unit – IV

Fuel, ignition, cooling, exhaust and lubrication systems, Simple problems on fuel injection, Various types of engines, their classification and salient features, Rotary I.C. Engines, their principle of working.

S.I. ENGINE SYSTEMS

Fuel, ignition system, cooling, exhaust/scavenging and lubrication system of S.I. engine, Fuel metering in S.I. engine, Theory of carburetion, simple problems on carburetion, fuel injection in SI engine (MPFI & TBI).

Unit – V

SUPERCHARGING

Effect of altitude on mixture strength and output of S.I. engines, low and high pressure supercharging, exhaust gas turbo charging Supercharging of two stroke engines.

ALTERNATE FUELS FOR I.C. ENGINES:

Hydrogen, Bio-gas, Alcohols, Vegetable oils etc.

Rotary combustion I.C. Engines: Stratified charge engine, principle of working and salient features.

Pollutants formation and control: Mechanism of formation of pollutants, CO, HC, NO and particulates measurement of pollutants and their control techniques.

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Books and References :

1. A course in I.C. engines – M.L. Mathur and R.P. Sharma-Dhanpat Rai & Sons
2. Internal combustion engine – V. Ganesan--THM
3. Internal combustion Engines theory and practice – C.F. Taylor.
4. Introduction to I.C. Engines – Richard Stone.
5. Fundamental of I.C. Engines-J.B.Haywood-Mcgraw Hill International Edition.

INTERNAL COMBUSTION ENGINE (M 507)

List of Experiments:

1. Determination of valve-timing diagram.
2. Load test on petrol engine.
3. To estimate and draw the heat balance sheet for petrol engine.
4. To estimate and draw heat balance sheet for diesel engine.
5. Study of Battery ignition system and electronic ignitions system.
6. Study of Diesel fuel pump.
7. Study of Diesel fuel injectors.
8. Study of Zenith and Solex carburetors
9. Study of Lubrication system C.I. engine
10. Morse Test

DYNAMICS OF MACHINE (M 502)

Unit - I

Vibration (longitudinal & transverse): Free, damped and forced vibration of single degree of freedom for., mechanical system. Transverse vibration of loaded and unloaded shafts, Transverse vibration of shafts having several loads, critical speed for shaft whirling of shaft.

Vibration(torsion) :Torsional vibration of geared system torsional vibration of two

and three rotor system vibration transmission and isolation, vibrations in two degrees of freedom for a mechanical system.

Unit - II

Toothed gears: Fundamental law of gearing, classification and terminology geometry and kinematics consideration of various tooth profiles. The involutes and cycloid profiles, spur gear and other type standards in tooth forms.

Unit - III

Gear trains: types, simple, compound and epicycle gear trains, their applications Design of spur gear velocity ratio of epicyclic gear train. Torques in epicyclic gear train.

Gyroscope: Precessional angular motion, gyroscopic couple, effect of gyroscopic

couple in Aero plane. Naval ship, stability of four wheel drive moving in curved path,

stability of two wheeler vehicle taking turn law of motion for rigid body, elements of gyroscopic motion, gyroscopic torque.

Unit - IV

Balancing: Balancing of rotating masses in one plane and in different parallel planes balancing of four bar linkage including slider crank mechanism, balancing of radial, including V and locomotive engines, principles of balancing machines.

Unit - V

Cams and cam dynamics: classification, types of motion curve and analytical

constructions of cam profile. For different types of followers, pressure angle and cam

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size, cam with specified contours, cam synthesis. Force analysis of cam follower system response, jumps and cross over shocks, zonsom numerical analysis, unbalance spring surge and wind up.

Reference books.

1. Mechanism of machine theory : J.S. Rao and R.V. Duddipati, New Age Publication
2. Theory of machines: S. Rattan, TMH.
3. Theory of machines: Thomas Bewan. CBS publication.
4. Theory of machines: Dr. P.L. Balani. – Khann Publication
5. Theory of machines: Green W.G. Blackin London.
6. Theory of machines: Ghosh and Malik. – Oxford Publication
7. Kinematics and dynamics of machines: Martin G.H.
8. Mechanism of machine theory: Ambedkar A.G., jain brothers New Delhi.
9. Mechanism & Dynamics of machinery by Srinav – Scitech Publication

DYNAMICS OF MACHINE (M 506)

List of Experiments:

1. Measurement of critical speed by whirling of shaft demonstrator.
2. Verification of Dunkerley's principle by universal apparatus.
3. Measurement of natural frequency of simple and compound pendulum.
4. Verification of velocity of precession by motorized gyroscope apparatus.
5. Static and dynamic balancing of rotating masses.
6. Study of radial and flat cam with oscillatory follower.
7. Construction of gear tooth profile of various types of gear.
8. Determination of velocity ratio of simple and compound gear train.

MECHATRONICS (M- 504)

UNIT-1. Fundamentals of Programming and Software

Basics of programming in C and Visual Basic. Introduction to the systems used for the course. Creating the programs and getting an introduction into Make files experimenting with manipulating binary and hexadecimal numbers. Basics of software engineering and its relation with mechatronic and robotic systems. Use of Sensoray 626 card to sample data from analog potentiometers (joystick) and digital switches (buttons) in a simple joystick device.

UNIT-2. Sensing and Filtering

An overview of sensor types and applications. Digital sensors, analog sensors, and sensor specifications. Sensors in practice v/s sensors in theory. Effect of noise on sensing, sampling theorem and digital filtering. Creating digital filters and analyzing their effects on signals. Using these filters to condition the sensor data.

UNIT-3. Data Acquisition

Getting signals into a computer, examination of A/D, D/A, and the sampling theorem. Different filtering methods. Analysis of an infrared range finding sensor and how to condition its output.

UNIT-4. Actuators

Introduction to different types of actuators including servomotors, dc motors, ac motors, and linear actuators. Modeling and Control of Dynamic Systems Controlling DC motors and analyzing their transfer functions.

UNIT-5. Mechatronics & Kinematics

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An introduction to kinematics and robotics. Detailed study of the SCARA Robot installed in the robotics lab.

Books

1. W. Bolton "Mechatronics: Electronic control systems in mechanical and electrical engineering" Second edition, Longman (1999) D.A. Bradley, D. Dawson, N.C. Burd and A.J. Loader "Mechatronics:
Electronics in products and processes" Chapman and Hall, 1991, ISBN 0412 58290 2 **(670.18-MEC)** Good general coverage of Mechatronics (recommended)
2. Lawrence J. Kamm "Understanding electro-mechanical engineering: An introduction to mechatronics" IEEE press, ISBN 0-7803-1031-4
3. Stuart Pugh, "Total Design", Addison Wesley, ISBN: 020141639 (1990) **620.04-PUG** Good coverage of a general design process (recommended)
4. Leon O. Chua. Charles A. Desoer. Ernest S. Kuh Chua Leon O. "Linear and nonlinear circuits", **(621.31921-CHU)** Has a good chapter on two port networks
5. Walter S. Heath "Real-time software techniques", VanNostrandReinhold, ISBN 0442003056 (1991) **(004.33-HEA)** Lectures on real-time software are based from this book (background)
6. Denny K. Miu "Mechatronics: Electromechanics and Contromechanics" 1993 Springer-Veria
7. MJ, Usher and D.A. Keating "Sensors and Transducers: Characteristics, Applications, Instrumentation, Interfacing" MacmillanPress. ISBN'0-333-60487-3 (1996) **(621J79-USH)**
8. Paul Horowitz and Winfield Hill "The art of electronics 2nd ed", Cambridge University Press, 1989. ISBN: 0521370957. **(621J81-HOR)**

MECHATRONICS (M- 508)

List of experiments:

1. Study of the SCARA Robot mechanism in Robotics lab.
2. Study of the Ladder programming for the operation of SCARA Robot.
3. Study of the sensing system for the SCARA Robot.
4. Study of the FMS system as used as used in the modern industries.
5. Small scale coding of a computer program and its implementation on the SCARA robot.

SEMESTER – VI

Fluid Mechanics and Hydraulic Machines (M 601)

Unit – 1

Basic concept of fluid flow and their applications. Continuity equations and momentum equations. Pitot tube, orifice meter and Rota meter lift and drag.

Unit – 2

Viscous flow in circular pipes. Power absorbed in viscous flow loss of head due to friction. Methods of determination of coefficient of viscosity. Turbulent flow through pipes: Darcy Resistance equation, effect of Reynolds's no. on resistance coefficient minor losses pipes in series and in parallel siphon transmission of power through pipes.

Unit – 3

Basic concepts of turbo machines. Types of water Turbine and their construction, fundamentals equation and simple theory of design, performance characteristics curves. Geometric and dynamic similarity of Turbines performance of similar turbines, cavitations.

Unit – 4

Rotodynamic pumps: Different types and their construction, fundamental equation and simple theory of design performance, characteristics and operations.

Unit – 5

Positive displacement pumps: Reciprocating pumps, Rotary pumps, Vane pumps, Lobe pumps Hydraulic RAM, Air life pumps and Jet pumps.

Transmission storage of energy: Hydraulic accumulator, hydraulic servomotors, hydraulic coupling and Toque converter.

Book and References:

1. Fluid machines and Hydraulic Machines by Dinesh Kumar.
2. Fluid machines and Hydraulic Machines by A.K. Jain.
3. Fluid machines and Hydraulic Machines by R.K. Bansal.- Dhanpat Rai Publication
4. Fluid machines and Hydraulic Machines by S.Subramaniam. – TMH Publication
5. Turbo Machines by – A Valan Arosu.
6. Fluid Machines and Hydraulic Machines by Modi and Seth.- Standard Book Delhi-C

Fluid Mechanics and Hydraulic Machines (M 606)

List of Practical

1. Verification of Bernoulli's theorem.
2. Verification of Impulse momentum principle.
3. To calibrate a venturimeter and study the effect of Reynolds no. on venturimeter coefficient.
4. To calibrate an orifice meter and determine the variation of orifice meter coefficient with Reynolds no.
5. To study the performance and to draw the characteristic curves of Pelton wheel.
6. To study the performance and to draw the characteristics curves of the Francis turbine.
7. To study the performance and to draw the characteristics curves of centrifugal pump.
8. To study the performance and to draw the characteristics curves of Reciprocating pump.

STEAM TURBINES AND GAS DYNAMICS (M 602)

Unit – I

Vapour power cycles: Carnot cycle, Rankine cycle, modified Rankine cycle, representation on P-V, H-S and T-S diagrams, calculation for work and efficiency, Reheat cycle, Regenerative feed heating cycle. Requirements of vapour cycle fluids, limitations of water vapour, Binary vapour cycles and its analysis, important binary vapour fluids.

Unit – II

Steam Nozzles

Steady flow energy equation and its application to steam nozzle, expansion of steam through convergent and divergent nozzles, critical pressure ratio, condition for maximum discharge, choking of nozzles, effect of back pressure, supersaturated flow through nozzles, flow with friction, nozzle efficiency, steam ejectors and injectors.

Unit – III

Steam Turbines

Principle and working of impulse and reaction turbines, pressure and velocity compounding, Velocity triangles for various types, stage efficiency, diagram efficiency, steam speed to blade speed ratio for optimum performance, losses in steam turbines, performance at part loads, governing of turbines.

Unit – IV

Gas Dynamics

- (a) One dimensional flow: continuity, momentum and energy equations for steady compressible one dimensional flow.
- (b) Isentropic flow: Sonic velocity, Mach number, Mach angle, stagnation properties, isentropic flow through nozzles, choking, effect of friction, relationship between pressure drop, area and Mach number, efficiency, design, performance of nozzles.

Unit – V

- (a) Shock – Wave phenomenon, formation of normal shock, wave, governing equations, analysis of normal shock, shock in nozzles.
- (b) Flow Through Ducts – Flow through constant area ducts, adiabatic flow, governing equations, stagnation properties, choking effect, flow with heat transfer.

Suggested Text Books and References

1. Steam and Gas Turbine – W.J. Kearton—CBS Publisher, New Delhi
2. Steam and Gas Turbine– R. Yadav—Central Publishing House, Allahabad
3. Compressible fluid flow – S.M. Yahya
4. Thermal Engineering – R.K.Rajput—Laxmi Publication

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5. Introduction of Gas Dynamic – R. Rotty

STEAM TURBINES AND GAS DYNAMICS (M 607)

List of Experiments

1. Study of Steam power plant
2. Performance of High pressure Boilers
3. Study of Air - Craft Engine
4. Study of High Pressure boilers.
5. Study of Constructional details and description of steam turbine components.

Production Engineering (M 605)

Unit – 1

Metal cutting theory, geometry of cutting tools, metal machining, chip formation types of chips, force analysis for orthogonal cutting, velocity relationship, stress and strain analysis, power and energy relationship, thermal aspects, dynamometers for turning and drilling.

Unit – 2

Evaluation of machinability, Mechanism and types of tool wear, tool life, surface finish economics of metal machining, functions of cutting fluids requirements of good cutting fluid, cutting tool materials and their application.

Unit – 3

Metal working analysis, Deformation behavior of metals, stress and strain analysis, yield criteria, flow lines and plastic deformation of metal, force analysis for strip rolling, wires drawing and extrusion, slab method slip line field, upper and lower bound holographs in sheet metal working, formability test, forming limit diagrams and their application.

Unit – 4

Design analysis of machine tools, elements, structure, sideways and guides, spindle unit drives in machinery tools, layout of gearbox, stepped speed regulators hydraulic regulators.

Design of single point Cutting tools, rigidity, design of chip breakers, dynamic chip breaking. Usefulness, principle and design of jigs and fixtures, locating and clamping devices, diamond pin locator, jig bushes, drill jigs milling, turning, boring and broaching fixtures, assembly fixtures, welding fixtures indexing devices, materials for jigs and fixtures, economics of jigs and fixtures.

Unit – 5

Standardization, interchangeability, limits, fits BIS, BSS and navel system, selection of bits an per Indians standards, metrology various types of comparators, design of limit gauges, tolerance wear allowance and quality control, basic concepts.

FMS and CIM: - Concept and evaluation of CIM (computer integrated manufacturing) basic system configuration, approaches to CIM, Automation and its types.

FMS: Components and types of FMS, Automated storage and retrieval systems automated guided vehicle, types of flexibilities benefits and case studies.

Introduction to group technology and CAPP, design for manufacturing and assembly.

Books:

1. shekh Juneja B.L.& singh – fundamentals of metal cutting & machine tools-New age
2. C.K.Singh, Pandey P.C. – Production Engineering-sciences standard publishers

3. Rowe – Metal working
4. Autizur – Metal working
5. S.K. Basu- Metal cutting principle
6. Ghosh and Malik- Manufacturing Engg
7. Kempster – Jigs and Fixture and Tool Design
8. Tool Design –Cyril Donaldson, Lechain & goold-TMH
9. Metal cutting principles – Bhalcharya
10. Grooves and zimmess, CAD/CAM-PHI
11. Surendra kumar – Introductory robotics & CIM-IBM
12. Zeid CAD/CAM theory and practice

OPERATIONS MANAGEMENT (M 603)

Unit – I

Operation Management: Introduction, System concept, Difference between production and operation management, objectives and historical developments in operations management, types of production system job, batch and continuous production flexible production, role of production manager.

Unit – II

Facility planning: Plant location, factors affecting selection of site, advantages and disadvantages of city sites suburban sites, single and multistory building.

Plant Layout: Principles of plant layout types of layout their merits and demerits flow pattern, types of flow patterns, use of travel chart, facility design procedure such as CORELAP, CRAFT etc.

Scheduling and Sequencing: Factors affecting scheduling and its approaches, Gantt chart algorithms for job shop and flow shop line balancing LOB Introduction, Master Scheduling.

Unit – III

Production planning and control: Introduction, phases, functions of PPC, CAPP, forecasting methods its relationship with Product Life Cycle. Aggregate planning: Introduction, strategies of aggregate planning, graphic and charting methods.

MIS: Objective and cost benefits of MIS, Decision making and MIS, decision strategies, information, determination, needs, sources, characteristics, measurement and amount of information, information search, storage and retrieval. Information feed back system, design, implementation and evaluation of MIS. Functional application of MIS, Office automation system: definition and importance.

Unit – IV

Materials Management: Purchasing & Store Keeping-Objectives, policies, procedure etc. Inventory control: Introduction, types, economic lot size EOQ & EMQ models, JIT, ABC, VED analysis

Material requirement planning and capacity requirements planning: Introduction to MRP-II. Maintenance management: Introduction, types of maintenance strategies.

Material Handling: Types, economic consideration of different devices, selection of material handling devices.

Unit – IV

Economic Analysis: Elements of costs and break even analysis: importance and scope of BEP, analysis of a break even chart. Cost curves, pricing strategies for

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various products/situations. Nature and scope of financial management, ratio analysis financial statements, fund flow analysis, capital structure, sources of industrial finance, capital budgeting.

Books:

1. Monks, Operations Management
2. Eilons; Production planning
3. Buffa E.W.; Production and operation management
4. Gopal Krishna, Material Management
5. Financial Management; IM Pandey
6. Khan and jain; financial management
7. Kanter, Management Introduction system (PHI)
8. Murdick and Ross, Management Introduction system (PHI)
9. Martand Telsung : Industrial Engineering & Management (S.Chand)
10. Chary

MACHINE DESIGN AND DRAWING (M 604)

Unit – I

1. Basic Design concept: Design and design process design process, steps detailed morphology of design.
2. Design consideration: Strength manufacturing maintenance energy environment and safety life cycle assessment basis of design, Design for recycle and reuse selection of materials, Factor of safety for steady and variable load, optimization, reliability consideration and standardization.

Unit – II

1. Fatigue – Importance in engineering design, concept of fatigue, fatigue strength and endurance limit, stress concentration , Goodman and Modified Goodman diagrams, Soderberge and Gerber equation, effect & loading type, size surface finish, notch, surface treatment and corrosion, cumulative fatigue damage, Design for finite life, fatigue under complex stresses, applied problem, study of fatigue testing machine.

Unit – III

2. Creep : Temperature
Consideration in design, creep, designing for creep, creep parameters stress relaxation, applied problem study of creep testing machine.

Unit – IV

Design of following

1. Rotating Machines eg. Centrifugal pump compressor
2. Gear box. Introduction of various CAD soft wares.

Reference Books

1. Mechanical Analysis and Design – Burr and chetaman.
2. Centrifugal pumps and Blower's – A. Church and j.Lal
3. Mechanical engg design – J.E. shigley-TMH
4. Machine tool Design – N.K. Mehata-TMH
5. Machine Design – A. Mubeen-Khanna Publishers
6. Engineering Design – Dieter.

MACHINE DESIGN AND DRAWING (M 604)

MACHINE DESIGN PRACTICE

1. Select a daily use product and design the conceptual design by applying the design process taking the controlling parameters.
2. Make a list of mechanical components and know their material and suggest some alternative materials for each of them .
3. Study of Fatigue testing machine and plot S-N curve to find endurance strength for various materials .
4. Study Creep Testing Machine and plot creep curve to find creep stress .
5. Calculation of the velocity ratios required in a gear box and then design the gear box in practical application .
6. Convert the design procedure of Rotating Machine/Gear box into an algorithm and write a code for its design or with the help of an application software.

SEMESTER – VII

REFRIGERATION & AIR CONDITIONING (M 702)

Unit I

Introduction: Definition, history of refrigeration, standard rating of refrigerating machines, C.O.P. of refrigerating machines, types of refrigerating machines, types of refrigeration, ice-refrigeration, evaporative refrigeration, air compression refrigeration, air compression refrigeration, vapour compression refrigeration, steam ejector refrigeration. Absorption refrigeration, vortex tube refrigeration and thermoelectric refrigeration. Principle of working of each type.

Air compression refrigeration: Basic air compression cycle. Flow diagram its working and function of its main components. Carnot and bell coleman air refrigeration cycles, their representation, open and closed cycles relative merits and demerits. Air cycle systems for aircraft and missiles, numerical examples.

Unit II

Vapour compression refrigeration: Theoretical vapour compression cycle, its working and representation on P-H, T-S and P-V diagrams. Coefficient of performance, practical vapour compression cycle, its main point of difference as compared to theoretical cycle, dry and wet compression, their relative merits and demerits, purpose of sub cooling of the high pressure liquid and superheating the low pressure vapour. Effect of suction and delivery pressures, volumetric efficiency, calculation of COP, power etc. COP as heat pump components their types and relative merits. Advanced vapour comparison systems. Principle of working and relative merits. Single evaporator advanced cycle of vapour compression refrigeration systems with simple numerical examples, compound compression refrigeration systems.

Unit III

Absorption refrigeration system: simple absorption systems, practical system-its main points of difference and improvements. Principle of working and relative merits.

Electrolux refrigerator application. Steam ejector refrigeration: principles of working, simple cycle of operation, description and working of simple system. Relative merits and demerits, limitations, applications. Refrigerants: Requisites of an ideal refrigerant, properties of commonly used refrigerants ammonia, freon-12, freon-22, R134a etc. alternate eco friendly refrigerant Production of low temperature (Cryogenics): limitations of vapour compression system for the production of solid CO₂. Joule Thomson effect and liquification of gases. Application of low temperature. Vortex tube and thermoelectric system: principles of working vortex tube refrigeration, stage of development, limitations and applications, principles of working of thermoelectric refrigeration system, limitations and applications.

Unit IV

Air Conditioning Introduction: Definition, need for air conditioning, modes of heat rejection from human body and their relative importance on human comfort under different weather conditions. Main duties of a good air conditioning system, relative importance of each of these on human comfort and health.

Psychrometry: Definitions, properties of air, vapour mixtures, definitions of psychrometric properties, representation of psychrometric properties on chart, psychrometric processes and their representation on psychrometric chart for calculations. Various types of air conditioning systems, main features of each type of

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system, their field of applications and relative merits and demerits. Description and principle of working of each of these systems.

Unit V

Load calculations (Comfort air conditioning): sources of heat and moisture gains as applied to summer air conditioning. Their relative importance in various weather conditions and applications, consideration in designing a building to be air conditioned for minimizing the heat and moisture loss. Sensible heat factor. By pass factor, room apparatus & coil apparatus, dew point sources of heat and moisture loss in winter air conditioning, their relative importance. Methods of reducing winter air conditioning load.

Industrial air conditioning: purpose of industrial air conditioning, justification of industrial air conditioning, components of cooling loads for typical applications e.g. cold storage, considerations in designing of industrial air conditioning system, discussions of typical applications.

Special features of air conditioning systems for commercial and other similar buildings supermarkets, cinema halls, hospitals, offices, schools etc.

Books

1. Refrigeration and Air-conditioning By P.L. Balaney
2. Refrigeration and Air-conditioning By S. Domkundwar & C. Arore
3. Refrigeration and Air-conditioning By C.P. Arora
4. Refrigeration and Air-conditioning By Jorden & Priester
5. Refrigeration and Air-conditioning By Manohar prasad

HEAT AND MASS TRANSFER (M 701)

Unit – I

Basic concept: Modes of heat transfer, Fourier's law, Newton's law, Stefan-Boltzmen law, Thermal resistance and conductance, combined heat transfer process.

Conduction :Fourier's heat conduction equation in Cartesian, cylindrical and spherical co-ordinates, thermal diffusivity, linear one-dimensional steady state conduction through a slab, tubes, spheres and composite structures, electrical analogies, insulation, critical thickness of insulation for pipes and spheres, effect of variable thermal conductivity, Factors affecting conductivity of metals, liquids, gases and insulator.

Unit – II

Extended surfaces (fins): Heat transfer through rectangular fins of uniform cross-section. effectiveness and efficiency of fin, use of fin analysis for measuring thermometric error, cylindrical fins of uniform cross-section, application.

Unsteady state heat transfer: Transient and periodic conduction, heating and cooling of bodies with known temperature distribution, system with infinite thermal conductivity, response of thermo couple, graphical solution of unsteady state problems.

Unit – III

Convection :Introduction, free and forced convection, analysis of free and forced convection using dimensional analysis, empirical correlations for laminar and turbulent flow over flat plates and pipes. concept of thermal and hydrodynamic boundary layer and its use in analyzing convective problems.

Boiling and condensation:

Film wise and drop wise condensation, Nusselts theory for film wise condensation on a vertical plate and its modification for horizontal tubes, Boiling heat transfer phenomenon, Regimes of boiling, Boiling correlations, factors affecting boiling film coefficient.

Unit – IV

HEAT EXCHANGERS

Heat exchanger types parallel flow, counter flow. Evaporator and condenser overall heat transfer coefficient, fouling factors, Log mean Temperature difference (LMTD) method of heat exchanger analysis, Number of transfer units (NTU) method of heat exchanger analysis, effectiveness of heat exchanger.

Mass Transfer

Fick's law of diffusion, steady state diffusion of gases and liquids though solids, equimolar diffusion, isothermal evaporation of water into air, unsteady state three dimensional mass diffusion, transient mass diffusion in semi infinite stationary medium, mass transfer coefficient.

Unit – V

RADIATION

Mechanism electromagnetic spectrum, absorption, transmission, reflection and emission of radiation, emissive power, intensity of radiation, Plank's distribution law, Kirchoff's law, Stefan-Boltzmann law, emissivity, Wien's displacement law, concept of a black body, radiation heat exchange between black and gray surfaces, geometrical shape factor for simple geometries and its important characteristics, Radiation shields.

Books:

1. Heat Transfer – J.P. Holman-TMH
2. Fundamental of heat Transfer – Incropera and Dewitt-John Wiley & Sons
3. Heat and mass Transfer – R Yadav.
4. Heat and mass Transfer – R.K. Rajput.
5. Heat and mass Transfer – S. Domkundwar.

HEAT AND MASS TRANSFER (M 706)

List of experiments

1. Determination of overall heat transfer coefficient for parallel flow heat exchanger
2. Determination of overall heat transfer coefficient for counter flow heat exchanger.
3. Thermal conductivity of a material by guarded ring type apparatus.
4. Determination of heat transfer in forced convection.
5. Determination of Stefan-Boltzmann apparatus by Stefan-Boltzmann apparatus.
6. Determination of overall heat transfer coefficient for cross flow air/water heat exchanger.

Theory and Design of Machine-I (M 703)

Unit – I

Design Consideration: Human consideration in design, Aesthetic consideration in design, and economic consideration in design, ergonomic consideration in design. Stiffness and rigidity consideration in design, shock and impact consideration in design impact stresses, resilience, General rules for design of parts subjected to shock and Impact.

Unit – II

Vibration Isolation and Transmissibility, creativity in design and alternative design residual stresses, causes manufacturing process causing thermal gradient impact etc. contact stress, hertzian stresses.

Unit – III

Design of pressure vessel's use of standard codes stresses in thin cylindrical shell, thin special shell, design of thick cylindrical shell. Auto fretting, compound cylindrical shell unfired pressure vessel, end closures opening in pressure vessel.

Unit – IV

Brakes and Clutches: materials for friction surfaces, uniform pressure and uniform wear theories.

Design of friction clutches: Disk or plate clutch, cone clutch and centrifugal clutches

Design of Basic; Band brake, band and block brake.

Unit – V

Power screws forms of thread force analysis of power screw, efficiency of square threaded screw, design of power screw and power nut, differential and compound screw, complete design of screw Jack.

Reference Books

Machine design by Shigley (TMH)

Machine Design by Juvinall (John - Wiley)

Machine design by Spotts (PHI)

Machine design by R.Norton (PHI)

Machine design by Sharma and Agrawal (Kataria & Sons)

Design of machine element – B. Bhandari (TMT)

Engineering design – Dieter

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Engineering design – Sadhu singh.

MACHINE DESIGN PRACTICES

1. Select a existing mechanical component /system and suggest a new conceptual design by using various design consideration (ie Asthetic consideration, ergonomic consideration etc).
2. Select a bracking system and justify the design parmeters.
3. Justify the design of single plate clutch of a engine assembly .
4. Design a screwjack using practical application by actual working and loading conditions.
5. Computer Aided Design of Power Screw, Brakes and Pressure Vessels.

SEMESTER – VIII

Industrial Engg. & Management (M 801)

Unit - I

Industrial Engg. : Introduction , History of Development of Industrial Engg.,Place of IE in Industries and Business, productivity and standard of living.

Work study: Introduction ,objectives and its applications, Method study : Definition, objectives and basic procedure, selection of job, various recording techniques, charts like outline process charts, flow process charts (Man, material and equipment type) , Two handed process chart, multiple activity chart, Principle of motion economy & their application, Micro motion and memo motion study, Therbligs, SIMO charts, cyclographs & chronocyclographs, Critical examination and development creative thinking, Installation and maintenance of the new improved method.

Unit – II

(Time study) work measurement : Definition and objectives, basic procedure of work measurement techniques, time study equipment, number of cycle to be timed, stop watch study and other method of time study , system of performance rating, calculation of basic time, allowances and standard time. Work sampling: Principles and basic procedure, Design of work sampling study, establishment of standard time. Standard data system: Predetermined motion time system, M.T.M.

Unit-III

Ergonomics and value analysis : Ergonomics fundamentals, ergonomics as a multi-disciplinary field, components, types and characteristic of Man-machine systems, Application of ergonomics in design of displays, seating, layout of equipment, design characteristics of control, fatigue, physiological and other causes of fatigue. Value analysis & engineering ; Introduction and objectives, procedure and application questionnaire for value analysis.

Unit – IV

Inspection and quality control: Definitions objectives, quality control organization difference between inspection and quality control, application of quality control in industries, economics of quality systems ,quality assurance, function on inspections, inspection standard, quality control factors, S.Q.C. fundamentals distributions, control chart for variable and attributes, acceptance sampling, single and double sampling plan. T.Q.M., evaluation of TQM, historical perspective, elements of TQM to service type organizations. Quality circle.

Unit – V

Job evaluation and Wage Administration: Job evaluation: Purpose, various types of job evaluations system and their application, Job classification. Merit rating, objectives and methods of merit rating.

Wage Administration: Objectives of wage and productivity program, mechanics of wage program control and appraisal, various types of wage incentive scheme and their impact on productivity, comparison of different incentives plan, design of incentive plans, managing incentive schemes, supervisory incentive plans, wage curve, salary structure, Group system of wage payment.

Books

1. I.L.O. introduction to work study
2. Martand Telsang –Industrial Engg.& production management- S Chand
3. Sumanth D.L. Production management (TMH)

4. Maynaed H.B., Industrial Engg. Hand Book.
5. Jams K.C. and Chilole A.K., quality Assurance and total quality management.
6. Grant E.L. and leave worth-statistical quality control (TMH)
7. Singalton, Introduction to Ergonomics.
8. Techniques of value analysis & engg. Miles- MCGraw Hills
9. S.K Sharma and Sanita sharma-Industrial Engg. & operations Management- S.K.Kataria & Sons.

theory and design of machines-II (M 802)

Unit – I

Concept of wear friction and lubrication, tribology wear consideration in design, different types of wears, factors affecting wear, effect of surface films, surface endurance and surface temperature. Method to improve wears resistance. Measurement of wear, designing for wear life.

Unit – II

Bearings and lubrication:

Lubrication, types of lubrication, Hydrodynamic Hydrostatics and boundary lubrication. Types of lubrication, lubricant properties, viscosity and temperature consideration, classification of bearings factors affecting choice of bearing. Bearing material, bearing modules, Sommerfield number design of Journal Bearings using McKee equation and Rai mondi and Boyd chart.

Type of Antifriction bearing, Bearing life and load ratings, Reliability of antifriction Bearings. Selection of ball and roller Bearing, Bearing failure Modes, lubrication of rolling bearings.

Unit – III

Gear Design: Design consideration for gear drive, Gear Materials, Tooth load on spur. Beam strength of gear tooth, Lewis equation. Dynamic load, wear load, causes of gear tooth failure, complete design of spur gear, helical gear, Bevel gear and worm gear drives.

Unit – IV

Detailed Design and working drawing of one machine.

Petrol Engine/Diesel Engine or

Reciprocating compressor/reciprocating pump.

- Note:**
1. Use of PSG design data book is permitted design the exam
 2. Weightage of unit I, II, and III will be 20% each and that of Unit – IV will be 40% for exam.

Books:

1. Engineering Design - Dieter
2. Engineering Design - Sadhu Singh
3. Computer Aided analysis and design - Goshal (PHI)
4. Product Design and manufacturing - Chitale and Gupta (PHI)
5. Optimization for Engg. Design – Deb (PHI)
6. Machine Design – A. Mubeen
7. Machine Design – Sharma and Agrawal (Katariya)
8. Design of Machine elements. By V.B. Bhandari –TMH

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MACHINE DESIGN PRACTICE

1. Find a transmission system involving the (a) Spur gear (b) Bevel gear (c) Worm and worm wheel and then find out the inputs required for its design and justify the design.
2. Computer Aided Design of Petrol engine/Diesel engine Reciprocating Compressor/Reciprocating pump (any one).
3. Select a Transmission system involving shaft gears etc recommended a bearing and justify it.
4. Study of various Wear Measuring Methods

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ADVANCED METALLURGY –(ELECTIVE-I)

UNIT – I

Crystal structure, crystal imperfection, microstructure and their effect on the properties of metals and alloys, strengthening mechanisms.

UNIT – II

Diffusion, diffusion mechanism, diffusion rate, factors affecting diffusion, application of diffusion on carburising, nitriding, cyaniding, phase transformation, rate of transformation, factors affecting phase transformation.

UNIT – III

Heat treatment of steels, cast iron and non - ferrous metals and alloys, phase transformations during heat treatment Effects of heat treatment on the properties, heat treatment of production toolings, measuring tools, spring, sheets.

UNIT – IV

Mechanical behavior of metals and alloys, types of failure, details to brittle transition, fatigue failure, P.H. curve, factors affecting fatigue-failure, creep and stress rupture, mechanism of creep, factors affecting creep.

UNIT – V

Principles of mechanical working, deformation mechanisms, rolling, classification of rolling processes, rolling mills, roll pass design, draft, production of seamless pipes and tubings, drawing of rods, wires and tubes, sheet metal forming.

REFERENCE BOOKS:

1. Material Science. Narula, Narula & Gupta
2. A first course on Material Science. Raghuvan
3. Principles of Physical Metallurgy. Reedhill

COMPUTER AIDED MACHINE DESIGN

UNIT - I

Introduction to computer technology, computer systems, operating the computer system, hardware in computer aided design. Mechanical design process, benefits of computer aided design, role of design analysis programs in CAD.

UNIT - II

Principles of interactive computer graphics, geometric modeling, modeling and display of curves and surfaces, introduction and application of graphic software (e.g. Auto CAD).

UNIT - III

Computer aided design and drafting data base facility, part library, standard component and symbol library creation and operation, associability between master entities and occupancies, attribute definition and generation of bill of materials, database management.

UNIT - IV

Introduction to optimal design and optimization techniques for design of mechanical elements, computer aided optimum machine elements such as springs, shafts, bearings gears, etc.

BOOKS:

1. Computer Aided Design Taylor
2. Computer Aided Design Sadhu Singh
3. Computer Aided Design Zoomer

MAINTENANCE ENGINEERING (ELECTIVE-II)

UNIT – I

Introduction - Fundamentals of Maintenance Engineering. Maintenance Engineering its importance in material & energy conservation, inventory control, productivity, safety, pollution control etc.

Safety Regulations, pollution problems, human reliability, total quality management (TQM), total productivity maintenance (TPM), environmental issues in maintenance, ISO 9000.

UNIT – II

Maintenance Management - types of maintenance strategies, Planned and unplanned maintenance, breakdown, preventive & predictive maintenance. Their comparison, advantages & disadvantages. Limitations, computer aided maintenance, maintenance scheduling, spare part management, inventory control, organisation of maintenance department.

UNIT – III

Tribology in Maintenance, friction wear and lubrication, friction & wear mechanisms, prevention of wear, types of lubrication mechanisms, lubrication processes. Lubricants - types, general and special purpose, additives, testing of lubricants, degradation of lubricants, seal & packings.

UNIT – IV

Machine Health Monitoring - Condition based maintenance, signature' analysis, oil analysis, vibration, noise and thermal signatures, on line & off line techniques, Instrumentation & equipment used in machine health monitoring. Instrumentation in maintenance, signal processing, data acquisition and analysis, application of intelligent systems, data base design.

UNIT – V

Reliability, availability & maintainability (RAM) Analysis - Introduction to RAM failure mechanism, failure data analysis, failure distribution, reliability of repairable and non repairable systems, Improvement in reliability, reliability testing, reliability prediction, utilisation factor, system reliability by Monte Carlo Simulation Technique.

REFERENCE BOOKS :

1. Maintenance Engineering Hand Book Higgins
2. Maintenance & Spare parts Management Gopal Krishnan
3. Industrial Maintenance Management • S.K. Shrivastava
4. Hand book of Condition Monitoring CNR Rao

ROBOTICS PRACTICE & PRINCIPLES (ELECTIVE-IV)

UNIT – I

Introduction: Robot, classification of robot, characteristics of robot, performance, advantages and disadvantages of robot, application of robot **Fundamentals of robot:** Various system, structure and definition, terms relating to type of industrial robots, basic term relating to robot performance and characteristics.

UNIT – II

Controlling the robot systems: Introduction to drives, hydraulic drives, Electric drive, feed back control, applying the PIP control systems and its applications, stepper motor design.

Robot dynamics analysis : Introduction, torque and inertia, centrifugal force.

UNIT – III

Robot kinematics analysis : Manipulation kinematics, co-ordinate systems & workshop organization co-ordinate transformation, robot matrix and transformations, specification of orientation.

UNIT – IV

Sensing System : Introduction, types of sensor, machine vision, artificial Intelligence, control techniques, robot language and multilevel control language features.

Application of various types of robots.

UNIT – V

Robot safety: Introduction, potential safety hazards, safety planning check list, safety guide lines, latest development in safety measurement Introduction to robot programming language, programme algorithm, flow chart for main programme, straight line, circle, angle.

Book Recommended –

1. Fundamentals of Robotics by Schilling
2. Robotics Engineering- An Integrated Approach by Klifter
3. Introduction to Robotics by Craig.
4. Introduction to A I Robotics by Robin R Myrphy
5. Introduction to Robotics Analysis System Application by Niku

EXPERIMENTAL STRESS ANALYSIS (ELECTIVE-IV)

UNIT – I

Photo-elasticity : Theories of light, polarized light, methods of getting polarized, double refraction, quarter wave plate, plane and circular polariscope, dark and bright fields arrangement.

UNIT – II

Stress-optic law, expression for light emergent from plane and circular polariscopes containing, loaded model, Isoclinic and Isochromatics. Fringe constant and its determination by tension, disc compression and beam methods.

Determination of fractional fringe orders, Babinet-Soleil compensator, tension specimen as compensator, tension specimen as compensator, use of analyser for fractional fringe order determination.

UNIT – III

Requirements of good photoelastic material, properties of commonly used materials such as Bakelite, CR-39, Araldits, Gelatin etc.

Separation of principle stresses by lateral strain measurement by shear difference method and by electrical analogy.

Principle of three dimensional photo elastic analysis techniques of casting, stress freezing, slicing and stress pattern analysis.

UNIT – IV

Strain gauges : Mechanical, optical, acoustical, electrical inductance and electrical capacitance type strain gauges, electrical resistance type strain gauges, details of construction, method of fixing, gauges factor, gauge length, circuits for measurement of strain, temperature compensation. Strain rosettes of rectangular, delta and T-delta types, evaluation of stress from strain readings obtained from rosettes.

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UNIT – V

Miscellaneous topics : Moire fringes technique, brittle lacquero, method, membranes analogy, methods for non destructive testing of materials, model analysis.

REFERENCE BOOKS:

1. Experimental Stresses Analysis Rilley & Dally
2. Experimental Stresses Analysis Sadhu Singh

INDUSTRIAL MEASUREMENT (ELECTIVE-IV)

UNIT – I

Stress-strain measurement and strain gauges : Introduction, mechanical strain gauge, optical strain gauge, stress measurement by photo elastic, instruction for strain gauge stress-strain relationship.

UNIT – II

Measurement of vibration : Common causes of vibration, diagnosis and remedial measurement methods for vibration measurements, vibrations, vibration amplifier for permanent monitoring.

UNIT – III

Speed measurement : Mechanical tachometer, electric tachometer, different types of tachometer, pneumatic types speed transmitting elements. **Temperature Measurement:** Technical temperature measurement, method for measuring temperature, radiation properties, optical properties, electrical properties, thermocouples, thermistors.

UNIT – IV

Analysis : Spectroscopic analysis, absorption spectrometer, gas analysis, chromatography, infrared gas analyser.

Level Measurement : Direct and indirect methods, electrical conductivity method, robotics method, solid level detector, level measurement by capacitance prols.

UNIT – V

Fundamentals of industrial measurement : Basic principles of measurement, basic characteristics and dynamics of measuring instruments.

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Transducers and serving elements: Classification capability of transducers, digital transducer, hydro pneumatic sensor, thickness sensor, mechano-electrical transformation.

Reference Books:

1. Industrial Instrumentation DP. Eckman
2. Mechanical Measurements Backwith and Buck
3. Instrumentation Measurements Nakre and Chaudhary and Analysis

ADVANCED ENGINEERING MATHEMATICS (ELECTIVE-III)

UNIT – I

Fourier Series: The orthogonal set of function, orthogonality of Bessel's function and Legendre's polynomials, Sturm and Liouville's problem. Fourier integral, solution of boundary value problem by the use of Fourier series and Fourier integral.

UNIT – II

Integral Transform: Laplace Transform. Transform of Fourier, Hankel and Mellin inversion and convolution theorem, Application of Hankel and Mellin transforms in solving ordinary differential equations and that of Fourier transform in solving partial differential equations including the equations of steady flow.

UNIT – III

Tensors: Definition of covariant, contravariant and mixed tensor, tensor algebra, matrix tensors, Christoffel's symbol, covariant differentiation gradient, divergence, Curl and Laplace operation in tensor notation.

UNIT – IV

Complex Variable: Applications of analytic function in two dimensional problems, conformal transformations with application in electrostatic and electro-dynamics.

UNIT – V

Matrices: Inverse, Linear transformations, linear quadratic-forms, Cayley-Hamilton theorem, minimal equations, eigenvalues, rank, triangularisation and diagonalisation of matrices.

REFERENCE BOOKS:

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|-------------------------------------|-----------------------|
| 1. Higher Engg. Mathematics | B.S. Grewal |
| 2. A Text Book of Engg. Mathematics | Srivastava and Dhawan |
| 3. Engg. Mathematics | S. S. Sastry |
| 4. Engg. Mathematics | H. K. Dass |

ENERGY CONVERSION & MANAGEMENT

UNIT – I

Introduction : Review of world and Indian energy situation in respect of demand, supply and resources in the historic context Generalised energy conversions system. Primary and secondary energy sources. Their inter convertibility. Introduction to methods of converting various energy sources to electric power. Introduction to direct conversion methods.

Unconventional energy sources, new sources of energy (e.g.) solar, wind, tidal, geothermal, biothermal, gobar gas. MMD - Converter, energy cells, thermoelectric modules. A review on unconventional energy conversions. Review of power development in India.

UNIT – II

Fossil fuel steam stations: Basic principles of siting and power station design. Effect of climatic factors on station and equipment design, choice of steam cycle and main equipment, recent trends in turbine and boiler sizes and steam conditions. Plant design and layout, outdoor plant. System components. Fuel handling, burning systems, element of feed water treatment plant. Condensing plant and circulating water systems, cooling towers. Turbine room and auxiliary plant equipment. Instrumentation, testing and plant heat balance.

UNIT – III

Nuclear Power station: Importance of nuclear power development in the world and Indian context, review of atomic structure and radio activity. Binding energy concept Fission and fusion reaction. Fissionable and fertile materials. Thermal neutron fission. Principles of reactor control. Important fuels, moderators and coolants their relative merits. Heterogeneous reactor systems of various types. Homogeneous reactor systems. Fast and thermal breeders, Review of Indian nuclear energy programme.

UNIT – IV

Hydro-Power Station: Elements of hydrological computations. Rainfall run off, flow and power duration curves, mass curves, storage capacity, salient

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features of various types of hydel stations. General discussion on hydel station, component such as dams, spillways, intake systems, head works, flumes, pressure tunnels, penstocks, reservoir, balancing reservoirs etc. Selection of hydraulic turbines for power station duty, selection of site.

UNIT – V

Power Station Economics: Estimation and prediction of load. Maximum demand, load factor, diversity factor, plant factor etc. and their influence on plant design, operation and economics. Principles of hydro and nuclear power plants typical cost structures. Different type of tariffs. Simple problems on cost analysis, economic performance and tariffs.

Interconnected System: Their advantages, elements of load dispatch in interconnected systems.

Environmental aspect and care studies, Environmental control, health and safety on the plant, energy conservation, Indian industries case study.

REFERENCE BOOKS

1. Power plant Engineering Domkundwar
2. Power plant Engineering G.D. Rai
3. Power plant Engineering R.L. Agrawal
4. Energy Technology S.Rao & B.B. Parulkar
5. Power stations Engineering and Economy Skortzki and Vopat

COMPUTER AIDED MANUFACTURING & AUTOMATION (ELECTIVE-II)

Hardware and software description of computer aided design and Manufacturing (CAD/CAM).

UNIT – II

Details of modules of computerized numerical control (CNC) which are used in machine tools.

UNIT – III

Robot axes and configurations.

UNIT – IV

Flexible Manufacturing System (FMS) technology and its building blocks.

UNIT – V

Computer Integrated Manufacturing Systems (CIMS)

REFERENCE BOOKS:

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1. Numerically Controlled M/C. Tools H.MT.
2. Numerically Controlled & CNC Machines. Kundra
3. CAD/CAM Pujara & P.N. Rao

MATERIALS MANAGEMENT (ELECTIVE-III)

UNIT – I

Forecasting & Purchasing: Forecasting in purchase and sales, methods of purchasing, Functions, organization of purchase department, mass production, purchasing and its procedure, source selection, negotiation, make or buy decision how much to buy.

Inventory planning (MRP) and Spare parts Management: Types of Inventory, Computer control in materials planning, factors affecting ordering quantity, in-process inventories, raw materials supplies, The problem of spare parts, pattern of failure, Reliability and variety, reduction, classification of spares replenishment, service level, work-in-process.

UNIT – II

Inventory Controls and its Various Models: Ordering procedures, re-ordering, reorder point and quantity, economic lot size, economic ordering quantity, quantity discount, influence of uncertainty, continuous supply.

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Selection Control, ABC, XYZ, HML, VED, FSN, SDE, and SOS analysis. Spare parts management of spares Reliability and Quality of spares. Spare parts procurement , spare parts marketing and pricing. Management of obsolescence spares.

UNIT – III

Materials handling: Introduction, definition, batched goods, charged pallet ratio, cargo, integrated transport, line load etc. selection of material handling

Rail mounted trolleys , trolley and tractor , automatically guided vehicles , lift, elevators , other equipment, sorting installations.

UNIT – IV

Position restricted: jib cranes and other fixed industrial robots.

Auxiliary: load carriers (Pallets, Stillage etc.) warehouse layouts, goods reception and dispatch equipment, equipment for assembling and securing loads

UNIT – V

Store keeping and Management: Objectives of storekeeping, function of store organization, store organization, location of storekeeping deptt. factor affecting location, centralised and de-centralised storing.

Store Planning: Methods of store-keeping, moving materials into and out of stock, protection of stores, codification, materials requisition, Preservation of stores, disposal of surplus & scrap.

Reference Books :

1. Materials Management S.C. Sharma
2. An Integrated Concept of Materials Management N.M. Shah
3. Maintenance & Spare parts P. Gopal krishnan & Management A.K. Bannerjee.
4. Inventory Control Buffa.

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UNIT – I

Theory of Elasticity : Plane stress and plane strain problem, strain-displacement relation, stress - strain relations, equilibrium equations, body-force, compatibility equations, airy stress function, analysis of simple two dimensional problems in cartesian coordinates.

UNIT – II

Plates : Bending of circular plates carrying uniformly distributed load over entire surface or with concentrated load at centre, simply supported rectangular plate carrying uniformly distributed (excluding derivation of formulae).

UNIT – III

Torsion of non-circular section shafts : St Venant's methods, torsion of shafts of elliptical and rectangular sections, membrane analogy, torsion of shafts of thin tubular section.

Laterally loaded columns : Analysis of long columns carrying lateral loads in addition to axial compression eccentrically loaded columns.

Beams on Elastic Foundations: Modules of foundation, equal- ion of elastic curve, solution for beams of infinite and semi infinite length.

UNIT – IV

Deformation beyond elastic limit : Behaviour of material beyond elastic limit, perfectly plastic material, torsion of shafts and analysis of thick cylinders with radial pressure when loaded beyond elastic limit, residual stresses.

Mechanics of forming processes : Mechanics of wire drawing and tube drawing through cylindrical and conical dies, calculation of draw forces, effect of back pull, mechanics of forging process.

UNIT – V

Miscellaneous Topics : Contact stress in ball and roller bearings, bending of curved tubes, stress analysis of flywheel.

Design of members for fatigue and creep : Fatigue behaviour, factors affecting fatigue, mechanics of fatigue failure, fatigue under combined stresses, fatigue life and cumulative fatigue, design formulae for fatigue calculations. Mechanics of creep, relationships regarding creeprates at different stresses and temperature, bending of beams at high temperature, stress relaxation in steam turbine bolting, creep under combined stresses, creep analysis of rotating discs.

REFERENCE BOOKS:

1. Mechanics of Materials Vol. II E.J. Hearn
2. Strength of Materials Vol II Timoshenko – TMH Publication

Project Management

Unit – I

Management fundamental of organizational planning, strategic policies and planning premises, Managerial decision making, Strategic Organizational Design, Effective Organizing and Organizational Culture, Staffing Leadership Controlling.

Fiancé

Indian financial system and financial institutions, Valuation of securities, Financial statement analysis, Financial forecasting, Sources of long term finance, Cost of capital and capital structure theories, Estimating working capital needs, Capital expenditure decision.

Unit- II

Project life cycle and overview project planning, project execution, project monitoring and control, Project closure, Project initiation and resource allocation, Market and demand analysis, Technical analysis, financial projection, Appraisal criteria.

Risk analysis in capital investment decisions, Social cost benefit analysis, Multiple and demand analysis, multiple project and constraint.

Unit- III

Human resource management and project management, Interfacing with major stake holders, Issues in project organizational design, Designing a project organization structure, Matrix structure and making it work, Communication, A key to project success.

Unit – IV

Procurement planning, Solicitation planning, Solicitation, Source selection
Contract administration contract closeout quality planning, Qualitative risk analysis.
Quantitative analysis, Risk response planning, Risk monitoring control,
MIS for project management.

Unit – V

Project Management through Network Analysis ; Work Break Down structure, Gantt chart etc, PERT activity average time variance and project completion time by Normal Distribution. CPM Critical path, floats and their Interpretation Event occurrence times, Net Slacks Q storable and Non-storable Resource allocation, Crashing of Network, Time cost trade-off Monitoring and control, Features of control, Project control performance analysis and cost control curves, Line of balance, GERT, computer applications. Regulatory framework for projects and industrial licensing, Income Tax benefits, Incentives offered.

Project/Case studies

Books Recommended

1. Project preparation Appraisal and Implementation Prasanna Chandra, TMH
2. Project planning and appraisal jain D K Uppal publishing House.

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3. Project management, Dennis lock, Galgota Publishers.
4. Project Engineering and Management, Sinha and Sinha, Vikas Publishing House.
5. Project Planning and Control, Mohsin M, Vikas Publishing House.

ENTERPRISE RESOURCE PLANNING

Unit1.

ERP. An Enterprise Perspective: Production, Finance, Personnel disciplines and their relationships, Transiting environment, MIS Integration for disciplines, information/ Workflow, Network Structure, Client Server Integrator System, Virtual Enterprise.

Unit 2.

ERP: A Resource Management Perspective. Resource Management, HRD, Personnel Management, Training and Development, Skill Inventory, Material Planning and Control, Inventory, Forecasting, Manufacturing, Production Planning production Scheduling, Production Control, Sales and Distribution, Finance, Resource Management in global scenario, dynamic data management in complex global scenario.

Unit 3.

ERP: An Information System Perspective: Evolution of Application Software Technology Management, EDP, MIS, DBMS, DSS, OLAP(Online Analysis and Processing), TP, OAS, KBS, MRP, BPR, SCM, REP, Information Communication Technology, E-Business, E-Commerce, EDI.

Unit 4.

ERP: Key Issues and Consultants: Concept Selling, IT Infrastructure, ERP Culture, Implementation Issues, And Resistance to change. Public Service and Organizations (PSO) Project, ERP selection issues, Return on investment, Pre and Post Implementation Issues, Role of Consultants, Key consultants in India & Abroad

Suggested Readings:

1. Grag, V.K. and Veket Krishna N.K., "ERP Concepts and Practice", PHI Publication, 1997.
2. Champy, J. Harper, "Re-engineering Management", Harper Collins, 1995.

ENTREPRENEURIAL PRACTICES

Unit 1.

Industrial Science and General Environment: National and international economics & trades. Balance of payment, deficit financing, inflation, unemployment and their impacts on SSI. Importance of entrepreneurship. Government policies and incentives related to SSI. Administration of SSI and industrial culture, impact of productivity and modernization, Function and roles of support institutions like SFC's, Banks, SISI. DIG, LUN, AVN, AKVN. NSIC. SAIL. MMTC etc.

Unit 2.

Entrepreneurial Behavior : Personality of an _ entrepreneur. Transactional Analysis, Priorities and management of time, self image, skills and creativity Achievement motivation, Entrepreneurial communication, role playing exercises, Analyzing situations and opportunities, receiving feedback, observation, 'memory, visualization, spread and depth of thoughts.

Unit 3.

Selections, Testing & Purchases for Materials. Processes, Equipments & Services : Different standards and testing procedures, inspection fixtures, gauges and test rigs design, commercial materials and their rates, detailed estimation and costing of products and services, purchasing procedures, manpower selections and controls, Evaluating new products, various selections criteria for materials, processes, machinery and equipments.

Unit. 4

Taxation and Legal Aspects : Factory and labour laws, safety and ecological considerations, sales tax, income tax, customs duties, excise duties, ESI, PF, bonus and incentives, ownership constitutions, contracting.

Unit 5.

Some Special Aspects: Competitor studies, cost reduction techniques and value Engg. in SSL Low cost tooling and automation, site selections, layout and plant design aspects, Various forms and procedures in SSI, products specifications practices, Planning of a new enterprise, Designing aspects for services like transportation, hospitals, hotels, software facilities, civil constructions etc.

Project Report Preparation: Product identification, Market survey, detailed project report preparations, market research, advertisements, and feasibility reports.

Case Studies.

Books & References Recommended :

1. Jain R. K... *Guide to Industries Policies & Procedures*, All Indian investments Pub.
2. Ruddar Datt. *Indian Economy*, S. Chand & Co. Ltd.
3. Andersen R. L.. Dunkelnsberg J. S., *Entrepreneurship : Starting a new Business*. Harper & Row. NY.
4. Saravanavel P.. *Entrepreneurial Development*, Ess Pee Kay Pub. House.

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5. *A Hand Book for New Entrepreneur*, EDII Ahmedabad.

Materials management

Unit – I

Forecasting and Purchasing

Forecasting in purchase and sales, methods of purchasing, function, organization of purchase department, mass production purchasing and its procedure, functions organization of purchase department source selection, Negotiation, make or buy decision have much to buy.

Unit – II

Inventory planning and spare parts management :

Types of inventory, computer control in materials planning factors affecting ordering quantity, in-process inventory Raw material supplies, The problem of spare parts pattern of failure reliability and variety reduction classification of spares, Replenishment, Service level, work in process.

Unit – III

Inventory controls and its various models :

Ordering procedures, Re-ordering reorder point and quantity economic lot size, Economic ordering quantity, Quantity discount influence of uncertainty, continuous supply.

Unit – IV

Selection control, ABC, XYZ, HML, VED, FSN, SDE and SOS analysis, spare parts management of spares reliability and quality of spares, spare parts procurement, spare parts marketing and pricing management of absolute spares.

Unit – V

Store keeping and management codification :

Objectives of store keeping, function of store organization, location of store keeping department, Factor affecting location, Centralized and decentralized storing.

List of Experiment

1. Study of Boiler Mounting and Accessories.
2. Study of Boiler Cochran Boiler.
3. Study of Boiler Locomotive Boiler.
4. Study of Boiler Locashere Boiler.
5. Study of Boiler Babcock and Wilcox Boiler.
6. Study of Boiler and Stroke petrol Engine.
7. Study of Boiler and stroke petrol engine.
8. Study of Boiler and stroke Diesel Engine.
9. Study of Window air conditions.

Stroke Planning:

Methods of store keeping moving materials into and out of stock, protection of stores, codification, materials requisition preservation of stores, Disposal of surplus and scrap.

Suggested Text Books and References

1. Material Management – S.C. Sharma.
2. An integrated concept of Materials Management – N.M. Shah.
3. Maintenance and spare parts management – P. Gopal Krishna.
4. Inventory Control – Buffa.

OPERATIONS RESERCH

UNIT-1:

History & development of operation research, Art of modelling, some mathematical preliminaries, general methodology of OR, application of OR to industrial problems.

Project management through network:

Work breakdown structure etc, project planning , difference between CPM & PERT.

CPM: critical path, floats & their interpretation, event, occurrence time ,slacks, crashing of network.

PART: Activity average time, variance & project completion time.

MANAGEMANT INFORMATON SYSTEM

UNIT-I

Introduction: Objectives and cost benefits of Management Information systems (M.I.S.), Decision making and M.I.S. A decision environment model, Decision strategies.