(59)

Price- 10

॥ अंतरी पेटवू ज्ञानज्योत ॥

North Maharashtra University,

Jalgaon

Syllabus for Second Year Engineering Degree Course in

MECHANICAL ENGINEERING

(w.e.f. July, 1999)

NORTH MAHARASHTRA UNIVERSITY, JALGAON

S.E. (MECHANICAL ENGG.)

SEMESTER - I

(W. E. F. July, 1999)

SR. NO.	CODE	SUBJECT	TEACHING SCHEME (HOURS PER WEEK)		EXAMINATION SCHEME				
			LECTURE	PRACTICAL	DURATION PAPERS (hrs)	MAXIMUM MARKS THEORY	TERMWORK	PRACTICAL	ORAL
01.	**	ENGG. MATHEMATICS-III	04	1(T)	03	100	—	—	—
02.		ENERGY CONVERSION - I	04	02	03	100	25	—	25
03.	**	M/C DRAWING AND COMPUTER GRAPHICS	04	06	04	100	25	—	25
04.		DYNAMICS OF MACHINERY-I	04	02	03	100	25	—	25
05.	**	MANUFACTURING PROCESSES	04	—	03	100	25	—	—
06.	**	WORKSHOP PRACTICE - III	—	* 03	—	—	25	—	-
		TOTAL	20	14	—	500	125	—	75
		GRAND TOTAL	34						700

NOTE- * Theory related to workshop practice III is to be taught in workshop in practical hours.
** Common to Mechanical and Production Engg.

S.E. (MECHANICAL ENGG.)

SEMESTER - II

(W. E. F. July, 1999)

SR. NO.	CODE	SUBJECT	TEACHING SCHEME (HOURS PER WEEK)		EXAMINATION SCHEME				
			LECTURE	PRACTICAL	DURATION PAPER (hrs)	MAXIMUM MARKS THEORY	TERMWORK	PRACTICAL	ORAL
01.	**	MECHANICS OF MATERIALS	04	—	03	100	—	—	—
02.		FLUID MECHANICS	04	02	03	100	25	—	25
03.	**	INDUSTRIAL ELECTRONICS & DRIVES	04	02	03	100	25	—	—
04.		ENERGY CONVERSION - II	04	02	03	100	25	25	
05.	**	MATERIAL SCIENCE	04	02	03	100	25	—	—
06.	**	WORKSHOP PRACTICE - IV	—	03*	—	—	25	—	25
		TOTAL	20	11	15	500	125	—	75
		GRAND TOTAL	31					700	

Note :- * Theory related to workshop practice IV is to be taught in workhop in practical hours.
** Common to Mechanical and Production Engg.

TOTAL of Maximum Marks of term I & II = 1400

ENGG. MATHEMATICS III

S.E.(Prod. & Mech.)

Teaching Scheme:-
Lectures:- 4 Hrs/week
Tutorial:- 1 hrs/week

Examination Scheme:-
Paper:- 100 marks
Paper Duration :- 3 hrs

UNIT I:- LINEAR DIFFIRENTIAL EQUATION:- (10 lectures)

Linear diffirential equation of order 'n', solution of linear diff. equation with constant coefficient, methods of variation of parameters, equation reducable to linear form (with const coeff.), Cauchy's linear equation, Legendre's linear equation. Applications of linear diff. equation to mass, spring system with coupled masses, whirling of shafts.

UNIT II:- (10 lectures)

2.1. Simultaneous L.D. equation of the forms

(i) $f_1(D)x + f_2(D)y = U_1(t)$)
$g_1(D)x + g_2(D)y = U_2(t)$) where $D = d/dt$

(ii) Symmetrical form : $dx/P = dy/Q = dz/R$

2.2. Partial differential equations: Problem related to solution of
(i) Wave equation
(ii) One dimensional heat flow equation
(iii) Two dimensional heat flow equation in steady state i.e. Laplace equation.

2.3. Application of elementary differential geometry, tangent line, principal normal, binormal to space curve, osculating plane, normal and rectifying planes, the torsion, curvature of curve. frenet serret formulae.

UNIT III:- (10 lectures)

3.1. Laplace Transform:
Definition of laplace transform, Inverse laplace transform, properties and theorams, laplace transforms of standard functions, unit step function, impulse function, Laplace inverse transforms. Periodic functions.
3.2. Application of Laplace Transform to solutions of different equations. (Linear).

UNIT IV:- (10 lectures)

4.1. VECTOR CALCULUS:- Vector differentiation, Radial & transverse, tangential & normal components of linear velocity and acceleration, Gradient of scalar point functions, Divergence & curl of vector point functions, Fractional & rotenoidal vector fields.
4.2. APPLICATION OF FLUID MECHANICS:- Problems related to equation of stream lines, Euler's equation of continuity equation of motion.

UNIT V:- (06 lectures)

5.1. Line integral, Green's lemma, Stoke's theorem, Gauss's divergance theorem.
5.2. FOURIER TRANSFORM:- Fourier integral theorem (only statement). Problems on sine, cosine integration and transforms.

ENERGY CONVERSION - I

S.E.(Mech)

Teaching Scheme:-
Lectures:- 4 Hrs/week
Practicals:- 2 Hrs/week

Examination Scheme:-
Paper:- 100 marks
Termwork:- 25 marks.
Oral:- 25 marks.
Paper Duration :- 3 hrs

UNIT I:- Fuels and Combustion and Steam Generators:- (12 Lectures)

Types of fuels, calorific values and their determination, combustion equations, Stoichiometric air-fuel ratio, flue gas analysis, Orsat apparatus, gravimetric and volumetric analysis and their conversions, excess air, determination of actual quantity of air from combustion analysis.

Steam Generators :-

Classifications, equivalent evaporation, boiler efficiency, energy balance, steam generation controls, boiler draught, natural and artificial draught, draught losses, regulation for chimney height, introduction to IBR laws.

UNIT II:- Condensers and Nozzles:- (08 lectures)

Introduction to condensers, Jet and surface condensers, types of condensers, condenser vacuum and vacuum efficciency, air pumps, capacity of air extraction pumps, cooling towers.

Nozzles:-

Types of nozzles, isentropic flow, use of mollier chart, effect of friction, Nozzle efficiency, critical pressure ratio and maximum discharge, super saturated flow, effect of variation in back pressure on nozzle characteristics.

UNIT III:- Vapour Power cycles:- (8 Lectures)

Carnot cycle applied to steam power plants, modified Rankine cycle, regenerative feed heating, regenerative cycle, parameters affecting Rankine cycle, reheating of steam, Reheat factor, inlet pressure and back pressure on performance of Rankine cycle.

Steam Engine:-

Constructional features and development, compound steam engine, indicator diagram, MEP, thermal and mechanical efficiencies, steam consumption.

UNIT 4:- Reciprocating Air compressors:- (08 lectures)

Reciprocating air compressors:- Introduction, classification, construction and details of single and multistage compressors, computation of work done, isothermal efficiency, effect of clearance, volumatric efficiency, F.A.D., theoratical and actual indicator diagrams, method of improving volumatric efficiency, need of multistaging, condition for maximum efficiency, intercooling and aftercooling, actual indicator diagram of multistage compressor, capacity control of compressors.

UNIT V:- Available Energy and Availability : (08 lectures)

Introduction, Availabile and unavailable energy, availability of system with heat transfer, availability of the non-flow and steady flow system, irreversibility energy analysis, availability function.

TERMWORK:

LIST OF PRACTICALS:-

1. Study of compound steam engine (neat sketch of compound steam engine indicating important parts).
2. Study of surface condensor/air extraction pumps, cooling towers, (with neat sketch).
3. Study and trial on reciprocating air compressor.
4. Determination of calorific value using bomb calorimeter.
5. Determination of exhaust gas analysis.
6. Study of boiler draught.
7. One assignment of numerical problems compulsory
8. Visit to thermal power station.

** Use of model should be done wherever necessary.
** All the experiments should be completed in the form of journal.

References books

1. Thermal Engg.
   by P L Ballaney
2. Thermal Engg
   by P K Purohit
3. Thermodynamics and heat engines
   by Arora, Domkundwar

MACHINE DRAWING AND COMPUTER GRAPHICS

(SE Mech. & Prod.)

Teaching Scheme:
Lectures : 4 Hrs/week
Practical: 2Hrs/week

Examination Scheme:
Paper: 100 marks
Term work: 25 marks
Oral : 25 marks
Paper Duration : 4 hrs

UNIT I:- (06 lectures)

1. Detail drawing of followings with complete dimensioning tolerances, material & surface finish specifications as per I.S. Codes.

- 1.1. Arbor
- 1.2. Couplings:-1.2.1. Universal coupling
  - 1.2.2. Oldham's coupling
- 1.3. Bearings
  - 1.3.1. Simple bush bearing
  - 1.3.2. Ball bearing & roller bearing
  - 1.3.3. Plummer block - details & assembly
  - 1.3.4. Foot step bearing
- 1.4. Bracket
- 1.5. Pulleys
- 1.6. Pipe joints
- 1.7. Lathe parts
  - 1.7.1. tool post
  - 1.7.2. Tail stock
- 1.8. Screw jack

UNIT II:- (06 lectures)

2.1. Introduction to the principle of part drawings & detailed working drawings, and assembly drawings.

2.2. Conventional representation
- 2.2.1. Welded joints
- 2.2.2. Pipe fitting & pipe joints
- 2.2.3. Springs
- 2.2.4. Screw threads

2.3. Working Drawing
- 2.3.1. I.C. engine parts
- 2.3.2. Tool Holder for CNC lathe
- 2.3.3. Vices
- 2.3.4. Clutches
- 2.3.5. Valves

UNIT III:- LIMITS, FITS AND TOLERANCES :- (06 lectures)

3.1. Introduction, terminology used in limits and fits, designation of tolerances, limits, fits, Indian standard system - Hole basis system, shaft basis system, suitable examples of application to product design, limit gauges and gauging. ISO system of tolerances, Surface roughness, texture, machining symbols, roughness value.

UNIT IV:- COMPUTER GRAPHICS: (12 lectures)

4.1. Study of drafting package Autocad Release 14 and introduction to latest version.
4.2. Study of Autocad commands for different operations.
4.3. To draw the given drawing with all details in at least two views, use of layers, dimensioning & all machining symbols.
4.4. To write sequence of commands for a particular part drawing.
4.5. Isometric drawings of simple machine components.
4.6. Use of MsAccess, Hayward Graphics package to draw different types of charts, graphs.

UNIT V : AUTOLISP (12 lectures)

A] a) Introduction to Autolisp.

b) Data types in Autolisp: Real, Integer, Strings, Lists, Selection Sets, Data type conversions.

c) Math Functions: Addition, Substraction, Multiplication, Division. Maximum and Minimum of numbers, Trignometric functions, Logical Functions.

d) Input & output functions.

e) Control Structures in Autolisp control functions.

f) Recursion with Autolisp: Nesting, iteration and rcursions. Tail recursive procedure.

B] a) Defining functions: Concept of Editor, Basic functions in Autolisp. Creating new commands and using AutoCAD as automating tool.

b) User response functions. Geometric and relational functions.

c) Menu customisation.

d) Application Programs: Simple Mechanical engineering based application programmes through Autolisp such as Design & Drafting of Knuckle joint through Autolisp. Design & Drafting of cotter joint through Autolisp.

e) Programs based on decision making required in mechanical engineering Design.

TERM WORK:-

Termwork shall consists of :

a) Three projects based on above syllabus. Two projects consisting of a imperial size sheets - involving assembly drawing with a part list and overall dimensions and drawings of individual components.

Manufacturing tolerances, surface finish symbols and geometric tolerances should be specified so as to make it working drawing. The third sheet should contain all the machining symbols, tolerances, welding symbols, etc.

b/ Two assignments on AutoCAD.

c) Two assignments on Autolisp (such as Design and drafting of knuckle joint through Autolisp)

REFERENCE BOOKS :

1. Machine Drawing by N D Bhatt.
2. Mechanical Engineering Design by J E Shigley & C R Mischke - 5th edition, McGraw Hill Publications.
3. P S G Design Data Book.
4. Machine Design - Hall & Helowenko - Schaum Series.
5. AUTOCAD references manual.
6. Machine Drawing by N Sidheswar & P Kannaiah - Tata McGraw Hill Co. Ltd.

DYNAMICS OF MACHINERY - I

S.E. (Mech)

Teaching Scheme:-		Examination Scheme:-	
Lectures:-	4 Hrs/week	Paper:-	100 marks
Practicals:-	2 Hrs/week	Termwork:-	25 marks.
		Oral :-	25 marks
		Paper duration:-	3 hrs

UNIT I:- BASIC CONCEPTS OF MECHANISMS AND MACHINES:- (08 lectures)

1.1. Kinematics & statics of machines, Analysis & synthesis, resistant bodies.
1.2. Definitions of Element, Link, Structure, Frame, Pair and its classifications
1.3. Definitions of elements, Link, Structure, Frame, Pair and its classifications.
1.4. Definition of Kinematics chain, Machines & mechanisms, Classification of Mechanism.
1.5. Motion & its types, Analysis of Constrained motion, Degree of freedom.
1.6. Inversions of mechanisms, Inversions of single nd double Slider Crank Mechanism, SHM.
1.7. Kinematics diagram of mechanisms such as Straight line pentograph, Geneva mechanism, Steering gear mechanism, Hooke's joint, Watts mechanism, Straight line mechanism, Offset straight line mechanism.
1.8. Instantaneous center of rotation, body & space centordes, & its application.
1.9. Kennedy's theorem of three centers in line & its applications.

UNIT II:_ VELOCITY AND ACCELERATION:- (12 lectures)

2.1. Velocity & acceleration and its purpose
2.2. Velocity & acceleration diagram
2.3. Coriolis component of accelleration.
2.4. Velocity and acceleration by vector algebra.
2.5 Velocity and acceleration by complex algebra.
2.6. Coordinate system, Loop closure equation, Chase equation
2.7. Velocity and acceleration of slider crank mechanism by analytical method, Klein's construction

UNIT III:- STATIC FORCE ANALYSIS & COMPUTER AIDED ANALYSIS:- (10 lectures)

3.1. Static force analysis of slider crank mechanism
3.2. Inertia force analysis of rigid bodies, Methods of finding inertia of rigid bodies.
3.3. Compound pendulum, Bifilar & trifilar suspension methods.
3.4. Inerrtia forces in engine mechanism, Inertia of geared system.
3.5. Dynamically equivalent system & its applications.
3.6. Introduction to Computer Aided Analysis.
3.7. Computer Aided Analysis of Four link mechanisms, Slider crank mechanism.

UNIT IV:- FRICTION AND LUBRICATION:- (08 lectures)

4.1. Types of friction, Laws of friction
4.2. Inclined plane.
4.3. Screw threads.
4.4. Pivots & Collers, Clutches - Types, power transmitted, Friction material.
4.5. Lubricants and its properties, Systems of lubrications, Methods of Lubrication.
4.6. Friction circle and friction Axis.

UNIT V:- BELT, ROPE ,CHAIN DRIVES:- (08 lectures)

5.1. Flat belt drive, Rope drive, Open & closed Belt drive.
5.2. Action of belts on pulleys, Velocity ratio
5.3. Slip, creep, Crowning of pulleys
5.4. Length of belt, V-belt & pulleys.
5.5. Power transmitted and Maximum power transmitted
5.6. Centrifugal effect on belt.
5.7. Chain, Chain length, Classification of chain, Specification of chain, Selection of chain and sprockets.
5.8. Angular speed ratio of chain.
5.9. Hoisting & Hauling of chain
5.10. Power transmitted by chain.

TERMWORK SHALL CONSIST OF FOLLOWING:

1) Three sheets (Half imperial size), Graphical solution of problems on velocity, acceleration in mechanism by relative velocity method, instantanous center of rotation method, Kleins construction, One problem containing coriolies component of acceleration.
2) A journal consisting of
   i) Experimentation on any four:-
      a) Determination of moment of inertia of rigid body by Bifilar or Trifilar suspension methods.
      b) Experimental determination of velocity and acceleration of Hook's joint.
      c) Determination of slip of flat belt drive.
      d)Determination of displacement of slider crank mechanism with the help of model & plot velocity & acceleration curves from it.
      e) Determination of mass moment of inertia of compound pendulum
   ii) Assignments:-
      a) Developing computer programme for velocity and acceleration of mechanism.
      b) Inertia forces in engine mechanism.
      c) Lubrication systems.

REFERENCES:-

1. Theory of machines
   by Thomas & Reven
2. Theory of Machines & Mechanisms.
   by Shigley.
3. Theory of Machines & Mechanisms.
   by P.L.Ballany
4. Theory of Machines & Mechanisms.
   by jagdishlal
5. Theory of Machines & Mechanisms.
   by S.S.Rattan, Tata McGraw Hill.
6. Theory of Machines & Mechanisms.
   by Ghosh, Malik

MANUFACTURING PROCESSES
S.E.(MECH & Prod)

Teaching Scheme :
Lectures : 4hrs/week

Examination scheme:
Paper : 100 marks
Termwork : 25 marks
Paper Duration:- 3 hrs

UNIT-I:- CASTING PROCESSES : (08 lectures)

1.1. Casting processes: Fundamentals of metal casting :- Introduction, Solidification of metals, Fluid flow and heat transfer.

1.1.1. Types of patterns and materials used.

1.1.2. Pattern allowances.

1.1.3. Design considerations in patterns.

1.1.4. I.S. Codes, melting and casting metals.

1.1.5. Foundry classification, tools & equipments, core boxes, core prints, moulding sands- types, properties & testing, molding procedure, sand -conditioning equipment, core making, sheet moulding, investment casting, die casting, slush casting, Expandable pattern casting, squeeze casting, vacuum casting, centrifugal casting. advantages and limitations of all above mentioned casting processes.

1.1.6. Casting techniques for single - crystal components, Gating & risering of castings, Melting furnaces - operation, fettling & cleaning, Casting defects, Design considerations and economics of castings and numericals on gating system design, risering design, etc.

1.1.7. Molding Processes :- Pit molding, Green Sand molds, Skin-dried molds, Laom molds, , Design of mould from component drawing by consideration of various allowances applicable.

UNIT - II:- JOINING PROCESSES:- (10 lectures)

2.1 Introduction, classification, terminology used in processes, tools & appliances, equipment, adhesives, fluxes, safety precautions, advantages, defects - causes, detection & remedies, limitations & applications of following processes :-

a) Arc welding (AC & DC), CO2 welding.
b) Gas welding & cutting
c) Spot welding
d) TIG, MIG
e) Thermit
f) Soldering & Brazing.

2.2 Solid-state welding processes :-

2.2.1 Introduction, cold welding, friction welding, etc.

2.3 Welding design and process selection :-

Weld quality, weldability, weld design and process selection, etc.

UNIT - III : FORMING & ROLLING PROCESSES : (08 lectures)

3.1. Introduction to forming processes, classification, Theory of plasticity :- Mohr's circle-Three dimensions, the flow curve, anisotropy in yielding, effect of strain rate, mechanics of metal forming, product applications.

3.2. Rolling :- Introduction, Rolling mills - construction & operation, deformation in rolling & determination of force/torque required. Geometry in rolling, friction and lubrication.

Rolling of rounds, flats & sections. Production of seamless tubing & pipe. Roll pass design. Defects in rolled products. No numericals.

3.3. Forging :- Introduction, Open and closed die forging, upsetting, edging, fullering and swaging, Hot & Cold forging, Forging hammers & presses - their construction, working & capacities. Design of forged parts & forging dies, selection of parting line, shrinkage and other allowances, load calculations. Defects & lubrication in forging.
Economics of forging.

UNIT IV :- EXTRUSION & WIRE DRAWING : (08 lectures)

4.1. Extrusion : Direct & reverse extrusion. Extrusion plant details and working. Dies for extrusion, stock preparation. Force required for extrusion, role of friction in extrusion. Lubricants , hot & cold extrusion.
Deformation & defects in extruded parts.
Hydrostatic extrusion, impact extrusion.

4.2. Wire drawing : Wire drawing machines, construction & working. Preparation of stock for drawing. Wire drawings dies, materials and design.
Force required for drawing. Lubricants in drawing, meximum reduction per pass.Defects in wire products, tube drawing.
Forming of wire products.

UNIT V :- Forming & Shaping of Plastics, Ceramics & Glass.
(8 lectures)

5.1. Introduction, shaping ceramics, Forming & shaping glass, Techniques for treating glass. Design considerations.

5.2. Thermoforming, Moulding - Injection, Blow, Rotational, Compression, Transfer, Processing Elastomers, Rapid Prototying, processing metal matrix & ceramic matrix composites.

Term Work:-

1. Assignment on different types of pattern.
2. Assignment on casting and molding process. including ISI codes.
3. Assignment on welding process and weld design.
4. Assignment on rolling and forging process.
5. Assignment on extrusion and wire drawing process.
6. Assignment on economics and accuracy obtainable by different processes.

Reference books:-

1. Metal forming Technology
   by Narayanswamy

2. Principles of manufacting Material & Processes.
   by J.S. Campbell
   * Tata McGraw Hill Ltd.
3. Production Technology
   by HMT
   * Tata McGraw Hill LTd
4. Manufacturing Technology
   by P N Rao

WORKSHOP PRACTICE - III
(SE Mech. & Prod.)

Teaching Scheme:
Practicals:- 3 Hrs/week

Examination Scheme:
Term work :- 25 marks.

1. Study of different tools, measuring instruments, specification of following machine tools.
   i) Lathe ii) Milling iii) Grinding iv) Shaper
   v) Drilling

2. Each candidate shall be required to complete and submit the following termwork.
   a) Lathe m/c:- One job on lathe having turning, taper turning, threading, knurling, drilling, chamfering, boring, operations.
   b) Forging and grinding of Lathe tool showing all angles & its measurements - one job.
   c) Shaper:- One job on shaper having dovetail machining & irregular surface machining operation.
   d) Milling:- One job on milling having keyway milling & thread milling operation.

3. Determination of cutting speeds, feeds, machining time & other parameters required for above job such as cost estimation etc.

NOTE:- A) The candidates are required to finish the job to the following limits.
   i) Lathe:- +/- 0.05 mm
   ii) Grinding:- +/- 0.05 mm
   iii) Shaper :- +/- 0.05 mm
   iv) Milling:- +/- 0.05 mm

B) Workbook shall include description with detailed drawing i.e. working drawing of each job showing all dimensions, limits, finishing processes, material used, machining symbols etc.

C) Theory concerning is to be taught in workshop only to every batch going to workshop for practicals; not in lecture rooms and only in practical hours only.

D) Demonstration on different cutting fluids and their actual applications.

E) THEORY :

(i) Introduction to machine tools and their attachments.

(ii) Standards of Measurements : Line & end standards, Interchangeable system - limits, fits and their system. Limit gauging.

(iii) Linear Measurements:- Vernier callipers, height gauges, bore gauges, use of slip gauges, surface plates, pitch gauge.

(iv) Angular measurements : Angle plates, protractors, levels, sino-bars, auto collimator, clinometers, dividing heads and special methods of angular measurements.

(v) Errors in measurements : Temperature, parallax, sine and cosine errors and allignment.

MECHANICS OF MATERIALS

S.E.(Mech & Prod)

Teaching Scheme:-
Theory:- 4 Hrs/week

Examination Scheme:-
Paper:- 100 marks
Paper Duration :- 3 hrs

UNIT I:- (08 lectures)

1.1. Concept of stress and strain (linear, lateral, shear, and volumatric), Hooke's law, Poisson's ratio, modulus of elasticity, Modulus of rigidity, stress-strian diagrams for ductile and brittle materials, factor of safety and working stress, Hooke's law, concept of 3D stress state. Bulk modulus, interrelation between elastic modulus.

1.2. Axial force diagrams, stress strain and deformations in determinate homogeneous and composite bars of following types.

1) Prismatic
2) Linearly varying and
3) Stepped sections under concentrated load & self wt.

1.3. Axial stresses and strains in determinate members- Axial stress, strains and deformations in following indeterminate homogeneous and composite bars.

1) Prismatic
2) Linearly varying and
3) Stepped bars, due to concentrated loads, self weight and temperature changes.

UNIT II:- (08 lectures)

2.1. Principal stresses and strains- Normal and shear stresses on any oblique planes, concept of principle planes, deviation of expressions for principle stresses strain and maximum shear stress, position of principal planes and planes of maximum shear, graphical solution using Mohr's circle of stresses, combined effect of shear and bending in beams.

2.2. Strain energy and impact- Concept of strain energy. Deviation and use of expressions for deformations of axially loaded members under gradual, sudden and impact loads. Strain energy due to self weight.

Theories of failure - Maximum stress, maximum strain, Max. shear stress, Max. total strain energy.

UNIT III:- (10 lectures)

3.1. Shear force and BM diagrams- concept and definations of SF and BM in determinate beams due to concentrated, UDL and uniformly varying loads and couples. Relation between SF,BM and intensity of loading construction of SF and BM diagrams for cantilerers simple and compound beams and bents defining critical and max. values and position of points of contraflexure.

Construction of loading diagrams and BMD from SFD, construction of loadig diagrams and SFD from BMD.

Slope and deflection of beams - Relation between BM, slope,slope and deflection for determinate beams. Double integration method.(Mecauley's method)/ derivation of formula for slope and deflection for standard cases.

3.2. Bending stresses:- Theory of simple bending, assumptions, derivations of flexure formula, second moment of area of common cross section with respect to centroidal and parallel axes. Bending stress distribution diagram. Moment of resistance and section modulus. Calculation of force on partial area of cross section and MR offered by partial area.

(08 lectures)

UNIT IV:-

4.1. Axially loaded columns, concept of buckling of column, derivation of Euler's formula for buckling load for column with hinged ends. Concept of equivalent length for various end conditions, Rankine's formula, formulae given by IS code, safe loads on columns, Limitations of Euler's formulae.

4.2. Direct and bending stresses in short columns and other structural components. Stress distribution diagram. Axial load with single eccentric self weights combined with lateral loads, concept of core of a section .i.e. middle third rule.

4.3. R.C.C. struts and columns:-
Design for no tension, Behaviour of concrete in tension and its limitations, tensile strength of R.C.C. and P.S.C.

(08 lectures)

UNIT V:-

5.1. Torsional shear-stresses:- Concept, derivation of shear stress distribution formula, shear stress distribution diagrams for common symmetrical sections, Max. and average shear stress, shear connection between flange and web.

5.2. Torsion of circular shafts:- Stresses and strains and deformation in determinate shafts and indeterminate shafts of hollow solid homogeneous or composite circular cross-section subjected to twisting moments. Derivation of torsion equation stresses due to combined torsion and bending and axial force for shafts.

5.3. Thin and thick walled pressure vessels:- Stresses, strain and deformation in thin walled seamless cylindrical and spherical vessels due to internal fluid pressures, change in volume, constants. Effects of additiional compressible or incompressible fluid injected under pressure. Use of IS code.

REFERENCES:-

1. Mechanics of materials.
   by Timoshenko
2. Mechanics of materials.
   by Bear & Johnson.
3. Strength of material.
   by Ramamurthum.
4. Mechanics of structures Vol. I
   by S.B. Junnerkar
   Charotar Publishers
5. Engg. mechanics.
   by K.L.Kumar
   TMH

FLUID MECHANICS

S.E. (Mech.)

Teaching Scheme:-
Lectures:- 4 Hrs/week
Practical:- 2 Hrs/week

Examination Scheme:-
Theory:- 100 marks
Termwork:- 25 marks
Paper Duration:- 3 hrs

UNIT I:- FLUID STATICS (08 lectures)

Fluid properties and definition, definition of fluid, viscosity, Bulk modulus of elasticity, Vapour pressure, surface tension, capillarity, speed of sound. Pressure at a point, liquid pressure on plane area, curved surface, centre of pressure, manometer, differential, in micro. Buoyancy and stability of floating and submerged bodies - determination of metacentric height. Relative Equllibrium horizontal and vertical acceration, uniform rotation of open vessels, Pascal's Law.

UNIT II:- KINEMATICS OF FLUID FLOW:- (08 lectures)

Types of flow, definition of steady, unsteady, uniform, non uniform, laminar, turbulant, 1D-2D flows, stream line, Streak line, path line, Stream tube, irrotational flow, concept of velocity, potential and stream function, flow net (no mathematical treatment) Continuity equation, 2D Euler's equation. Bernoulli's equation along a stream line for compressible and incompressible flows and its application, Pilot tube, Venturimeter, diffirential mono circular sharpe edged mouth pieces and orifics rotometer. Matches- rectangular, triangular and trapezoidal end contraction and correction for velocity of approch.

UNIT III:- LAMINAR FLOW:- (08 lectures)

Definition, relation between shear stress and pressure gradient, flow between parallel plates, circular tubes, Couttee flow. Lubrication mechanism, Hagen poiseuille's Theory, Hydrodynamically smooth and rough boundaries.
TURBULENT FLOW:- Definition, Prandtl's mixing length theory logarithmic and parabolic velocity, Variation of flow through pipe, minor losses in pipes and fittings, Darcy-Weisbach equation for frictional head loss, Mooddy diagram.

UNIT IV:- FLOW THROUGH PIPE:- (08 lectures)

Reynold's experiment, pipe discharging from a reservior, pipe connecting two reservior, pipes in series and parallel, syphons, Transmition of power and flow through nozzle.

Introduction to compressible flow, sound wave and Mach no. Introduction to unsteady flow in closed conduit, oscillation of liquid, phenomenon of surges and water hammer and other their control.
Dimensions-Dimensions homogeneity-dimensional analysis method. Reilage's method and Buckingham's Pi theoram, Model analysis - Dynamic forces - Dimension less no. - similitude - based on Reynold's and Mach numbers.

UNIT V:- CENTRIFUGAL PUMPS:-(CP) (08 LECTURES)

Introduction - Classifications of centrifugal pumps - components of CP - starting and working of CP - Heads of pumps - Energy conversion in a CP - Variation of Euler's head with vane shapes - Effect of finite number of vanes on Euler head - Losses and efficiencies - Minimum starting speed - limitations of suction lift - cavitation - effect of cavitation - methods to prevent

cavitation - detection of cavitation. Net positive suction head - Head loss due to flow variation - pumps in aprallel and series - specific speed - performance of centrifugal pumps.

LIST OF PRACTICALS:-

1. Viscocity of given liquid.
2. Study of manometer.
3. Study of stability of floating bodies.
4. Study of forced vortex motion.
5. Flow net by electrical analogy method.
6. Study of flow pattern by use of heleshaw apparatus.
7. Verification of Bernoulli's theoram.
8. Calibration of Venturimeter / Orificometer.
9. Study of sharp-edged circular orifice/mouthpiece.
10. Verification of momentum equation.
11. Study of laminar and turbulent flow by use of Reynold apparatus.
12. Study of flow through pipe.

Any eight practical of the above should be completed.
Oral is based on above practicals.

RECOMMENDED BOOKS:

1. A textbook of fluid mechanics and hydraulics machines
   by R K Bansal
   * Laxmi Publications, Delhi.
2. Hydraulics & Fluid Mechanics
   by Dr. P N Modi, S M Seth.
3. Fluid Mechanics, Hydraulics and Hydraulic Machines
   by S Ramamrutham
   * Dhanpat Rai & Sons.
4. Engg. Fluid mechanics
   by K L Kumar
   *. Eurasa Publications House, Delhi.
5. Fluid Mechanics and Machinery
   by S K Agrawal
   * Tata McGraw Hill Ltd.

INDUSTRIAL ELECTRONICS AND DRIVES

(SE Mech. & Prod.)

Teaching scheme:
Lecture: 4 Hrs/week
Practicals: 2 Hrs/week

Examination Scheme :
Paper: 100 marks
Term work: 25 marks
Paper Duration : 3 hrs.

UNIT I:- (10 lectures)

Industrial safety: Electrical shock, safety in the workplace, grounding. Electrical symbol, wiring diagrams, motor connection and terminology. Power distribution systems, transformer operation and applications, transformer connections and symbol, substation , in-plant distribution. electric power and energy.

UNIT II:- (10 lectures)

Industrial control devices: Primary and ol devices, manually operated switches, mech ed switches, transducers and sensors, actuators. t instruments, bridge measuring circuits, thyristors, circuits.

UNIT III:- (10 lectures)

AC generators, DC generators, DC motors, AC motors, motor selection, installation and maintenance. Relays, electromechanical control relays, solid state relays, timing relays, latching relays, relay logic.

UNIT IV:- (06 lectures)

Contactors and motor starters: Magnetic contactor, arc supprression, contactor sizes and ratings, magnetic motor starters, solid state contactor.
Motor control circuits : Motor protection and installation, motor starting, motor reversing and jogging, motor stopping, motor speed control.

UNIT V:- (06 lectures)

Types of control :- Motion control, pressure control, temperature control, time control, count control, sequence control. Process control systems : types of processes, structure of control systems, controller responses, data acquisition systems. Introduction to controls over CNC and robots.

REFERENCE BOOKS:-

1. Industrial Electronics,
   by Frank D Petru zella,
   Mc Graw Hill
2. Industrial Electronics and Control,
   by Bhattacharya and Chatterji,
   TMH
3. Electrical Tech.
   by Edward Hauges.
4. DC & AC m/c:-
   by Liwshets, Garik & weil
5. Control of Electrical Machines,
   by Bhattacharya and Single,
   New Age International

LIST OF EXPERIMENTS:-

GROUP I:-

1. (a) Study of digital multimeter
   (b) Study of CRO
   (c) Study of wheatstone bridge for measurement of resistance.
2. Full-wave rectifier circuit alongwith capacitor filter. Measurement of regulation and ripple factor.
3. (a) BJT timed switching circuit.
   (b) Multivibrator oscillator as a flasher.
4. Triac/Diac lamp dimmer circuit.
5. (a) Sine wave oscillator using opamp.
   (b) Schmitt trigger circuit using opamp.
   (c) Pulse generator using IC555
6. (a) Binary to 7-segment display.
   (b) Four bit binary full adder

GROUP II:-

1. Study of single phase and three phase alternator
2. Study of dc generator
3. Study of dc motor
4. Study of single and three phase induction motors
5. Study of three phase synchronous motor
6. Study of stepped motor in detail.
7. (a) Starter for dc motor.
   (b) Starter for ac motor

NOTE:-

* Minimum 4 experiments should be done from group I and all experiments from group II are compulsory.
* The termwork marks will be based on overall performance.
* All the experiments applications should be shown practically in mechanical workshop.

ENERGY CONVERSION - II
(S.E. MECH.)

Teaching Scheme :
Lectures : 4hrs/week
Practicals: 2hrs/week

Examination scheme:
Paper : 100 marks
Termwork : 25 marks
Practical : 25 marks
Paper duration : 3 hrs

UNIT-I:- AIR STANDARD CYCLES :- (10 hrs)

Air standard cycles:- Introduction, Carnot cycle, air standard cycle, Air fuel cycle, Actual cycle, Thermal efficiency. Stirling, Otto,Diesel, Dual, Combustion cycle, Derivation of their efficiency equation, cycle analysis, comparision on the basis of heat input, compression ratio, Maximum pressure and temperature, mean effective pressure.

UNIT- II:- IC engine Systems:- (10 hrs)

i) Fuel feeding systems of SI and CI engines theoritical air fuel consideration, engine requirements of petrol engine, simple carburettor, Solex type carburettor. Provision for starting economy range acceleration, compensating jet etc, Simple numerical problems on carburetion, fuel injection in diesel engines, study of fuel pump.
ii) Ignition system:- Ignition system requirement, battery ignition, magneto ignition, electronic ignition system in two stroke engines, Ignition timing, spark timing advance.
iii) Cooling systems:- Engine cooling systems, thermostat, additives.
iv) Lubrication:- Mechanism of lubrication, different methods, important properties of lubricating oils.
v) Starting methods of IC engines.
vi) Governing of IC engines, requriement, study of typical system for constant speed and variable engine.

UNIT-III:- Combustion in SI and CI engines:- (10 hrs)

Combustion in SI engines, Ignition lag, velocity of flame propagation, Detonation, preignition. Rating of SI engines fuels, octane number, Dopes, combustion chamber for SI engine.
Combustion in CI engine:-
Diesel knock, Effect of engine variables on ignition delay and knock, Rating of CI engine fuels cetane number, peformance number, combustion chamber for CI engines.

UNIT IV:- Engine testing and performance: (10 hrs)

Measurement of indicated power, brake power, Morse test, energy balance and effeciency calculations, BIS specification, supercharging of IC engines, turbochargers (elementary details only).

UNIT V:- Economics of power generation:- (10 hrs)

High pressure boilers and power plants:- Load curves, load duration curves, cost analysis, elements of controlling the cost of power plant.

Principle and working of high pressure boilers, Lamont, Loeffler,Benson, Velox, Schmidt Hertman, Gertmann boilers.
Super critical boilers, fluidised bed boiler.
Steam power plant, Diesel power plant, Nuclear power plant- waste fuel disposal. Cooling towers used in power plants.

TERM WORK

List of Practicals:-(Any 8)

1. Study of Carburation and Solex Carburator and fuel injection sytem of diesel engine, 'Bosch' fuel pump.
2. Study of ignition systems, Electronic ignition system for two wheeler.
3. Study of cooling systems of I.C engine.
4. Study of Lubrication system of I.C. engine.
5. Study of trial on petrol engine and to determine its performance by heat balance sheet.
6. Morse test on petrol engine.
7. Performance test on diesel engine to determine thermal, mechanical efficiency, F.P. by william's line, performance curves.
8. Study of combustion chambers in S.I. engine.
9. Study of combustion chambers in C.I. engine.
10. Visit to Nuclear and Hydraulic plant.

RECOMMENDED BOOKS :-

1. Internal Combustion Engine ---> M L Mathur & R P Sharma
2. Internal Combustion Engine ---> V Ganeshan
3. Thermal Engineering ---> P L Ballaney

MATERIAL SCIENCE

S.E. (Mech & Prod)

Teaching Scheme:-
Lectures:- 4 Hrs/week
Practical:- 2 Hrs/week

Examination Scheme:-
Theory:- 100 marks
Termwork:- 25 marks
Paper Duration:- 3 hrs

UNIT I:-

(08 lectures)

1.1. Engineering materials:- Metals, non-metals such as ceramics, plastics and polymers, composite materials.

1.2. STRUCTURE OF MATERIALS:- Structures and their property corelationship in relation to engineering materials, indexing of lattice planes and directions. Plastic deformation - Mechanisms. Deformation of single crystals and polycrystalline metals, imperfections in crystals, dislocations, work, hardening. Cold and hot working of metals.

1.3. PYROMETRY:- Principle, operation and uses of various pyrometer, Thermocouples materials, resistance pyrometer, Disappearing filament pyrometer, total radiation pyrometer.

UNIT II:-

(08 lectures)

2.1. MECHANICAL TESTING:- Tension test- Engineering and true stress-strain curves, conversion relationships, evaluation of properties, Numerical based on tension test, types of engineering stress-strain curves, compression test, cupping test on sheet metal. Hardness test- Brinell, Poldi, Vickers, Rockwell superficial, sceleroscope, Durometer, Moh's test, Micro hardness and hardness conversions, Impact tests - Charpy and Izod. Fatigue and creep test.

2.2. NON-DESTRUCTIVE TESTING:- Visual inspection, Magnaflux, dye penetrant test, sonic and ultrasonic test, radiography and eddy current test.

Examples of selection of NDT and mechanical testing methods for selected components like crankshafts, gears, razor blades etc. Welded joints, steel and C.I. casting, rolled products.

UNIT III:-

(08 lectures)

3.1. EQUILLIBRIUM DIAGRAMS:- Related terms and their definitions, Hume Rothery's rule of solid solubility, Gibb's phase rule, Polymorphism, solidification, dendritic growth. Cooling curves, plotting of equillibrium diagrams, lever rule. Isomorphous system. Coring. Eutetic systems, partial eutatic systems, other transformation, non equillibrium cooling and its effect.

3.2. STRENGTHENING MECHANISMS:- Refinement of grain size, solid solution hardening, dispersion hardening, age hardening, martensitic transformation. Composite materials.

UNIT IV:-

(08 lectures)

4.1. POWDER METALLURGY :- Advantages and limitations, Characterisation and testing of metal powders. Power manufecture, powder conditioning. Production of sintered structural components, self lubricating bearings, cemented carbides, cermets, sintered carbide cutting tools, Refractory metals, Electrical contact materials, friction materials. Diamond impregnated tools.

UNIT V:-

(08 lectures)

5.1. CORROSION AND PREVENTION:- Dry corrosion, wet corrosion. Types of corrosion: pitting corrosion, stress corrosion, cracking, season cracking, cavitation caustic embrittlement, inter granular corrosion.
Prevention of corrosion: selection of materials, design of components, modification of environment, cathodic protection, coatings, anodising, inhibitors,etc.

5.2. METHODS OF SURFACE IMPROVEMENT:-
i) Surface properties of base materials like strength, adhesion structural requirements for metal to metal and non metal to metal deposition.
ii) Plating, coating, vapour deposition and ion implantation processes.

Termwork :-

LIST OF EXPERIMENTS:-

1. Tensile test on mild steel and aluminium test pieces.
2. Compression test on cast iron and brass test pieces with variable L/D ratio.
3. Brinell hardness test on steel, C.I., brass, aluminium, etc.
4. Poldi hardness on steel, C.I., brass and aluminium test pieces.
5. Vickers hardness test on mild steel, aluminium alloy, brass, H.S.S etc.
6. Rockwell and Rockwell superficial test on different samples with different scales.
7. Izod and Charpy impact tests.
8. Erichen cupping test on minimum three different sheet metal samples.
9. Magnaflux testing, dye penetrant testing and ultrasonic testing.
10. Effect of cold working on hardness of minimum two materials.
11. Calibration of tensile testing machine by using load cell or load ring.

NOTE: Student should perform at least eight experiments to certify the termwork.

RECOMMENDED BOOKS :

1. V D Kodgire - Material Science and Metallurgy for Engineers, Everest Publishing House, Pune.
2. Davis H E, Troxell G E & Wiskocil C T - Testing of Engg. Materials, McGraw Hill Book Co.,Inc.
3. Van Vlack L H - Elements of Material Science, Addison Wesley Publishing Co Inc.
4. Smith W F - Principle of material science and engineering. McGraw Hill Book Co.,Inc.
5. Baldev Raj, T Jaykumar and Thavasimethu - Practical non-destructive testing, Narosa Publishing House, Delhi.
6. Engg. Metallurgy - Gholap, Kulkarni, Nirali Prakashan.
7. Introduction to Engg. Materials by B K Agrawal, Tata McGraw Hill Co. Ltd.
8. Material Science, Narula, Tata McGraw Hill Co. Ltd.

REFERENCES BOOKS :

1. ASM Handbook : Surface Engg, Vol. No.5
2. TME Handbook : Materials, Finishing and Coating, Volume No.3.

WORKSHOP PRACTICE - IV

S.E.(Mech & Prod)

Teaching Scheme:-
Practical:- 3 Hrs/week

Examination Scheme:-
Termwork:- 25 marks
Oral:- 25 marks.

1. Preparation of pattern, casting of pattern, inspection and testing of the same. Actual weight calculation, yield and costing of item should be performed.

NOTE:- Items should be the parts of machine tools e.g. Pulleys, Brackets, foot rest levers, etc. Allotment of job to each student should be such that variety of the products should come out.

2. Disassembly and assembly of following mechanisms for preventive maintainence.

a) All geared head stock
b) Apron mechanism
c) Quick return mechanism

3. One composite job involving different machining operations on lathe, shaper, slotter, drilling, milling machine. (Group of maximum 3 to 4 students depending upon the work involved)

NOTE:- Marketable utility items should be selected and it should be manufactured as per IS codes. e.g. Bench vise, Screw & toggle jacks, Hand press, etc,.

4. Determination of cutting speeds, feeds, machining time and cost equired for above job and should be compared with market value and rates.

NOTE:-

A) The candidates are required to finish the job to the following limits :

i) Machine shop - +/- 0.05 mm
ii) casting - +/- 0.5 mm

B) Workbook should include description with detailed working drawings, assembly drawing furnishing all dimensions, limits, finishing processes, material used, machining symbols, etc.

C) Theory concerning is to be taught in workshop only to every batch going to workshop for practicals, not in lecture room in practicals hours only.