Price-10
(16)

॥ अंतरी पेटवू ज्ञानज्योत ॥

North Maharashtra University,

Jalgaon

Syllabus for Second Year Engineering Degree Course in

PRODUCTION ENGINEERING

(w.e.f. July, 1999)

NORTH MAHARASHTRA UNIVERSITY, JALGAON

S.E. (PRODUCTION ENGG.)

SEMESTER - I

(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.	**	ENGG. MATHEMATICS - III	04	1(T)	03	100	—	—	—
02.		FLUID MECHANICS & FLUID POWER	04	02	03	100	25	—	25
03.	**	MACHINE DRAWING AND COMPUTER GRAPHICS	04	06	04	100	25	—	25
04.		THERMAL SCIENCE	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		

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

S.E. (PRODUCTION 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.		PRODUCTION TECHNOLOGY - I	04	—	03	100	25	—	25
03.	**	MATERIAL SCIENCE	04	02	03	100	25	—	—
04.		THEORY OF MACHINES	04	02	03	100	25	—	25
05.	**	INDUSTRIAL ELECTRONICS AND DRIVES	04	02	03	100	25	—	—
06.	**	WORKSHOP PRACTICE - IV	—	03*	—	—	25	—	25
TOTAL			20	09	—	500	125	—	75
Grand Total			29				700		

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

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) $f_1(D)x + f_2(D)y = Q_1(t)$;
$\phi_1(D)x + \phi_2(D)y = Q_2(t)$ } 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 theorems, 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.

FLUID MECHANICS AND FLUID POWER

S.E.(Prod)

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

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

UNIT I:- (08 lectures)

Fluid properties:- Fluid statics and kinematics of fluid flow, viscocity, specific gravity, thermal expansion, stability, compreseibility, surface tension, capillarity, mass, weight, density, specific volume, bulk modulus, Newtonian and non Newtonian fluids, pressure and its measurements. Buoyancy and floatation, Pascal's law, centre of pressrue, types of fluid flow, continuity equation-2D, Euler's equation, Bernoullis equation along a stream line for compressible and incompressible flows & its applications.

UNIT II:- (06 lectures)

Laminar flow and turbulent flow:- Relation between shear stress and pressure gradient, flow between parallel plates, Darcy-Weisbach equation for frictional head loss, flow through pipes - Major & minor energy losses, Reynold's experiments, flow through nozzle, Darcy's equation.

UNIT III:- (10 lectures)

Pumps and Turbines:- Classification of pump, gear vane, piston pumps, centrifugal and reciprocating pumps (Description & construction details with other related characteristics), introduction to jet, air lift, deep well, regenrative pumps; Types of turbines, their velocity triangles, mechanical efficiency, and specific speed characteristics, cavitation phenomenon (Francis, kaplan, Impulse, Denaz, reversible, load heat turbines), Governing mechanisms for Francis, Kaplan, pelton wheel.
Selection of turbines considering various factors.

UNIT IV:- (10 lectures)

Merits and applications of hydraulic & pneumatic power, compressors types, Hydraulic valves- pressure control, relief, counter balance, flow control, direction control valves (construction & operation characteristics) Filters, regulators, lubricators, other accessories like Air & oil hoses, pipe fittings pressure & temp. switches. Accumulators, Intensifier, Heat exchanger, seal & sealing devices, Types of cylinder mountings, Design consideration for cylinders, Hydraulic & pneumatic symbols.

UNIT V:- (06 lectures)

Hydraulic circuit design & other miscellaneous hydraulic machines:- Control of single & double acting hydraulic cylinder, regenrative, sequencing, cylinder synchronising circuit, counter balance valve application, speed control of hydraulic motor, hydraulic - press, crane lift, ram, coupling, torque converter, shock absorbers.

LIST OF EXPERIMENTS:-

1. Viscosity of a given liquid.
2. Study of manometers
3. Verification of Bernoulli's equation/theorm.
4. Study and trial on centrifugal pumps.
5. Study and trial on Francis turbine.
6. Study and trial of Pelton turbine.
7. Study and trial of Kaplan turbine.
8. Study and demostration of hydraulic & pneumatic trainer.
9. Study of Hydraulic press, hydraulic jack.
10. Study of speed regulation using meter in, meter out, circuit.

REFERENCE BOOKS:-

1. Fluid mechanics & Hydraulic machines.
   by R.K.Rajput
   S.Chand and company Ltd.
2. Fluid mechanics and machinary
   by S.K.Agarwal
   Tata McGraw Hill
3. Industrial hydraulics
   by Pippenger & Hich
   McGraw Hill,1980
4. Fluid power with application
   by Anthrony Esposity
   Prenrice Hall International Editions
5. Hydraulics & Pneumatics
   by Adrew parr, Jaico books
6. Power Hydraulics
   by A.B. Goodwin
7. Industrial Hydraulic manual
   by Vickers

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, mechining 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 mechining 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.

THERMAL SCIENCES
(S.E. Prod.)

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

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

UNIT I:- Fuels and combustion:- (06 lectures)

Types of fuels, calorific values of fuels and their determination, combustion equations, stoichometric air fuel ratio, fuel gas analysis, orsat apparatus, gravimetric and volumetric analysis and their conversion, excess air determination and actual quantity of air from combustion analysis.

UNIT II:- Boilers and condensers:- (10 lectures)

2.1. Boilers:- Historical developments, classification, study of fire tube and water tube boilers, boiler mountings and accessories, boiler effeciency, equivalent evaporation.
2.2. Boiler draught:- Natural and artificial draught, forced induced and balanced draught, Draught losses, Regulations for chimney height(with referance to IBR)
2.3. Condensers:- Jet and surface, Types of condenser, condensers vacuum, vacuum effeciency, air pumps, capacity of air extraction pumps, cooling towers.

UNIT III: I.C.Engines:- (07 lectures)

3.1. Air standard cycles, Auto Diesel and dual.
3.2. Classifications of I.C. Engines.
3.3. I.C. Engines and its components.
3.4. Carburation & fuel Injection
3.5. Lubrication, cooling & governing of I.C. Engines
3.6. Performance, trial and heat balance sheet.

UNIT IV:- Compressors, Refrigeration & Air conditioning:- (10 lectures)

4.1. Air compressors:- Introduction, classification, terminology, working of reciprocating compressor, work done equations, volumatric efficiency, Isothermal efficiency, multistage compression, Introduction to rotary compressor.
4.2. Refrigeration:- Introduction, Refrigerator, heat pump, simple vapour compression refrigeration system, common refrigerants and their properties, Description of vapour absorbtion refrigeration system and electrolax refrigerators.(without numericals)
4.3. Air conditioning:- Introduction, psychometry, Psychrometric relations, Psychrometric charts, Psychrometric processes, Comfort conditions.

UNIT V:- Heat transfer:- (07 lectures)

5.1. Introduction, models of heat transfer, fourier's law of heat conduction, haet transfer by conduction through a slab hollow cylinder, hollow shpere & composite walls.
5.2. Convection and heat transfer co-efficient, Natural convection & forced convection, overall efficiency of heat transfer, combined conduction & convection.
5.3. Radiation, black body concept, Kirchoff's law, heat transfer by radiation, Heat exchagers, overall heat transfer co-efficient.

LIST OF EXPERIMENTS:-

1. Study of trial on petrol engine to determine its performance at any one load.
2. Study & trial on reciprocating air compressor.
3. Study of bomb calorimeter & determination of calorific value of given sample of solid fuel.
4. Study of high pressure boilers.
5. Study of surface condenser with neat fig.
6. Determination of conductivity of composite slab.
7. Determination of Stefan Boltzmann's constant.

REFERANCE BOOKS:-

1. Heat transfer.
   by J.P.Holman.
2. Thermal Engg.
   by P.L.Ballani
3. Basic Engg. thermodynamics.
   by T.Roy. Chaudhari
4. Thermodynamics and Heat Engines.
   by Domkundwar.

MANUFACTURING PROCESSES
S.E.(MECH & Prod)

Teaching Scheme :
Lectures : 4hrs/week
Practical :

Examination scheme:
Paper : 100 marks
Termwork : 25 marks

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 [illegible] 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, maximum 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, Techni es 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.

Note :- First two jobs should be different for each batch coming to practicals and practicals will be conducted in workshop premises only. Jobs should be selected

Reference books:-

1. Metal forming Technology
   by Narayanswamy

2. Principles of manufacting Materials & Processes
   by J.S. Campbell
   * Tata McGraw Hill Ltd.

3. Production Techeology
   by HMT
   * Tata McGraw Hill LTd

4. Manufacturing Technology
   by P N Rao

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

Teaching Scheme:
Lectures:- 1 Hrs/week
Practicals:- 3 Hrs/week

Examination Scheme:
Term work :- 25 marks.
Oral :- 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.

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.

III - THEORY OF MACHINES
S.E.(Prod)

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

Examination Scheme:
Theory :- 100 marks
Term work :- 25 marks

UNIT - I : MECHANISMS : (08 lectures)

Link, Types of links, kinematic pairs (lower and higher), kinematic chains, mechanisms, structure, inversion of mechanisms, Instantaneous centre, kennedy's three centre theorem, Instantaneous centre method and relative velocity method for velocity diagrams, acceleration diagrams, coriolis component of acceleration. Velocity and acceleration analysis, Velocity and acceleration of piston by analytical method, Klien's construction.

UNIT - II : CAMS & BALANCING : (08 lectures)

Cams : Definition, Dynamics of cams, forces in rigid system: Types of followers & cams, displacement diagrams, velocity and acceleration curves, calculations, Tangent and convex cam, pressure angle and radius of curvature of cam.
Balancing : Need of balancing, Balancing fr rotating and reciprocating masses, Balancing of rotating masses in single palne, multiple plane. Balancing machines.Measurement of unbalanced forces and couples.

UNIT - III : FRICTION & FLYWHEELS : (08 lectures)

Friction : Dry friction, friction between screw and nut, screw jack, V-threads, pivot and collar friction, flat pivot, flat collar pivot and conical pivot. Friction in turning pair, friction axis, friction in mechanism.
Flywheels : Turning moment diagram, fluctuation of energy and speed, determination of the flywheel size for different types of engines and machines.

UNIT - IV : CLUTCHES AND BRAKES : (08 lectures)

Clutches : Single plate and multiplate clutches, cone clutches, heat generated.
Brakes : Types of brakes, shoe brakes, external and internal shoe brakes, block brakes, band brakes, disc brake, heat generated in braking. Braking effectiveness, Dynamometers, absorption and transmission dynamometers.

UNIT - V : VIBRATIONS : (08 lectures)

Introduction, definition, types of vibration, undamped and damped, free and forced mechanical vibrations of single degree of freedom system. Damping and logarithmic decremental critical speeds. Torsional vibertions of gear systems. Tranverse vibrations of shafts. Vibrations due to reciprocating and rotating imbalance. Vibration isolation and transmissibilty. Vibrometers and accelerometer.

Termwork :

i) Experimentation on any three from following :
a) Determination of moment of inertia of rigid bodies by bifilar suspension or trifilar suspensionn method.
b) Compund pendulum, dynamic equivalent system.
c) Experimental determination of velocity and acceleration of Hooke's joint.
d) One problem on transverse, torsional vbibrations. Experiments on studies of transverse, free, forced and damped vibrations.
ii) Assignments

MECHANICS OF MATERIALS

S.E.(Mech & Prod)

Teaching Scheme:-
Theory:- 4 Hrs/week
Practicles:- 2Hrs/week

Examination Scheme:-
Paper:- 100 marks

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 chages.

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.

UNIT IV:-

(08 lectures)

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 ateral loads, concept of core of a section

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.

UNIT V:-

(08 lectures)

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 & deformation in thin walled seamless cylindrical and spherical vessels due to internal fluid pressures, change in volume, constants. Effects of additional 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

PRODUCTION TECHNOLOGY – I

B.E.(Prod.)

Teaching Scheme :
Lectures : 4hrs/week

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

UNIT – I: FUNDAMENTALS OF METAL CUTTING & MACHINE TOOLS : (10 lectures)

1.1. Introduction : Need for metal cutting research.

1.2. Mechanics of metal cutting
- 1.2.1. General Principles
- 1.2.2. Metal cutting terminology
- 1.2.3. Plastic flow of metal
- 1.2.4. Chip formation : Types of chips, chip thickness, shear plane, cutting ratio, shear angle, shear strain, chip velocity.
- 1.2.5. Mechanics of oblique cutting
- 1.2.6. Surface finish & integrity
- 1.2.7. Machinability

1.3. Economics of metal cutting
- 1.3.1. Optimum machining conditions
- 1.3.2. Economics factors in tooling
- 1.3.3. Economics of metal removal
- 1.3.4. Cutting fluids and lubricants.

1.4. Introduction & classifications of M/c tools
- 1.4.1. Principle, classification, specification, construction, accessories, attachments, operations, economics of operations, cutting tools, cutting forces, power, speed, feed machining time – NO NUMERICALS , safety precautions of following machine tools:–

a) Lathe
b) Drilling
c) Shaper
d) Milling
e) Grinding

1.5. Planer, Slotting, Boring, Broaching machines:–
Construction, specifications & operations, types of work done, cuting tools.

UNIT – II :– NON-CONVENTIONAL MACHINING PROCESSES. (10 lectures)

2.1. EDM, ECM, LBM, WJM, AJM, ECG, AAC, ERM, CHM, neutral particle Etching.

2.2. Economics of non traditional machining processes and Numericals on above topics.

2.3. HERF, MPF, Electrohydraulic forming, Hot machining.

UNIT –III :– GEAR MANUFACTURING & THREAD CUTTING. (6 lectures)

3.1. Introduction. Method of gear manufacturing such as casting, rolling, stamping, powder metallurgy, extruding, coining, machining. Formed tooth processes such as milling, Broaching, Shaer cutting of gears. Generating processes.

3.2. Different methods of indexing. Thread standard & terms, Various method of manufacturing methods such as casting, rolling, chasing, Die cutting, Thread rolling, etc.

UNIT - IV :- CAPSTAN & TURRET LATHES. (4 Lectures)

4.1. Introduction, Types of turret lathes, Principle parts, construction & working, Headstock, Carriage or cross slide,.

4.2. Attachment used on turret lathe, Tool & Tool Layout, No Numericals

UNIT - V :- SURFACE FINISHING PROCESSES & COATINGS : (08 lectures)

5.1. Surface finish:- Definitions, surface structure & properties, Main characteristics, various methods of surface evaluation & equipment used.

Accuracy obtainable by diffirent types of metal working operations.

5.2. Basic principles, process variables & equipment for honing, shot blasting, buffing, lapping & super finishing.

5.3. Surface coatings: Introduction, surface preparation, metallic coatings, plastic coating, Organic & Inorganic coatings. e.g. Thermal spraying, vapor deposition, Ion implantation, porcelain enameling, conversion coating, etc.

Termwork:

Minimum 8 assignments on above syllabus.

Reference books:-

1. Fundamentals of metal cutting & m/c tools.
   by B.C. Juneja, G.S. Sechon
   * Wiley Eastern Ltd.
2. Principles of manufacting Material & Processes.
   by J.S. Campbell
   * Tata McGraw Hill Ltd.
3. Production Technology
   by HMT
   * Tata McGraw Hill LTd
4. Metal Cutting- Theory & Practices
   by A. Bhattacharya
   * New Central Book Agency.

MATERIAL SCIENCE

S.E. (Mech & Prod)

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

Examination Scheme:-
Theory:- 100 marks
Termwork:- 25 marks.

UNIT I:- (08 lectures)

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

1.2. STRUCTURE OF MATERIALS:- Structures and their property correlationship in relation to engineering materials, indexing of lattice planes and directions. Plastic deformation - Mechanisms. Deformation of single crystals and polycrystalline metals, imperfactions 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, scleroscope. 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 manufacture, 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 inpregnated 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 envirnment, 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 Engineering, 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 Publishi Co Inc.
4. Smith W F - Principle of material science and engineering, McGraw Hill Book Co.,Inc.
5. Baldev Raj, T Jaykumar and Thavasimathu - 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.

THEORY OF MACHINES
S.E.(Prod)

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

Examination Scheme:
Theory :- 100 marks
Term work :- 25 marks
Oral :- 25 marks
Paper Duration :- 3 hrs

UNIT - I : MECHANISMS : (08 lectures)

Link, Types of links, kinematic pairs (lower and higher), kinematic chains, mechanisms, structure, inversion of mechanisms.
Instantaneous centre, kennedy's three centre theoram, Instantaneous centre method and relative velocity method for velocity diagrams, acceleration diagrams, coriolis component of acceleration. Velocity and acceleration analysis, Velocity and acceleration of piston by analytical method, Klien's construction.

UNIT - II : CAMS & BALANCING : (08 lectures)

Cams : Definition, Dynamics of cams, forces in rigid system. Types of followers & cams, displacement diagrams, velocity and acceleration curves, calculations. Tangent and convex cam, pressure angle and radius of curvature of cam.
Balancing : Need of balancing, Balancing of rotating and reciprocating masses, Balancing of rotating masses in single palne, multiple plane. Balancing machines.Measurement of unbalanced forces and couples.

UNIT - III : FRICTION & FLYWHEELS : (08 lectures)

Friction : Dry friction, friction between screw and nut, screw jack, v-threads, pivot and collar friction, flat pivot, flat collar pivot and conical pivot. Friction in turning pair, friction axis, friction in mechanism.
Flywheels : Turning moment diagram, fluctuation of energy and speed, determination of the flywheel size for different types of engines and machines.

UNIT - IV : CLUTCHES AND BRAKES : (08 lectures)

Clutches : Single plate and multiplate clutches, cone clutches, heat generated.
Brakes : Types of brakes, shoe brakes, external and internal shoe brakes, block brakes, band brakes, disc brake, heat generated in braking. Braking effectiveness, Dynamometers, absorption and transmission dynamometers.

UNIT - V : VIBRATIONS : (08 lectures)

Introduction, definition, types of vibration, undamped and damped, free and forced mechanical vibrations of single degree of freedom system. Damping and logarithmic decremental critical speeds. Torsional vibartions of gear systems. Tranverse vibrations of shafts. Vibrations due to reciprocating and rotating imbalance. Vibration isolation and transmissibilty. Vibrometers and accelerometer.

Termwork :

i) Experimentation on any three from following :

a) Determination of moment of inertia of rigid bodies by bifilar suspension or trifilar suspensionn method.

b) Compund pendulum, dynamic equivalent system.

c) Experimental determination of velocity and acceleration of Hooke's joint.

d) One problem on transverse, torsional vbibrations. Experiments on studies of transverse, free, forced and damped vibrations.

ii) Assignments

a) Develop a computer programme for velocity and acceleration of a mechanism.

b) Inerta forces in engine mechanism.

c) Steering gear mechanism.

REFERENCES :

i) Theory of machines
by Khurmi.

ii) Theory of machines
by Jagdish lal

iii) Theory and machines and mechanism
by Shigley

iv) Mechanical vibrations
by Church

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
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, substations, in-plant distribution, electric power and energy.

UNIT II:- (10 lectures)

Industrial control devices: Primary and pilot control devices, manually operated switches, mechanically operated switches, transducers and sensors, actuators. Electronic test instruments.

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 suppression, 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.

WORKSHOP PRACTICE - IV

S.E.(Mech & Prod)

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

Examination Scheme:-
Theory:- 100 marks
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 some 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 maintainance.
   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 required 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 woerkshop for practicals, not in lecture room.

D) Practical examination should be performed cosidering syllabus of workshop practice - III.