(58)

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॥ मंत्री पेटवू ज्ञानस्योत ॥

North Maharashtra University, Jalgaon

Syllabus for Third Year Engineering Degree Course in

MECHANICAL ENGINEERING

(w.e.f. July, 2000)

NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.E. (MECHANICAL ENGG.)

First TERM

(W.E.F JULY,2000)

SR. NO.	CODE	SUBJECT	TEACHING SCHEME (HOURS PER WEEK)		EXAMINATION SCHEME				
			LECTURE	PRACTICAL	DURATION PAPER (hrs)	MAXIMUM MARKS THEORY	TERMWORK	PRACTICAL	ORAL
01.	##	NUMERICAL ANALYSIS & COMPUTATIONAL METHODS	04	02	03	100	25	--	--
02.	##	ENGINEERING METALLURGY.	04	02	03	100	25	--	25
03.		INDUSTRIAL ENGG. & MANAGEMENT	04	--	03	100	--	--	--
04.		MACHINE DESIGN - I	04	04	04	100	25	--	25
05.		HEAT TRANSFER & GAS DYNAMICS	04	02	03	100	25	--	--
06.	#	WORKSHOP PRACTICE - V	--	03#	--	--	25	--	25
	TOTAL		20	13	--	500	125	--	75
	Grand Total		33				700		

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

T.E. (MECHANICAL ENGG.)

Second TERM

(W.E.F Dec, 2000)

SR. NO.	CODE	SUBJECT	TEACHING SCHEME (HOURS PER WEEK)		EXAMINATION SCHEME				
			LECTURE	PRACTICAL	DURATION PAPER (hrs)	MAXIMUM MARKS THEORY	TERMWORK	PRACTICAL	ORAL
01.		TURBO MACHINERY	04	02	03	100	25	--	25
02.		MANUFACTURING TECHNOLOGY	04	--	03	100	--	--	--
03.		DYNAMICS OF MACHINERY - II	04	02	03	100	25	--	25
04.		MACHINE DESIGN - II	04	04	04	100	25	--	--
05.	##	METROLOGY & QUALITY CONTROL	04	02	03	100	25	--	25
06.	##	PRACTICAL TRAINING/SPECIAL STUDY MINOR PROJECT/EDP	--	--	--	--	25	--	--
	TOTAL		20	10	16	500	125	--	75
	Grand Total		30				700		

Note:- ## Common to Mechanical & Production Engg.

Total of Maximum marks of term I & II == 1400

IEYM-I

NUMERICAL ANALYSIS & COMPUTATIONAL METHODS (Paper II)

T.E.(Mech & Prod)

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

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

(5 hours)

Introduction to language C Programing:-
Study of Numerical methods & feature of the language & its brief teaching for simple INPUT/OUTPUT formatted INPUT/OUTPUT, various IF-statements, loops array, functions & subroutine, introduction algorithm development, flow chart.

UNIT - I: (8 hrs)

A) SOFTWARE DEVELOPMENT:-
Software development principles.
Concept of mathematical modelling and engineering problem solving. Errors in computation.

B) SOLUTION OF TRANSCENDENTAL EQUATIONS:-
Bracketing methods: Graphical method, Bisection method, false position method.
Successive approximation method, the Newton-Raphson method, rate of convergence.

(weightage - 20 marks)

UNIT - II:- (8 hrs)

A) NUMERICAL INTEGRATION:-
Trapezoidal rule, Simpson's 1/3rd & 3/8th rule, Guass Quadrature technique.

B) SOLUTION OF ORDINARY DIFFERENTIAL EQUATION:-
Taylor's series method, Euler's method, Improved and modified Euler's method, Fourth order Runge-Kutta method.

(weightage - 20 marks)

UNIT - III:- (8 hrs)

A) INTERPOLATION:-
Linear & quadratic interpolation, Lagrange's interpolation, Newton's forward & backward interpolation, Newton's divided difference interpolation, Stirling interpolation.

B) CURVE FITTING(least square criterion):-
Linear & quadratic regression, Logarithmic & exponential curve fitting.

(weightage - 20 marks)

UNIT - IV:- (8 hrs)

SOLUTION OF LINEAR ALGEBRIC EQUATIONS:-
Elimination methods: Gauss Elimination method, LU-decompositon method.
Iterative method :- Jacobi Iteration method, Gauss Siedal Iterative method, Cholesky method.
Convergence analysis, Choice of method.

(weightage - 20 marks)

UNIT - V:- (8 hrs)

FINITE DIFFERENCE METHOD:-

Solution of ordinary differential equation.

Solution of elliptical equations for various boundary condition.

Solution of parabolic equation by explicit, implicit & Crank Nicolson method.

FINITE ELEMENT METHOD:-

Introduction,comparision with finite difference method,General approach, Interpolation function, Finite element application on one dimension(beam element).

(weightage - 20 marks)

**SCOPE OF PROGRAMMING SHOULD BE RESTRICTED TO PRACTICAL CLASS ONLY.

ASSIGNMENTS:

The term work should consist of minimum eight assignments including Analytical/Numerical solution, algorithm, flow chart & computer programme.

1. A general program like sorting,conditional interest etc.
2. Solution of quadratic equation.
3. Solution of transcendental (exponential or logarithmic) equation related with engineering application.
4. Calculation of work/heat transferred by using any integration method .
5. One exercise on Numerical integration related to mechanical engineering application.
6. Solution of Poisson equation.
7. Solution of one dimensional parabolic equation by Crank-Nicolson method.
8. Curve fitting for the data related to mechanical engineering applications.
9. Solution of one/two dimension problem by finite element method using any compatible software.
10. Interpolation for any tabulated data used in mechanical engineering.

RECOMMENDED BOOKS:

1.Chapra,Canale: Numerical methods for Engineers-McGraw Hill Co.
2.S.S.Sastry : Introductory methods of Numerical Analysis-Prentice Hill India.
3.Jain,Jain & Iyengar:Numerical methods for scientist & engineering Computations-New Age International(P) Ltd.
4.J n.Reddy :Finite element method-McGraw Hill Co.
5.Belegundupatla : Introduction to Finite Elements methods-Prentice Hall India.
6. S.Rajaraman: Computer Oriented Methods.

ENGINEERING METALLURGY (Paper II)
T.E. (MECH & PROD)

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

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

UNIT 1: (9 hrs)

1. Metallography:
Microscopy-Specimen preparation, etching, principles of electrolytic polishing, etching reagents and optical mettalurgical microscope. Macroscopic-specimen preparation , macroetching , sulfur printing, flow lines observation, examination of fractures and spark test. Applicationof electron microscope.
2. Steels: Plain Carbon steels:
Iron Iron Carbide equilibrium diagram. Critical temperatures. Allotropy, Cooling curve and volume changes of pure iron. Microstructures of slowly cooled steels, estimation of carbon from microstructure. Non-equilibrium cooling of steels. Specification of some commonly used steel for engineering application.

(Weightage: 20 marks)

UNIT II: (9 hrs)

1. Heat Treatment of steels: Principles of heat treatment: Transformation products of austenite, Time-Temperature-Transformation diagrams. Critical cooling rate. Continuous cooling transformation diagram. Heat treatmentof steels.
Quenching media, annealing, normalizing, hardening, other heat treatments such as austempering, patenting, ausforming, martempering, Isoforming, etc. Retention of austenite - Effects of retained austenite. Elimination of retained austenite, yempering, secondary hardening, temper embrittlement, quench cracks, hardenability testing, defects due to heat treatment and remedial measures.

(Weightage: 20 marks)

UNIT - III:- (9 hrs)

1.A) SURFACE HARDENING TREATMENTS:
Carburising, Heat treatment after Carburising, Nitriding, Carbonitriding, Tufftriding, and sursulf process. Flame Hardening, and Induction hardening, commercial heat treatment practice of gears of different sizes, tools lathe beds, springs etc.
HEAT TREATMENT FURNACES & ATMOSPHERES:-
1. Heat treatment furnaces & their classification. Batch type furnaces continuous furnaces, salt bath furnaces, controlled atmosphere.

(Weightage: 20 marks)

UNIT IV:- (9 hrs)

1) ENGINEERING ALLOY STEELS:-
Effects of alloying elements. Classification of alloying elements. Examples of alloy steel.
Stainless steel. Sensitisation and weld decay of stainless steel.

Tool steel and tool materials. Heat treatment of high speed steels. Special purpose steels with applications.
2) CAST IRON:
Classification- Gray cast iron, chilled and alloy cast iron, effect of various parameters on structure and properties of cast iron. Application of cast irons for different components of machine tools, automobile, pumps etc.

(Weightage: 20 marks)

UNIT V: (9 hrs)

1. Engineering Non-Ferrous Alloys:
Brasses, Bronze (Tin, Aluminum, Beryllium), Copper- Nickel alloys. Aluminum and aluminum alloys. Solders, bearing materials and their application, Precipitation hardening alloys.
Composite Materials: Classification,different types of composite material and it's applications.

(Weightage: 20 marks)

Recommended books :

1) B.K.Agrawal: Introduction to engineering Materials.Eight reprint 1998, Tata McGraw Hill Publishing company Limited, New Delhi.
2) Kodgire R.D: Material Science and Metallurgy for engineering. Everest publishing House,Pune.
3) Clark D.S. and Varney W.R.: physical Metallurgy for Engineers. Affiliated East-West press Pvt.Ltd.
4) Sidney H.Avner: Introduction to physical Metallurgy Second Edition,Third Edition Reprint 1998, Tata McGraw Hill Pubishing Company Ltd., New delhi.
5) Robert E Reed Hill: Physical Metallurgy Principals, East-West Publication.
6) Metals Handbook on Heat Treatment, Metallography by ASTM/ASM.

List of experiments:

1) Microspecimen preparation and use of the metallurgical Microscope.
Objectives:
a) To provide practice in the techniques of microspecimen selection, polishing and Etching.
b) To provide initial training in the use of the metallurgical microscope.

2) Furnace operation and spark testing:
Objectives:-
a) To determine the natural(empty furnace) heating and cooling rates of ar available laboratory furnace.
b) To drew Spark diagrams of Medium, High carbon steel, Cast Iron & stainless Steel.

3) Study and drawing of microstructure of mild steel (low carbon steel), medium carbon steel Eutectoid and hypertectoid steel, in annealed condition.
OBJECTIVES:-
a) To study the constituents present in the microstructure of steel and their effect on properties of steel.

4) To study and drawing of microstructure of Grey modular cast iron, white and malleable cast iron.

5) Sulfur print test on a steel specimen / or flow lines examinations of forged component.

6) Study of change in micro-structure on annealing and normalising of a medium steel.

OBJECTIVES:

a) To normalise and fully anneal the sample of medium carbon steel and to study the hardness and micro structure of steel.

7) Hardening of steels:- Study of effect of carbon on the hardness of the hardened steel.

OBJECTIVES:-

a) To determine the temperature needed to harden mild steel and high carbon steel to their respective maximum harness.

b) To study the changes in micro structure of steel as it is heated through the critical range.

c) To determine the effect of carbon on hardness.

8) Tempering of steels:- Effect of temperature on properties:

OBJECTIVES:-

a) To determine the effect of hardening on the structure of steel.

b) To determine the effect of tempering on the structure of steel.

9) Jominy Hardenability test:

OBJECTIVES:-

a) To conduct the jominy hardenability test on two types of steel.

b) To utilize the jominy test results to determine steel and to illustrate its industrial applications.

10) Study and drawing microstructure of carburised steel fusion weld in mild steel.

11) Study and drawing microstructure of alpha brass, Alpha-beta brass, Aluminiumbronze and bearing metal.

Minimum 8 experiments must be performed out of the above list.

NOTE:- Oral will be based on the prescribed term work presented in the form of certified journal.

INDUSTRIAL ENGINEERING & MANAGEMENT (Paper III)
T.E. (MECH)

Teaching Scheme :
Lectures : 4hrs/week

Examination scheme:
Paper : 100 marks
Paper duration : 3 hrs

UNIT I:- (9 hrs)

1) Introduction to Industrial Engineering, origin and growth, contribution of taylor, gilbreths relevence and importance in the economics & industrial development through productivity.

2) Workstudy :-
a) Workstudy and productivity improvement; scope and application.
b) Method study:-
i) Introduction scope and application.
ii) Select criteria for selecting assignments; Record charting symbols. Flow process chart, multiple activity chart.
Examine - Questioning technique, Develop motion economy, worplace layout, improvement in working condition, implement and maintain.
c) Work measurement:-
i) Aims, objectives, scope and applications.
ii) Stop watch study- equipment and procedure, Rating allowance and standard time; Activity sampling - principles, procedure and applications.

(Weightage: 20 marks)

UNIT - II:- (9 hrs)

1) PLANT LAYOUT AND MATERIAL HANDLING:-
a) Criteria for plant location, site selection, types of plant layout, planning for utilities.
b) Material handling- necessity of material handling, procedure for analysing material handling system, methods and equipment of material handling.
c) Effect of layout and material handling system on productivity and profitability.
d) Safety in material handling and factory operation.

2) a) Factory act
b) Indian boiler act.

(Weightage: 20 marks)

UNIT - III:- (9 hrs)

PRODUCTION AND MATERIAL PLANNING AND CONTROL:-
a) Production planning.
i) Production and material planning as in integral and interdependent system.
ii) Production planning - Forecasting, capacity estimation, planning scheduling and control.
b) Material planning- Need and basis for material planning, planning and control of raw material ark-in and Bought out components.
c) Progress control - Introduction, step involved, Bar chart, Gantt chart, Transmission of report and corrective action.

(Weightage: 20 marks)

UNIT - IV:- (9 hrs)

PLANT MAINTANANCE:

Objective of plant maintanance, importance of plant maintanance, Duties, Functions and responsibilities of plant maintenance department.

Types of Maintenance, corrective or Breakdown maintenance, schedule maintenance, preventive maintenance, predictive maintenance, plant maintenance schedule, standard data for maintenance, Some recent developments in plant maintenance.

(Weightage: 20 marks)

UNIT - V:- (9 hrs)

Wage administration- Job analysis, Job description, Job rating, Wage survey, wage scale.

1) Job evaluation and payment of results:-

Job evaluation- necessity and principles of job evaluation, systems of job evaluation, application.

2) PBR as a motivating factor, Incentive scheme- basis of schemes, Taylor Rowan, Halsey and Bedoux plans, Incentives to indirect workers, Preplanning for introduction incentive schemes.

3) Value analysis/Engg. Concept, Procedure and steps in value analysis/ engineerign scope & appliction.

(Weightage: 20 marks)

Recommended Books:-

1. Industrial Engg. & Management System. -Mansoor Ali & Dalela.
2) Work study -- P.M.Currie.
3. Work study -- ILO.
4) Production planning and control -- Samuel Eilm.
5) Material management - Gopalkrishnan
6) Factory act -1948
7. Indian Boiler act - 1923 (revised 1983)
8) H.B Maynard, "Industrial Engg. Handbook", Mc Graw Hills Book Co. U.S.A
9) L.C.Jhamb, "A text book of Industrial Engg. " everest Publicity House, India.

MACHINE DESIGN - I (Paper IX)
T.E. (MECH)

Teaching Scheme :
Lectures : 4hrs/week
Practicals: 2 hrs/week(Drawing)
2 hr/week (computer)

Examination scheme:
Paper : 100 marks
Termwork : 25 marks
Oral : 25 marks
Paper duration : 4 hrs

UNIT - I:- INTRODUCTION TO MACHINE DESIGN (9 HRS)

a) Mechanical Engineering design process: Traditional design methods. Design consideration: Strength, deformation, Wear, creep, and corrosion. Aesthetic and ergonomic considerations in design.

b) Standards: ISO 9000, Use of standardisation, use of Design Data books.

c) Stresses:- Simple stresses - Tension, Compression, bending and torsion, Stress Strain relationship. Combined effect of different stresses.

d) Design of machine elements subjected to static loading: Knuckle joint, Cotter joint.

e) Materials: Properties of material such as strength, plasticity.

f) Theories of failure: Maximum normal stress theory, Maximum shear stress theory, Maximum distortion energy theory and maximum strain theory, max. pricipal stress theory - their applications and limitations.

(Weightage: 20 marks)

UNIT II:- (9 hrs)

a) Joints - Applications. ISO metric screw threads, stresses in screw fastners. Bolted joints under tension, Torque requirement for Bolt tightening, pre-loading of bolts under static loading, gasketed bolted joints, Eccentrically loaded bolted joints.

b) Power Screws: power screw thread forms and their applications.

c) Design of threaded fastners: Types of thread forms and their torque analysis with square threads. Collar friction, stresses in power screw - Differential and compound screw, Recirculating ball screw.

d) Design of Welded joints- Advantages, types and applications of welded joints, Stresses in Butt and Fillet welds, strength of welded joints, welded joints subjected to torsional and bending moments.

e) Design of riveted joints- Advantages, stresses, Strength of riveted joint.

(Weightage: 20 marks)

UNIT - III:- (9 HRS)

a) Shaft, Keys and Couplings: Various design considerations in transmission shafts, splined shafts.

b) Spindles and axles - strength lateral and torsional rigidity. ASME code for designing shafting. Shaft materials and stresses.

c) Types of keys-their classification and fitments in keyways. Design considerations in parallel and tapered sunk keys.
Couplings: Design considerations, Design of rigid couplings, Muff & Flange type, Design of flexible coupling.

d) Flywheels: Fundamentals equation of motion, Torque analysis,

stresses in flywheel rim and its sprockets, Design of solid and spoked flywheel.

(Weightage: 20 marks)

UNIT - IV: (9 HRS)

a) Springs: Types, applications, materials of springs. Stress - deflection equations of helical springs, Wahl's factor, style of ends. Design of helical compression, tension and torsional springs under static loads. Construction and design considerations in leaf springs. Shot perming.

b) Clutches: Design requirements of friction clutches, selection criteria. Torque transmitting capacity of single plate clutch, multiple clutch, cone cluch and centrifugal clutch. Dry and wet clutches. Material for clutch facings. Energy considerations and temperature rise.

Brakes: Design considerations in brakes - Energy equations, the maximum considerations, rating of brakes. Design of block brakes with short shoe, long shoe, internal expanding shoe brakes and band brakes. Brake friction materials properties.

(Weightage: 20 marks)

UNIT - V: (9 hrs)

a) Stress concentration - causes and remedies - Fluctuating stresses, S-N diagram under fatigue load, Endurance limit, factors affecting fatigue failure of machine components. Notch sensitivity. Endurance strength modifying factors.

b) Design for finite and infinite life inder reversed stresses. Cumulative damage in fatigue failure. Soderberg and goodman diagrams. Modified goodman diagram.

c) Fatigue design of components, under conbined stresses, such as shafts, bolte joints, welded joints and springs.

d) Selection of flat and V belts and chains from manufacture catalogue.

(Weightage: 20 marks)

Termwork:

The termwork shall consists of Two design projects based on the above syllabus, consisting of two imperial size sheets - one involving assembly drawing with a part list and overall dimensions and the other sheet involving drawings of individual components. Manufacturing tolerances, surface finish symbols and geomoetric tolerances should be specified so as to make it a working drawing. A design report giving all necessary details of calculations of the design of components and assembly should be submitted in a separate file.

Five assignments of problems based on above topics of the syllabus out of which minimum three should be solved with the use of Computer aided design. (..e two problems should be solved in C language and one in AutoLISP.)

**SCOPE OF PROGRAMMING SHOULD BE RESTRICTED TO PRACTICAL CLASS ONLY.

For example, "Design and Drafting of knuckle joint" with the help of computer.

Oral:-
Oral will be based on the prescribed termwork presented in the form of certified journal.

Recommended Books:-

1. Mechanical Engineering Design by J. E. Shigley and C. R. Mischke - 5th Ed., McGraw Hill Publications.
2. Design of Machine elements by M. F. Spotts - Prentice Hall Publications.
3. Machine Design by Schaum Series.
4. Fundamentals of machine design by phelan - McGraw Hill Publications.
5. PSG Design Databook.
6. Machine Design - Maleev & Hartman.
7. Programming In "C" by Balgurusamy

HEAT TRANSFER AND GAS DYNAMICS (Paper V)
T.E. (MECH)

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

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

UNIT I:- (9 hrs)

CONDUCTION HEAT TRANSFER:

Modes of heat transfer, fundamental laws of heat tranfer. Mechanism of heat conduction, thermal conductivity and its variation with temperature, variable theraml conductivity, isotropic and anisotropic materials. Heat transfer by combined parks, elecrical analogy, overall heat transfer coefficient, log mean area, critical thickness of insulations.

Derivation of unidirectional heat conduction in solids having uniform and variable cross sectional area with heat generation. Thermal difussivity, sulution of unidirectional differential equation (Poisson equation) with different boundary conditions.

Extended surfaces, solution for heat transfer through fins of uniform cross-sectional area. Types of fins, fin effectiveness and fin efficiency.

(Weightage: 20 marks)

UNIT - II:- (9 hrs)

Unsteady state heat conduction through solids with negligible internal resistance, Use of Heisler charts.

Mechanism of heat convection, natural and force convection, concept of hydraulic and thermal boundary layers, similarities between velocity and temperature profile.

Heat transfer coefficient and effect of various parameters such as physical properties of fluid sysyem, fluid geomatry and fluid flow.

Dimensional analysis for forced convection, physical significance of dimensionless numbers (Re, Nu, Pr, Gr,Ra, Pe,St). Reynold analogy between momentum and heat transfer over flat plate.

Natural convention from a vertical plate, correlations for horizontal cylinder and rectangular duct.

Film and dropwise condensation, condensation on vertical plate (derivation), critical heat flux.

(Weightage: 20 marks)

UNIT - III:- (9 hrs)

Radiation heat transfer: Mechanism of thermal radation, Basic concepts and definitions of radiation properties, laws of thermal radiations- Kirchoff's law, Plank's law, Wien's displacement law, Stefan Boltzmann law and Lambert Cosine law, Intensity of radiations, solid angle, irradiation and radiosity.

Shape factor for simple geomatry and properties of shape factors and its determinations from charts.

Radiation heat exchange between two bodies. Electrical network analogy for radiation heat exchange between two and three gray bodies, thermal radiation sheild. (Weightage: 20 marks)

UNIT - IV:-

Heat exchangers: Classifications, overall heat transfer coefficient, fouling factor, LMTD for parallel and counter flow heat exchanger, correction factor. NTU and effectiveness of heat exchanger. Design considerations, Industrial applications of heat exchangers. (9 hrs)

(Weightage: 20 marks)

UNIT - V:-

Gas dynamics: Introduction of compressible and incompressible fluid flow, velocity of sound, velocity of sound for an ideal gas, sonic, supersonic and subsonic flow, Mach number. Stagnation properties and their relation. (9 hrs)

Steady one dimensional flow, change in cross-sectional area, shock, normal shock, effect of friction factor in one dimensional flow. Fanno lines, effects of one dimensional heat transfer in one dimensional heat transfer. Rayleigh lilnes, analytical solution of normal shock, strength of shock.

(Weightage: 20 marks)

List of experiments:-

** Minimum eight experiments should be performed.

1. Determination of thermal conductivity of metal rosd.
2. Determination of thermal condcutivity of insulating powder.
3. Determination of temperature distribution, fin efficiency in natural and forced convection.
4. Study of potentiometer and callibration of thermocouples.
5. Determination of film coefficient in natural convection.
6. Determination of film coefficient in forced convection.
7. Determination of stefan-Boltzman constant.
8. Determination of emmissivity of test surface.
9. Performance of parallel and counter flow heat exchanger.
10. Study of normal shocks.
11. To determine critical heat flux.

Recommended Books:-

1. Gupta & Prakash: Engg Heat Transfer, Nemchand Brns. Roorkee.
2. P.Yadav: Heat & Mass Transfer, Central publishers, Allahabad.
3. R C Sachdeva: Fundamentals of Engg Heat transfer, New Age Internal Ltd, New Delhi.
4. P K nag: Engg Thermodynamics, Tata Mc Graw Hill Pubications.
5. S Radhakrishnan: Gas Dynamics, Prentice Hall India.
6. J P Holman; Heat transfer.
7. S P Sukhatme; mHeat Transfer.
8. M Ozisik; Heat Transfer
9. Alan chasman, Macmillan Publishing Co, Heat Transfer
10.) G Kern, McGraw Hill, Process Heat Transfer

WORKSHOP PRACTICE - V (Paper VII)

T.E. (Mech)

Teaching Scheme :
Practicals: 3hrs/week

Examination scheme:
Termwork : 25 marks
Oral : 25 marks

Note :- * Theory related to workshop practice - V is to be taught in workshop in practical hours.

1. One mini project on die making for sheet metal working, rubber or plastic by using Jig Boring machine, precision grinding operation like surface grinding, cylindrical grinding, etc. Other machining operations as required should be carried out on general purpose machines.
(12 hours)

2. One job of programming and manufacturing on CNC lathe or trainer
(1 hr)

3. One job of programming and manufacturing on CNC milling machine or trainer
(1 hr)

4. The fabrication job of manufacturing a pipe fitting like tee, bend etc., involving designing of intersections of solids/surfaces, development of surfaces and operations like gas cutting and welding by suitable method.
(2 hrs)

5. Maintenance of CNC and above mentioned machine tools.
(4 hrs)

Note All jobs specified 1 to 5 should be allocated to batch of 5 to 6 students and different batches should have different designs of jobs.

DEMONSTRATIONS OF FOLLOWING MACHINES AND PROCESSES TO BE CARRIED OUT IN THE WORKSHOP ONLY. (ONE HOUR FOR EACH DEMONSTRATION)

1. Gear Hobbing or Gear Shaping Operation.
2. Operations on Capstan & Turret Lathe and Single Spindle automats.
3. Sheet metal working on Mechanical or Hydraulic Presses.
4. Superfinishing operations like lapping, honning, etc.
5. Plastic moulding operations on injection moulding machines.
6. Drop forging on power hammer.
7. Spot welding machine.
8. Different types of grinding wheels, selection criteria, standard marking system of grinding wheel, wheel balancing, truing and dressing operations.
9. Planner.

THEORY: Theory concerned to different machines, their capabilities, applications and limitations, tool holding, work holding devices etc. for above jobs and demonstrations, is to be taught in the workshop only for every batch going to the workshop. Concept of

alignment and geometric tolerancing required for job no.1 is to be taught in the class room.

i) Marketable utility items should be selected and it should be manufactured as per IS codes, e.g. Nuts, Bolts, Bushes, pins, gas nozzles, etc.

ii) Setting of turret/capstan for assigned jobs should be done by individual students.

iii) Preparation of CNC programs for job on CNC machine should be done by group of students for their job.

iv) CNC maintenance should be done practically i.e. demonstration regarding various components of both categories; electronics and mechanical.

6. Determination of cutting speeds, feeds, machining time and other parameters required for above job such as cost estimation etc. and should be compared with market rates.

(1 hr)

7. One job on planner should be prepared involving all students batchwise.

(1 hr)

8. The candidates are required to finish the jobs to the following limits:- i.- CNC lathe & milling - +/-0.05mm
i.- Capstan & Turret lathe - +/-0.05mm
iii- Planner - +/- 0.3 mm

Note:- Oral will be based on the prescribed termwork presented in the form of certified journal.

Term-II

TURBO MACHINARY (Paper-I)

T.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 - 1. (9 hrs)

Steam Turbines: Types of turbines, constructional details, impulse turbine, compounding of turbine, velocity diagrams, output, efficiency, losses in turbines, reaction turbine, velocity diagrams, degree of reaction, constructional features of blades.

Governing of turbines, application of turbones, types of seals, and packing to reduce leakage. losses in turbines.

(Weightage: 20 marks)

UNIT - 2. (9 hrs)

Gas Turbine: Theory and fundamnetals of gas turbines, principles, classification, Joule's cycles, assumptions for simple gas turbines, cycle analysis, work ratio, concepr of maximum and optimum pressure ratio, actual cycle, effect of operating variables on thermal efficiency regeneration, intercooling, reheating, their effects on performance, closed cycle and semiclosed cycles gas turbine plant, applications of gas turbines.

(Weightage: 20 marks)

UNIT - 3. (9 hrs)

Jet propulsion and Rotary compressors: Introduction, theory of jet propulsion, types of jet engines, energy flow through jet engines, thrust, thrust power, and propulsive efficiency, turbo jet, turbo prop, turbo fan engines, pulse jet and ram jet engines, performance characteristics of these engines, thrust augmentation, application of jet engines. Concept of rocket propulsion.

ROTARY COMPRESSORS:

Concepts of rotary compressors, root blower and vane type compressors, centrifugal compressors, velocity diagram and expression for work done, introduction to terms like slip factor, power input factor.

(Weightage: 20 marks)

UNIT - 4: (9 hrs)

Hydraulic turbines

Impulse momentum principle, fixed and moving flat plate and curved vanes, series of plates & vanes, velocity triangles and their analysis, work done, efficiency etc. classification of hydraulic turbines, Heads & various efficiencies, Impulse turbine: Main components and constructional features of pelton wheel, velocity diagrams & work done, condition for max. hyd. efficiency, number of buckets, jets, Non dimensional parameters (speed ratio, jet ratio)

(Weightage: 20 marks)

UNIT - 5 (9 hrs)

Hydraulic turbines

Reaction turbine, main components & constructional features, types of reaction turbine (Francis, kaplan), draft tube types, efficiency, cavitation, govering mechanisms for pelton wheel, Francis, kaplan turbines, Types of characteristic curves, unit quantities, selection of turbine considering varios factors,specific speed, Application of similarity as applied to turbines, scale effect.

(Weightage: 20 marks)

LIST OF PRACTICALS:

** Minimum 8 experiments to be performed out of which there should be minimum 5 trial experiments.

1. Study of steam turbine power plant.
2. Study of steam turbine systems
   a) Methods of compounding
   b) Methods of governing
   c) Losses in steam turbine
   d) Lubrication system.
3. Trial on steam turbine
4. Study of gas turbines.
5. Study of hydraulic turbines.
6. Trial on pelton wheel.
7. Trial on francis turbine.
8. Trial on kaplan turbine.
9. Trial on gas turbine plant.
10. Trial on centrifugal/axial flow air compressor.

Note; Oral will be based on the prescribed termwork presented in the form of certified journal.

Recommended Books:-

1. 'A course in thermodynamics and heat engines' by Domkundwar.
2. 'Thermal Engg' by P L Ballaney.
3. 'Thermal Engg' by R K Rajput.
4. 'Fluid mechanics and Hydraulic M/c by Dr. R.K.Bansal
5. Hydraulic m/c by Dr. Jagdish Lal.
6. Hydraulis & fluid m/c by Dr Modi seth.
7. R.yadav: Steam & Gas turbine, Central Publications, Allahbad.
8. J.K.Jain: Gas Turbine Theory & Jet populsion, Khanna Publications, New Delhi.
9. Cohen, Roger: Gas Turbine Ttheory , Longman Publications.
10. Anantswami: Fundamentals of Hydraulic machinery, United Book Corporation, Poona.
11. Turbo Machinery by Rahya Khan.

MANUFACTURING TECHNOLOGY (Paper II)
T.E. (MECH)

Teaching Scheme :
Lectures : 4hrs/week

Examination scheme:
Paper : 100 marks
Paper duration : 3 hrs

UNIT - I:- (9 hrs)

1.1 Theory of Metal Cutting:- Introduction, Mechanics of chip formation, Single point cutting tool Geomatry, Designation of cutting tool, Method of Machining, Types of Chips, Determination of cutting tool, Method of machining, Types of chips, Determination of shear angle & chip thickness, Force analysis- Merchant circle, cutting force dynamometers.
Determination of cutting speeds & feeds, depth of cut & effect of these on cutting forces, cutting time, power, choice of machine tools & optimization of cutting processes, Tool wear & tool Life, Economics of metal cutting, Machinability, Cutting tool material, Tool nomenculture, Design of cutting tools(no problems). Types of cutting tools - Single point, Multipoint- milling cutter, broach, drills, reamers, form tools.

1.2. Economics of tooling:- MAchine tool replacement, Return on investment, Mathematical analysis for economic equipment equipment selection, Economics of small tool selection, Small tool replacement, Break even analysis, Economics lot size, Minimum cost analysis, Difference between economic batch quantity & Break even quantity. Other relations for Economic batch quantity,problems.
(Weightage: 20 marks)

UNIT - II:- (9 hrs)

2.1 Capstan & Turret :- Introduction, Difference between Engine, Capstan & Turret Lathe, Indexing mechanisms, Bar feeding mechanisms, Work holding devices, Tool holding devices, Tool Layout, Automates- forming & single spindle & multi spindle.
2.2 Gear Manufacturing:- Gear cutting process forming & generation, Gear cutting or milling, hobbing, shaping, Gear finishing processes - shaving, lapping & grinding construction & working of mechanics.
2.3 Thread manufacturing:- Thread cutting - internal & external. Chasers, dies, threac milling, rolling, lapping & grinding.
(Weightage: 20 marks)

UNIT - III:- (9 hrs)

3.1. Machining Processes:- Introduction to single point machining- turning, boring, facing, forming, shaping & planing. Multipoint machining, Drilling, Milling, Broaching.
3.2. Jigs & fixtures:- Introductions, Definitions & concepts, Advantages, Elements of jigs & fixtures, Degree of freedom, Principle of location, Locating devices, Ejectors Clamping devices, Type of jigs & fixtures.(Introductory)
(Weightage: 20 marks)

UNIT – IV:–
(9 hrs)

4.1. Press tools :– Types of presses, Fundamentals of die cutting operation, Cutting action in punch & die operations, Die clearance, Types of die Construction.

4.2. Die Design Fundamentals:– Blanking & piercing die design, Compound die design, Bending die, Forming dies, Drawing dies, Progressive dies, Strip layout determination of blank size, Drawing force.

(Weightage: 20 marks)

UNIT – V:–
(9 hrs)

5.1. Finishing & Surface treatment processes:– Grinding, Hobbling, Lapping, Buffing, Polishing, Hobbing tools, Lapping Materials, Abrasive, Buffing & Polishing wheels Electroplating, Electrolessplating, Plasma coating, Phosphating, Galvanizing metal, spraying, Anodizing, Shot peening.

5.2. Non Conventional machining Processes:– Introduction, CM,ECM, EDM, EBM, LBM, PAM, AJM, WJM, IBM, Ultrasonic machining, Explosive forming, Hot machining.

(Weightage: 20 marks)

ASSIGNMENTS:–

1. Jig design for drilling operation for given component.
2. Fixture design for milling operation for given component.
3. Blanking/ Punching Die design for given components.
4. Tool layout for turret or capstan lathe for a job.
5. Assignment on unit 2 & 5.

Recommended Books:–

1. A Bhattacharya, metal cutting theory & practices – Central Book Publishers, India.
2. P.C.sharma, Production Engineering.
3. Hajra Chaudhari & Bose – Workshop Technology Vol–II: Asia Publishing House.
4. H.S.Bawa Workshop Technology Vol–II, TataMcGraw Hill.
5. John A. Schey, Introduction to manufacturing processes, McGraw–Hil. International Editions.
6. American Society of tool & manufacturing Enginners, Fundamentals of tool design , Prentice Hall of India Pvt Ltd.
7. Donaldson, tool design, Tata McGraw Hill
8. P.C.Pandey, H.S.Sahu, Modern machining Processes, TataMcGraw Hil .
9. O.P.Khanna, M.Lal – A text Book Production Technology, Vol I & II, Dhanpat Rai & Sons.

DYNAMICS OF MACHINERY - II (Paper III)
T.E. (MECH)

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

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

(9 hrs)

UNIT - I:-
BRAKES AND DYNAMOMETER:
1. BRAKES:-a) Different types of brakes b) Force analysis of brakes, external and internal expanding shoe brakes, Block brakes, Band brakes, Block & band brakes c) Breaking torque.
2. DYNAMOMETERS:- a) Different types of absorbtion and transmission type dynamometer b) Eddy current dynamometer construction and working principle, c) Torque measurement d) Fluid coupling.

(10 hrs)

UNIT - II:-
GOVERNORS & FLYWHEEL:-
1. GOVERNOR:- a)Types of governors- Watts, Porter, Proell, Hartnell, Spring controlled, Inertia controlled, b) Sensitiveness of a governor, c) Hunting, Isochronism, Stability d) Effect of governor, e) Power of governor, controlling force.
2. FLYWHEEL :- a) Turning moment diagrams, D'alemberts principle b) fluctuation of energy and spped, c) Equivalent offset inertia force d) Piston effort, crank effort e) Determination of flywheel size for different types of engine and machine.
(Weightage: 20 marks)

(10 hrs)

UNIT - III:-
KINEMATICS OF CAM & GYROSCOPE
A) Cam:
a) Types of cam b) Types of follower c) Definitions d) Follower displacement programming e) Motion of follower, analysis of motion f) Determination of cam profile for given follower motion g) Analysis of cam with specified counters-circular arc cam, tangent cam, h) Cycloidal cam, polydyne cam, Kinematics equivalent of cam.
B) Gyroscope: Angular velocity and acceleration, gyroscopic couple, gyroscopic effect on neval ships, stability of a two wheel vehicle.
(Weightage: 20 marks)

(10 hrs)

UNIT - IV:-
GEARS AND GEAR TRAIN
A) Spur Gear: Terminology of gearing, Conjugate action, Involute and cycloidal profile, Path of contact, arc of contact, contact ratio, interference, undercutting, methods to avoid the under cutting and interference, rack shift, effect of center distance variation, friction between gear tooth.
B) Internal gears
C) Helical gears: Torque transmitted by helical gears on parallel shafts, normal and transverse module.
D) Spiral gears: Spiral angle, shaft angle, efficiency of spiral gears.

E) Worm and worm gear terminology, geometrical relationship, application and tooth forces, torque transmitted.
F) Types of gear trains, velocity ratio, tooth load, torque transmitted, holding torque.

(Weightage: 20 marks)

UNIT - V:- (10 hrs)

BALANCING

a) Balancing of rotationg masses in one and several planes
b) Balancing of reciprocating masses in single and multicylinder engine, inclined, radial and vee types.
c) Primary and secondary balancing analysis. d) Concept of direct and reverse cranks
e) Balancing of locomotive engines and effect of partial balancing
f) Static and dynamic balancing machine, controlling force.

(Weightage: 20 marks)

Termwork shall consist of any 'NINE' experiments of the following:-

1. Study of various types of gearboxes such as industrial gear boxes, synchromesh gear box, Differential gear box.
2. To draw the conjugate profile for any general shape of gear tooth.
3. To generate gear tooth profileand to study the effect of undercutting and rackshift usig models.
4. To determine torque capacity of dynamometr using transducers.
5. To study epicyclic gear train and to measure torque transmitted and holding torque
6. To draw cam profile for various types of follower motion.
7. To determine the characteristic curve of a centrifugal governor & to find its coefficient ofineensitiveness & stability.
8. Verification of principal of gyroscopic couple.
9. Study of any two gyro controlled instruments.
10. To study the dynamic balancing machine & to balance a rotor.

Oral

Oral will be based on the prescribed termwork presented in the form of certified journal only.

Recommended Books:-

1. Theory of machines - Thomas & Beven
2. Theory of machines & mechanisms - Shigley
3. Theory of machines & mechanisms - P L Ballaney
4. Theory of machines & mechanisms - Jagdishlal
5. Theory of machines & mechanisms - S S Ratan
6. Theory of machines & mechanisms - Ghosh, Malick

MACHINE DESIGN - II (Paper IX)
T.E. (MECH)

Teaching scheme :
Lectures : 4hrs/week
Practicals: 4hrs/week
(2hrs/week for computer)
(2hrs/week for drawing)

Examination scheme:
Paper : 100 marks
Termwork : 25 marks
Paper duration : 4 hrs

UNIT - I:- (12 hrs)

SPUR AND HELICAL GEARS

Classification of gear drives and their selection criteria's, revision of theory of gears, standard system of gear tooth.

Spur: Gear tooth load, number of teeth, face width, strength of gear teeth, static beam strength, (Lewis equation), barth equation, dynamic tooth loads, (spotts equation), wear strength (Buckingham's equation), estimation of module on beam strength and wear strength, gear design for maximum power, types of gear teeth failures, gear materials and constructional details of gear wheels, methods of gear lubrication.

Helical: Gear tooth load, formative number of teeth in helical gears face width, strength of gear teeth, static beam strength, lewis equation, barth equation, dynamic tooth loads, (spotts equation), wear strength (Buckingham s equation), estimation of module on beam strength and wear strength, gear design for maximum power, types of gear teeth failures, gear materials and constructional details of gear wheels, methods of gear lubrication.

(Weightage: 20 marks)

UNIT - II: (10 hrs)

BEVEL AND WORM GEARS

Straight tooth bevel gears terminolgy and geometrical relations standard dimensions and recommendations of worm gearing, force analysis, mountings of bevel gears and bearing reactions. Beam strength and wear strength of bevel gear teeth, dynamic tooth load, Design of straight tooth bevel gears based on beam and wear strength. Design of spiral bevel gears and hypoids gears and comparision with straight with straight tooth bevel gears.

WORM GEARS:-Worm and worm gear technology and geometrical relations. Standard dimensions and recommedations of worm gearing, Force analysis of worm drive. Friction in worm gears, efficiency of worm gear drives. Design criteria for worm drive. Strength and wear rating worm gears, thermal considerations in worm drive, types of failure in worm gearing,worm and worm wheel material, method of lubrications.

(Weightage: 20 marks)

UNIT - III:- (10 hrs)

BEARINGS:-

a) Rolling contact bearings: Type of rolling contact bearings, static and dynamic load capacities, Stribeacks equations, equivalent bearing loads, load life relationship, bearing life, load factor, selection of bearings from mfg. catalogue. Ball and taper roller bearings, Design for variable load and speed. Bearing with probability of survival other than 90%. Lubrication and mountings of bearings, oil seals and packing.

b) Sliding Contact Bearings:- Basic modes of lubrication, viscosity and its measurements effect of temperature on viscosity, viscosity index. Types of lubricating and additives, greases, selection of lubricants, Bearing materials.

(Weightage: 20 marks)

UNIT - IV:- (10 hrs)

PRESSURE VESSELS:-

Thick & thin cylinders, Failure criteria of vessels. Lame's equation, Clavarino's & Birnic equations, auto frettage & compound cylinders.

TYPES OF PRESSURE VESSELS:- Horizotal, vertical, classification of pressure vessels as per IS:2825-1969 and typical categories of welds. Materials of constructional details. Stresses induced in pressure vessels,Design of pressure vessels as per IS: 2825 code & ASME code, Shell and end closures. Effect of openings and nozzles in shells and cover area compensation method, gasketed joints, types of vessel supports.

(Weightage: 20 marks)

UNIT - V:- (9 hrs)

Statistical in Design, probability, Random variables- sample & population, Normal distribution, Sampling distribution, Confidence intervals, Population combinations, design & natural tolerance, design for assembly, Statistical analysis of tolerences.

ERGONOMICS & AESTHETIC DESIGN:-

basic tyes of product forms, designing for appearance- shape, design features, materials & finishes, color & tone, quality, ergonomical considerations- relation between user, machine and environmental communication between user & machine- control devicee, control layout & shape of control- display signals, layout of display panel.

(Weightage: 20 marks)

TERMWORK:-

The term work shall consists of ONE design project based on the above syllabus. Each design project consisting of two imperial size sheets- one involving assembly drawing with a part list and overall dimensions and the other sheet involving drawings of individual components. Manufacturing tolerances, surface finish symbols and geomatric tolerances should be specified so as to make ot a working drawing. A design report giving all necessary details of calculations of the design of components and assembly should be submitted in a seperate file.

FIVE design assignments of problems based on the topics of the syllabus out of which at least three shall be solved with the help of computer. (i.e two problems should be solved in Visual C ++ language and one in AutoLISP.)

##S OFF OF PROGRAMMING SHOULD BE RESTRICTED TO PRACTICAL CLASS ONL .

Rec mmended Books;-

1 Mechanical Engg. design by J.E.Shingley and C.R. Mischke -- 5th edition, Mcgraw Hill Publications.
2. Design of machine elements by M.F. Spotts- Prentice hall Pub cat on.
3. Machine design Hall and Helowenko - Schaum series.
4 Fundamentals of machine design by Phelan- McGraw Hill Pub ications.
5. Design of mac ine elements by V.B.Bhandari, Tata McGraw Hill
6. P.S.G design data book.
7. Machine design - Maleev & hartman
8. IS: 2825-1969 code for unfired pressure vessels.
9. Process equipment design by M.V.Joshi, McMillan India Ltd.

METROLOGY & QUALITY CONTROL (Paper-V)
T.E. (MECH)

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

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

A) METROLOGY:-

UNIT - I:- (9 hrs)

Definition measurement, precision, accuracy, sensitivity, classification of method of measurement.

LINEAR MEASUREMENT:- Standards, line standards, end standards, wavelength standards, classification of standards, precision measurement, precision measuring instruments and their characteristics, slip gauges.

STRAIGHTNESS, FLATNESS AND SQUARENESS:- Surface plates, angles plates, V-blocks, measurement of straightness, flatness testing, squareness testing, roundness testing, machine tool metrology.

MEASUREMENT BY LIGHT WAVE INTERFERENCE:- Basic principle, sources of light, optical flats, frige patterns and their interpretation, testing of flat, convex and concave and irregular surface, checking of slip gauges, calibration of optical flat.

(weightage: 20 marks)

UNIT - II:- (9 hrs)

DESIGN AND MANUFACTURING OF GAUGES:-

Three surface generation, manufacture of slip gauges, principle of alignment, errors.

COMPARATORS:- Characteristics, application, types, construction and working of different mechanical, optical, electrical, pneumatic comparators.

ANGLE MEASUREMENT:- Sine bars, sine centers, uses of sine bars, angle gauges, autocolimeter, angle dekker-constant deviation prism.

MEASUREMENT OF SURFACE FINISH:- Surface texture, definitions, terminology and basic concept, methods of measuring surface finish, assignment of surface roughness as per IS, relationship between surface roughness and manufacturing processes.

(weightage:20 hrs)

UNIT - III:- (9 hrs)

METROLOGY OF SCREW THREADS:- Terminology, errors and their effects, thread gauges, measurement of elements of external and internal threads.

GEAR MEASUREMENT:- Calipers measurements, involute testing, roller measurements, toolmaker's microscope, profile projectors.

STUDY OF MEASURING MACHINES:- Universal measuring machine, co-ordinate measuring machine, possible sources of errors in CMM, electric inspection and measuring machines.

RECENT TRENDS IN ENGG METROLOGY:- Development in optical measurements, precision instruments based on laser, probes, telemetric systems, isometric viewing of surface defects, image shearing microscope for vertical dimensions. (weightage: 20 marks)

(9 hrs)

(b) QUALITY CONTROL:-
UNIT - IV:-
1. Concept of quality & quality control, elements of quality & its growth, purpose, set up, policy and objectives, factors controlling quality of design and conformance, balance between the cost of quality and value of quality.
2. Introduction to topics- zero defects, statistical process control, quality circles, company wide quality management, total quality control, ISO 9000 and equivalent Indian standards.
3. Total quality management, vendor inspection, process capability study, quality audit system, quality assurance, difference between practice and quality control and quality assurance. (weightage: 20 marks)

(9 hrs)

UNIT - V:-
STATISTICAL QUALITY CONTROL:-
Basic statistics, mean, mode, standard deviation, data coolection, histogram, frequency distribution, importance of statical methods in quality control. Variables and attributes. Measurement inspection, different types of control charts(X,R,np,P and C chart). Machine/ process capability analysis.
ACCEPTANCE SAMPLING:
Sampling inspection v/s hunderd % inspection, basic concept of sampling inspection, operating characteristics curves, conflicting interests of consumer and producer, producer's and consumer's risk, AQL, LTPD, AOQL. single and double sampling plans, standard sampling tables, vendor rating. (weightage: 20 marks)

Termwork:-
The termwork shall consists of record of any ten out of the following experiments and assignments. Oral will be based on termwork.
1. Determination of linear/angular dimensions of part using precision and non-precision measuring instrument.
2. Angular measurement using a sine bar, autocollimator, angle decker.
3. Machine tool alignment tests on any machine tool like Lathe, Drilling, Milling.
4. Measurement of gear parameters (i) gear tooth thickness (ii) constant chord (i.i) pitch circle diameter.
5. Surface finish measurement.
6. Measurement of surface flatness using optical flat.
7. Exercise on design of limit gauges using Taylor's principles.
8. Study and measurment of parameters using tool makers microscope.
9. Assignment on unit-iv (** with the use of computers)
10. Assignment on unit-v.

11. Measurements by using mechanical, electrical and pneumatic comparators.
12. Measurement of screw parameters using floating carriage micrometer.

Note:** Only for practicals

Recommended Books:-

1. R K Jain; Engg Metrology; Khanna Publishers.
2. Handbook of industrial metrology; ASTME; Prentice Hall Pub.
3. J M Juran; Handbook of quality control, McGraw Hill Pub.
4. M.Mahajan; Statistical Quality Control;
5. K C Jain; TQM & ISO 9000; Khanna Publishers.
6. I C Gupta; A textbook of Engg Metrology; Khanna Publishers.
7. P C Gupta; Engg Precision Metrology; Khanna Publishers.

Note:
Oral will be based on the prescribed termwork presented in the form of cerified journal.

Term-II [redacted]

Practical Training/ Special Study/Minor Project

(Common with TE (Electronics, Industrial Electronics, Electronic and Telecommunication Engineering & Computer Engg., Electrical Engg., Instrumentation, Mech., & Production Engg.)

Examination scheme :
Termwork : 25 marks

Every student need to complete following requirements for termwork of Practical Training/Special Study/ Minor Project.

Practical training in any industry for a period of minimum two weeks and submit training report certified by personnel manager or works manager or any other higher authority of that industry.

OR

Special study on a recent topic from reported literature and submit a report on it.

OR

One mini theoritical or fabrication project and submit a report on it.

OR

Attend a course of Entrepreneurship Development course conducted by college and submit a report on it.

NOTE:-

1. Practical training is to be undergone in Summer Vacation after S.E. and / or in Winter Vacation after first term of T.E.

2. Report should be typed on A4 size paper and three copies paper bounded are to be prepared, one copy is for the candidate, one for the library and one for the teacher concerned.

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