3007

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॥ अंतरी पेटवू ज्ञानज्योत ॥

North Maharashtra University, Jalgaon

Syllabus for Third Year Engineering Degree Course (B.E.)

AUTOMOBILE

w.e.f. July,2001

C:\ENGINEERING\COVERPAGE.doc\PRAMOD CHAVAN

North Maharashtra University, Jalgaon

T.E. (Automobile Engineering) (1998 Course)

Term I

Sr. No	Subject Code	Subject	Teaching Scheme Hours/Week		Examination Scheme				
			Lectures	Practical	Paper Duration Hours	Maximum Marks			
						Paper	TW	PR	OR
1		** ENGG. METALLURGY	4	2	3	100	25	-	25
2		CAD/CAM	4	2	4	100	25	-	-
3		**INDUSTRIAL ENGG. & MANAGEMENT	4	-	3	100	-	-	-
4		**MACHINE DESIGN-I	4	4	4	100	25	-	25
5		HEAT TRANSFER & MASS TRANSFER	4	2	3	100	25	-	-
6		*** WORKSHOP PRACTICE--V	-	3	-	-	25	25	-
		Total	20	13	-	500	125	25	50
		Grand Total	33		-	700			

Note:- * Theory-related to workshop practice V is to be taught in workshop in practical.
** Common to Mechanical & Production Engg.
*** Common to production & Automobile

Term II

Sr. No	Subject Code	Subject	Teaching Scheme Hours/Week		Examination Scheme				
					Paper Duration Hours	Maximum Marks			
			Lectures	Practical		Paper	TW	PR	OR
1		*** METROLOGY & QUALITY CONTROL	4	2	3	100	25	-	25
2		HYDRAULICS & PNEUMATICS	4	2	3	100	25	-	25
3		AUTOMOBILE SYSTEMS	4	2	3	100	25	-	25
4		** DYNAMICS OF MACHINERY-II	4	2	3	100	25	-	-
5		MANUFACTURING TECHNOLOGY	4	-	3	100	-	-	-
6		***PRACTICAL TRAINING / SPECIAL STUDY / MINOR PROJECT / EDP	-	-	-	-	25	-	-
		Total	20	08	-	500	125	-	75
		Grand Total	30		-	700			

Note:- ** Common to Mechanical & Automobile Engg.
*** Common to Mechanical, Production & Automobile Engg.

Total of Maximum of Term I & II = 1400

TERM -1

ENGINEERING METALLURGY

T.E. (Mech/Prod/Auto)

Teaching Scheme :	Examination scheme:
Lectures : 4hrs/week	Paper : 100 marks
Practicals: 2hrs/week	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 an available laboratory furnace.
b) To draw 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 steel:- 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) Jomney Hardenability test:
OBJECTIVES:-
a) To conduct the jomny hardenability test on two types of steel.
b) To utilize the jomny 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 bras, 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.

TERM -I
CAD/CAM
T.E. (Auto)

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

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

UNIT 1: (9 hrs)
BASICS OF CAD/CAM:-
Definition: Concept, product life cycle and CAD/CAM. Reasons for implementing CAD systems, COmputer aided design process and various steps in it. Benefits of CAD. Integration of CAD/CAM, necessity, automation. Types of automation. Application of CAD/CAM. Wireframe modelling, surface modelling, solid modelling. Introductionto rapid prototyping or layered manufacturing technology. Concurrent engineering. (Weightage: 20 marks)

UNIT 2:-
INTERACTIVE COMPUTER GRAPHICS:-
Definition, concepts, two dimenstional transformations, scaling translation, rotation. Matrix representation and homogeneous co-ordinates. Composite transformations, curves and surfaces. Paramatric and non-paramatric representation of curves and surfaces. Bazier curve, BSpline curve, Bezier surface, B-Spline surface.
(NOTE: C++ programming is limited for practical class only. It should be asked in theory paper) (Weightage: 20 marks)

UNIT 3:-
FEM ANALYSIS AND ITS APPLICATION:
Introduction, process of FEA, physical problems, mathematical models and the finite element solution. Finite element analysis as an integral part of CAD.
Heat transfer analysis: Governing heat transfer equations. Incremental equations. Incompressible inviscid flow, torsion. FEM analysis of rolling and extrusion processes, 2-D analysis.
(Weightage: 20 marks)

UNIT 4:- FMS, GT (CAM)-
Components of computer integrated manufacturing systems. Building blocks of flexible manufacturing systems. FMS in job, batch and mass production. Machining systems of FMS. Tool management systems. Workpiece handling systems. Flexible manufacturing cells. Means to acheive various types of flexibilities such as machine process, material handling, product, production flexibility.
GROUP TECHNOLOGY:-
Models and algorithms, visual methods, coding method, cluster analysis mehtod, matrix formulation, mathematical programming formulation.
Concept of cellular manufacturing, types of cell manual and robotized, method of cell formation, advantages of cellular manufacturing. (Weightage: 20 marks)

UNIT 5:- ROBOTICS:-
Components, classification, selection, sensor technology. Robot arm trajection, arm dynamics, trajectory planning, robot grippers. Robot kinematics: Object location,transformations (2d & 3d), direct and inverse kinematics, manipulator motion. Mathematical model of servo systems.
REVERSE ENGG:-
Basic steps in reverse engg., such as Data capture, preprocessing, Segmentation and surface fitting, 3D CAD model crearion, Application of reverse engg. (Weightage: 20 marks)

TERM WORK: (ANY FIVE):-
1.Design of any of the subsystems of compressor, condensor or evaporator in "C" language.
2. Design of any one of the following: Piston, cylinder, Connecting rod, Crank shaft, Valves etc. with the help of "C" language.
3. Drafting of any one of the following components - Rotor and stator blades, casing, bearings, etc. with the help of Autocad.
4. Use of generative manufacturing processes for rapid prototyping.
5. Use of software packages like - I-deas, pro-E, Catia, Unigraphics, Surfcam , Mastercam etc. for solid modelling of any of engg. components.
6. Reverse engg. of any Geomatric model.
7. Problems on FEM (Gears, etc.) by using CAD/CAM packages like I-deas, Ansys, etc.
8. Program for transformations- translations, rotation, scaling.
9. Assignment on Robot programming. (compulsory)
10. Assignment on FMS, group technology. (compulsory)

Note: Computer programming is restricted for practical i.e. termwork only.

ORAL:-
Oral will be based on above termwork only.

REFERENCE BOOKS:-
1. CAD/CAM by Ibrahim Zeid
2. CAD/CAM by Ramamuruti
3. CAD/CAM by Zimmer, Groover.
4. Robotics: Control, sensing, vision & Intelligence - Fu - McGraw Hill.

TERM -1

INDUSTRIAL ENGINEERING & MANAGEMENT

T.E. (Mech/Auto)

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 evalution, 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) Industrial Engg. & Management - M. Mahajan
2) Workstudy - P.M.Currie.
3) Workstudy - 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.
10. Industrial Engg. & Management by Hicks - McGraw Hill

TERM -1
MACHINE DESIGN - I
T.E. (Mech/Auto)

Teaching Scheme :	Examination scheme:
Lectures : 4hrs/week	Paper : 100 marks
Practicals: 2 hrs/week(Drawing)	Termwork : 25 marks
2 hr/week (computer)	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 rimmed 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 peening.
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.
c) Brakes: Design considerations in brakes - Energy equations, thermal 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 influencing 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 , bolts 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 seperate 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. (i.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 by P C Sharma

TERM -1

HEAT TRANSFER & MASS TRANSFER

E.E. (Auto)

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

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

UNIT 1: (9 hrs)
CONDUCTION:-
1.1 Mechanism of heat transfer by conduction, importance of heta transfer.
1.2 Fourier's three dimensional differential equation for conduction with heat generation in steady state in the cartesian coordinates.
1.3 Solution for Fourier's equation for one dimensional steady state conductions such as plane wall, plane composite wall, cylindrical and sherical composite walls. (for cylindrical and spherical wall, derivation of fouriers three dimensional equation is not included). Over all heat transfer coefficient, LMA.
1.4 Critical thickness of insulation and its importance.
1.5 Unsteady state conduction through a plane wall having no internal resistance. Fins. (weightage: 20 marks)

UNIT 2: (9 hrs)
CONVECTION:-
2.1 Mechanism of heat transfer by convection. Natural and Forced convection.
2.2 Hydrodynamic and thermal boundary layers. Similarity between velocity profiles and temperature profile.
2.3 Heat transfer coefficient (film coefficient) for convection. Effect of various parameters such as physical properties of the fluid, system geometry, fluid flow on heat transfer coefficient.
2.4 Perinciples of dimensional analysis. Application of dimensional analysis to convection for finding heat transfer coefficient.
2.5 Empirical relations for convection. Physical significance of dimensionless numbers such as Nusselt's Number, Grashoff's number, Prandtl's number, Reynold number, Stanton number, Pe number. (weightage: 20 marks)

UNIT 3: (9 hrs)
RADIATION:-
3.1 Mechanism of heat transfer by radiation.
3.2 Concept of black body and gret body. Emissive power and emissivity.
3.3 Basic laws of radiation:- Planck's law, Kirchoff's law, stefan-boltzman law, Wien's displacement law and Lanbert's Cosine law. Intensity of radiation radiosity.
3.4 Radiation heat exchange between two black bodies. Electrical

network analogy for radiation heat exchange between two and three grey bodies.
3.5 Shape factor for simple geometry's. Properties of shape factor. (weightage: 20 marks)

UNIT 4: (9 hrs)
HEAT EXCHANGERS:-
4.1 Classification of heat exchangers.
4.2 Logarithmic Mean Temperature Difference, Correction factor and effectiveness of heat exchangers.
4.3 Effectiveness as a function of number of transfer units and heat capacity ratio.
4.4 Overall heat transfer coefficient, fouling factor. Pressure drop in fluids across heat exchangers. (weightage: 20 marks)

UNIT 5: (9 hrs)
MASS TRANSFER:-
5.1 Mechanism of mass transfer. Importance of mass transfer in engineering.
5.2 Fick's law of diffusion. Steady state diffusion of gases and liquids through plane, cylindrical and sherical walls. Equimolal diffusion.
5.3 Isothermal evaporation of water into air.
5.4 Convective mass transfer cosfficient. Empirical relations for mass transfer, in terms of Sherwod number, Reynold's number and Schmidt's number. (weightage: 20 marks)

TermWork:-
Termwork shall consists of any 7 experiments and assignments on the following topics:
1. Experiment on thermal conductivity of metal bar.
2. Experiment on thermal conductivity of insulating material.
3. Experiment on free convection.
4. Experiment on forced convection.
5. Experiment on heat exchanger.
6. Experiment on emissivity of a surface.
7. Experiment on stefan boltzman constant.
8. Experiment on heat transfer through pin fin and effectiveness.
9. Study of mass transfer mechanism, its importance and convective mass transfer, etc.
10. Study of heat exchangers.

Note: Atleast one assignment must be based on each chapter including two different problem from each unit of the syllabus.

Recommended Books:-
1. Heat and Mass transfer
by R. K. Rajput, S. Chand,
2. Heat Transfer
by Sukhatme
3. Heat and Mass Transfer
by C. P. Arora
4. Heat Transfer
by Holfman
5. Heat Transfer
by Ozisik
6. Heat Transfer
by Cenzel

TERM -I

WORKSHOP PRACTICE - V

T.E. (Prod & Auto)

Teaching Scheme :
Practicals: 3hrs/week

Examination scheme:
Termwork : 25 marks
Practical: 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/trainer. (1 hr)

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

4. One 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. Die 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
ii- Capstan & Turret lathe - +/-0.05mm
iii- Planner - +/- 0.3 mm

Note:- Termwork will be presented in the form of certified journal.
Practical examination will be of 4 hours.

TERM-2

METROLOGY & QUALITY CONTROL

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

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 marks)

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)

B) QUALITY CONTROL:-
UNIT - IV:- (9 hrs)
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 inspection and quality control and quality assurance. (weightage: 20 marks)

UNIT - V:- STATISTICAL QUALITY CONTROL: (9 hrs)
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 charts) 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 dekkor.
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 (iii) 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.
10. Assignment on unit-v.
11. Measurements by using mechanical, electrical and pneumatic comparators.
12. Measurement of screw parameters using floating carriage micrometer.

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. M. Mahajan; A textbook of Engg Metrology; Khanna Publishers.
7. R C Gupta; Engg Precision Metrology; Khanna Publishers.
Note:
Oral will be based on the prescribed termwork presented in the form of cerified journal.

TERM -2

HYDRAULICS & PNEUMATICS

T.E.(Auto)

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)

PUMPS:

Introduction, classification, reciprocating pump, working principle, piston pumps (single acting and double acting single cylinder pumps, two throw pumps), plunger pumps, bucket pumps, slip and co-efficient of discharge, rate of delivery, velocity and acceleration of water, cavitation, speed, indicator diagrams, effect of bent delivery pipe on seperation, air vessels, maximum speed of the pump provided with air vessels, work saved by air vessels, other types of reciprocating pumps, (direct acting pumps and differential pumps). Axial flow pumps, scrtew pumps, jet pumps, air lift pump. (weightage: 20 marks)

UNIT 2: (9 hrs)

TURBINES:-

Intrroduction, classification, Impulse turbines, reaction turbines, pelton turbine, francis turbine, kaplan turbine (Working, construction, characteristic curves). Governing, cavitation, selection pf hydraulic turbines. (weightage: 20 marks)

UNIT 3: (9 hrs)

FLUID SYSTEMS:-

Introduction, hydraulic press, hydraulic accumulator, differential hydraulic accumulator, hydraulic intensifier, Hydraulic ram, hydraulic lift, direct acting and suspended hydraulic lift, hydraulic crane, hydraulic coupling, hydraulic torque converter, hydraulic jack, hydraulic rivetter, fluid drives for machine tools. Some applications of hydrostatic transmissions.
(weightage: 20 marks)

UNIT 4: (9 hrs)

Hydraulic and pneumatic system components and their symbols - seal, gasket, filters, rules for symbols, general symbols, hydraulic pumps, air compressors, hydraulic and pneumatic motors and cylinders, electric motor, Intensifier, accumulator, pressure switch, pressure gauge, spring, rotating shaft, heat exchanger, stainer, seperator, lubricator, storage tank, valves, muffles.
(weightage: 20 marks)

UNIT 5: (9 hrs)

HYDRAULIC & PNEUMATIC CIRCUITS:-

Speed control circuits, variable delivery pump circuits, meter in flow control circuit, meter out circuit, bleed off speed control circuit, regenerative circuit, counter balance circuit, control of single acting and double acting hydraulic cylinder, pneumatic circuits to control rate of piston movement (for single and double cylinder) (weightage: 20 marks)

Termwork:-

1. Trial on reciprocating pump.
2. Trail on hydrulic jack.
3. Study or trial on pelton wheel turbine.
4. Study or trial on francis turbine.
5. Study or trial on kaplan turbine.
6. Trial on hydraulic trainer.

7. Trial on hydraulic ram.
8. Trial on hydraulic press.
9. Trial on pneumatic trainer.
10. Synthesis of simple hydraulic and pneumatic circuits.

Recommended Books:-

1. Introduction to fluid mechanics and fluid machines.
   by Som & Biswas - TMH publications.
2. A text book of fluid mechanics and hydraulic machines
   by Dr. R K Bansal
3. Fluid Mechanics by S S Rattan.
4. Pneumatics and Hydraulics by Harry Stewart
5. Foundation of fluid dynamics by Yuan
6. Industrial hydraulics and its application by Pipenger

TERM -2

AUTOMOBILE SYSTEMS

T.E. (Auto)

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)

GENERAL:
Vehicle specifications, vehicle layout, types of vehicles and their applications, two and four wheelers, cars, light commercial vehicles, trucks, buses, earth moving machinery, highway vehicles, agriculture tractors, construction of automobile and various systems of automobile.

Chasis & frame:
Frame, subframe, integral construction frame alignment, body, bumpers, doors, hood, articulated vehicles, trailors and safety considerations. (Weightage: 20 marks)

UNIT 2: (9 hrs)

COOLING SYSTEM:
Necessity, methods of cooling, air cooling, water cooling, components of water cooling system, radiator pressure cap and expansion reservoir, thermostat, water pump, fan, other methods of cylinder cooling, antifreeze solutions, cooling system trouble shooting.

LUBRICATION:
Introduction, types of lubricants, testing of lubricants, oil additives, crankcase ventilation, systems of engine lubrication, oil strainers, pumps, filters, oil pressure gauges, lubricating system service, lubrication system trouble shooting. (Weightage: 20 marks)

UNIT 3: (9 hrs)

IGNITION SYSTEMS:
Conventional ignition systems: Function, types of ignition system, components, battery ignition system, coil and magneto ignition system, testing of ignition circuit, ignition system trouble shooting.

ELECTRONIC IGNITION SYSTEMS:
Introduction, semiconductors, principles of electronic ignition, pulse generator, distributorless ignition.

STARTING SYSTEM:
Storage batteries, types, charging, testing, trouble shooting.
Starting motor, starting drives, bendix drives, overrunning clutch drive, dyer drive, starting motors switch and control circuits,

starting system trouble shooting. (Weightage: 20 marks)

UNIT 4:
WHEELS, TYRES & TUBES: (9 hrs)
Construction & Types of wheels, wheel dimensions, types of tyres, tyres properties, tyre materials, considerations in tread design, wheel and tyre trouble shooting. Retreading of tyres.
Tubes, natural rubber and butyl flops. Rims, types and maintenance.
FRONT AXLE & STEERING:
Introduction, front axle, factors of wheel alignment, steering geometry, steering mechanisms, cornering force, selfrighting torque, understeer and oversteer, steering linkages, steering gears, steering ratio, special steering columns, power sterring, advanced steering system. (Weightage: 20 marks)

UNIT 5:
AIR CONDITIONING SYSTEMS: (9 hrs)
Definition of basic terms of psychometry such as DBT, WBT, RH, etc. Human comfort conditions, temperature control system, insulation methods in auto air conditioner. Study of typical auto air conditioning sytems, location of window air-conditioner. Study of typical auto air conditioning systems, various parts of system, compressor performance and its effect on overall engine performance. (Weightage: 20 marks)

TermWork:
Two assignments from each unit.

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

Recommended Books:

1. Automobile Engineering - Vol 1&2 by Kirpal Singh, Standard Publishers Distributors.
2. Automobile Engineering by Anil Chhikara
3. Automotive Mechanics, by Crouse, TMH publications.
4. Automotive Technology, by Sethi, TMH publications.
5. Automotive Engg, by Narang.

TERM -2

DYNAMICS OF MACHINERY - II

T.E. (Mech & Auto)

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

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

UNIT - I:- (9 hrs)
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. (Weightage: 20 marks)

UNIT - II:- (10 hrs)
GOVERNORS & FLYWHEEL:-
1. GOVERNOR:- a)Types of governors- Watts, Porter, Proell, Hartnell, Spring controlled, Inertia controlled, b) Sensitiveness of a governor, c) Hunting, Ischronism, 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 sizes for different types of engine and machine.
(Weightage: 20 marks)

UNIT - III:- (10 hrs)
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)

UNIT - IV:- (10 hrs)
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 undercutting 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 ofinsensitiveness & 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

TERM -2
MANUFACTURING TECHNOLOGY
T.E. (Mech & Auto)

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 or 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 mechaniams, Bar feeding mechaniams, 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 on milling, hobbing, shaping, Gear finishing processes - shaving, lapping & grinding construction & working of mechanics.
2.3 Thread manufacturing:- Thread cutting - internal & external, Chases, dies, thread 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, Types 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. N K Mehta, Metal Cutting & Machine tools,TataMcGraw Hill.
5. American Society of tool & manufacturing Enginners, Fundamentals of tool design , Prentice Hall of India Pvt Ltd.
6. Donaldson, tool design, Tata McGraw Hill
7. P.C.Pandey, H.S.Sahu, Modern machining Processes, TataMcGraw Hill.
8. O.P.Khanna, M.Lal - A text Book Production Technology, Vol I & II, Dhanpat Rai & Sons.

TERM -2

PRACTICAL TRAINING / SPECIAL STUDY / MINOR PROJECT/EDP

T.E. (Mech, Prod & Auto)

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 & 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 theoretical or fabrication project and submit a report on it.

Note:- 1. Practical training is to be undergone in summer vacation after SE and/or in winter vacation after first term of T.E.

2. 3 Report should be typed on A4 size paper and three copies in paper bound form to be prepared. One copy is for the candidate, one copy for the library and one for the teacher concerned.

OR

Attend a course of entrepreneurship development programme conducted by college and submit a report on it.