

Faculty of Engineering & Technology
Department of Mechanical Engineering

Study and Evaluation Scheme

Of

Diploma (Engineering)
(Mechanical Engineering)

Diploma (ME)

(Applicable w.e.f Academic Session 2015-18, till revised)



AKS UNIVERSITY, SATNA

Study and Evaluation Scheme

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Faculty of Engineering & Technology
Department of Mechanical Engineering
Diploma (Engg.)- (Mechanical)

III Semester

TEACHING & EXAMINATION SCHEME

Sr. No.	Paper Code	Subject	L	T	P	Credit	Total Credit
1.	06ME301	Material Technology	3	1		4	25
2.	06ME302	Manufacturing Process	3	1		4	
3.	06EE303	Basic Electrical and Electronics	3	1		4	
4.	06ME304	Mechanical Drafting and Auto CAD	3	1		4	
5.	06ME305	Strength of Material	3	1		4	
1.	06ME351	Manufacturing Process Lab			2	1	
2	06ME352	Mechanical Drafting and Auto CAD Lab			2	1	
3	06ME353	Strength of Material Lab			2	1	
4	06EE354	Basic Electrical & Electronics Lab			2	1	

Faculty of Engineering & Technology
Department of Mechanical Engineering
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IV Semester

TEACHING & EXAMINATION SCHEME

Sr. No.	Paper Code	Subject	L	T	P	Credit	Total Credit
1.	06ME401	Fluid Mechanics and Hydraulic Machines	3	1		4	23
2.	06ME402	Thermal Engineering	3	1		4	
3.	06ME403	Theory of Machine	3	1		4	
4.	06MT404	Industrial Management	3	1		4	
5.	06EN405	Entrepreneurship	3	1		4	
1.	06ME451	Fluid Mechanics and Hydraulic Machines Lab			2	1	
2	06ME452	Theory of machine Lab			2	1	
3	06ME453	Thermal Engineering Lab			2	1	

Faculty of Engineering & Technology
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V Semester

TEACHING & EXAMINATION SCHEME

	Paper Code	Subject	L	T	P	Credit	Total Credit
1.	06AC501	Process Planning Estimating Costing	3	1		4	24
2.	06ME502	Machine Tool Technology	3	1		4	
3.	06ME503	Engineering Measurement and Maintenance Practice	3	1		4	
4.	06ME504	Modern Practices in Manufacturing and Management	3	1		4	
5.	06ME505	Industrial Engineering	3	1		4	
1	06ME551	Machine Tool Technology Lab			2	1	
2	06ME552	Engineering Measurement and Maintenance Practice Lab			2	1	
3	06ME553	Industrial Engineering Lab			2	1	
4	06ME554	Modern Practices in Manufacturing and Management Lab			2	1	

Faculty of Engineering & Technology
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VI Semester

TEACHING & EXAMINATION SCHEME

	Paper Code	Subject	L	T	P	Credit	Total Credit
1.	06ME601	Design of Machine Elements	3	1		4	25
2.	06ME602	Refrigeration and Air Conditioning	3	1		4	
3.	Elective- I (Choose Any one)		3	1		4	
	06ME603-A	Automobile Engineering					
	06ME603-B	CAD-CAM					
4.	Elective- II (Choose Any one)		3	1		4	
	06ME604-A	Power Plant Engineering					
	06ME604-B	Non conventional Sources of Energy					
1	06ME651	Major Project				6	
2	06ME652	Design of machine elements Lab			2	1	
3	06ME653-A/B	Elective-I Lab			2	1	
4	06ME654	Refrigeration and air conditioning Lab			2	1	

Diploma (Engg.)
Mechanical Engineering
Semester-III
MATERIALS TECHNOLOGY

RATIONALE : *The knowledge of materials, their properties and behavior is essential for people associated with engineering activities. Materials technology plays an important role in design and production of product from the point of view of reliability and performance of product.*

The curriculum of the subject emphasizes upon understanding the properties and behavior of materials in correlation with their structure and external environmental effects. The range of materials available for engineering use is quite vast, hence only the basic groups of materials such as ferrous, non-ferrous non-metallic materials along with their general characteristic and application have been stressed.

Requirement of Engineering materials, mechanical properties and their testing :

UNIT-I

Introduction to engineering materials, classification of engineering materials and their properties. Mechanical properties of materials, destructive including Tensile test, compression test, hardness test, impact test fatigue test, endurance limit, bending test, shear test and non-destructive testing methods.

Structure of Solid materials: Classification amorphous and crystalline states, unit cells and crystal structure (B.C.C., F.C.C. and H.C.P) allotropy. Crystal imperfection and their effects on properties

Solidification of Metal and ingot structure: Process of nucleation and grain growth, ingot solidification, dendritic and columnar structure, segregation of impurities, grain and grain boundaries.

Equilibrium Phase Diagrams and Phase Transformation : Equilibrium of phase Diagrams : Plotting of equilibrium diagrams, interpretation, phase rule and lever rule and its application Phase transformations – Eutectic Eutectoid, Peritectic and Peritectoid

UNIT-II

Practical Metallography : Preparation of specimen, selecting the specimen, mounting the specimen, grinding , polishing, etching and etching reagents. The metallurgical microscope. Use and care of microscope.

Iron- Carbon Equilibrium System : The complete iron carbon diagram and its interpretation. The solidification and cooling of various carbon steels, structures produced, correlation of mechanical properties with carbon content.

Heat Treatment of Steels: Objective of heat treatment, thermal processes- annealing, normalizing, hardening and tempering. Hardening process : Surface hardening, flame hardening, case hardening methods, their scope, limitations and advantages, quenching mediums and their effect on hardness, Hardening defects due to improper quenching, hardenability, Jominy end quench test and interpretation of its results. T.T.T. curves interpretation and use, Isothermal heat treatment processes -martempering, austempering, spheroidising and patenting

UNIT-III

Ferrous Metals and Alloys : Classification, types of cast irons their properties and uses, alloy cast-irons, various alloying elements used, their effects on properties and uses. Classification, composition and uses of plain carbon steels, effect of impurities, Alloy steels - various alloying elements, their effects on properties and uses. Alloy steel classification. Tool Steel : Typical compositions, requirements of tool steels, high speed steel, high carbon steel. Standardization of steels. Designation of steels as per B.I.S. codes.

Non- Ferrous Metals and Alloys : Copper : Its Properties and uses Cooper Bases Alloys : Brasses, their classification, composition, properties and uses, designation of copper alloys as per B.I.S. aluminum its properties and uses. Aluminum Alloys : Their composition, Classification, properties and uses. Designation of Al- alloys as per B.I.S, Zinc, Nickel and lead their alloys properties and uses Bearing alloys - their composition and field of application.

UNIT-IV

Non- Metallic Materials : introduction to Ceramic Refractory, Rubbers Insulators and Lubricants

Plastics: characteristics, classification, commonly used thermo- setting and thermoplastic - their properties and uses. Ingredients for processing plastics. Plastic processing methods different methods.

UNIT-V

Powder Metallurgy:-Introduction and application. Description of process, manufacture and blending of metal powder compacting and sintering.

Metal Preservation: Corrosion meaning various mechanism effect of corrosion, methods of minimizing corrosion

Modern Trends in Materials Engineering : New materials like FRP, Composites, synthetic fibers, synthetic wood. Super conductors

REFERENCES

1. Engineering physical Metallurgy-By Prof. Y Lakhtin MIR Publishers mascow
2. A Text Book of Material Science And Metallurgy by O.P. Khanna.
3. Material Science And Process. by S. K. Hazia Choudhry
4. Mechanical Metallurgy by Dieter (Tata Mcgrawhill)
5. Materials For Engineers by M.H.A. Kempsty
6. Introduction to Material Science And Engineeringby K.M. Ralls, T.H. Courtney, John Wuff (Wiley Eastern New Delhi)
7. Physical Matallurgy Principles by Read Hill (Affiliated East- West Press Pvt. Ltd. NewDelhi)
8. Engineering Metallurgy by R. Higgins (ENS).

TEXT BOOKS

1. Materials Science by B.S. Narang (Pub. CBS pub. & Distributions New Delhi)
2. Padarth Prodyogiki (Hindi) by P.N. Vijayvergiya (Deepak Prakashan, Gwalior)

Diploma (Engg.)
Mechanical Engineering
Semester-III
MANUFACTURING PROCESSES

RATIONALE: *Manufacturing processes are advancing very fast with the expansion of technology. This course will provide basic insight to the students regarding methods of manufacturing processes. The course gives the opportunity for exhaustive study of metal casting, Mechanical working of metals, press working and metal joining. The abilities developed by studying this course will be directly helpful to all the technicians, in whichever field they are employed.*

UNIT-I

Introduction to Manufacturing Processes: Definition, classification of basic manufacturing processes i.e, mechanical working, casting, metal joining processes, metal cutting process, press working . Examples of each of the above listed manufacturing processes, factors which influence selection of manufacturing process for a particular application.

Metal Casting : Introduction , advantages and limitations of casting as production process.

Pattern Making : Definition of pattern, types of patterns and their details, materials, allowances, tools required, colour code for patterns.

UNIT-II

Moulding : Definition, moulding methods and types of moulds, moulding materials, moulding sand and its composition, sand properties, testing parameters of sand, and their effects, sand preparations, sand conditioning, characteristics and defects of moulds. Function of runners, risers and gate.

Cores and core making, core boxes. Cleaning of casting, Special casting methods, need for special casting methods, die casting, centrifugal casting, investment (lost wax) casting, casting defects, causes and analysis, area of application of casting process.

Furnaces : Cupola ,crucible, pit and electric arc furnaces, induction furnace , their salient features, safety aspects.

UNIT-III

Press Working : Introduction of press working of metals, principle of press working , description of a simple press working unit, press working operations : punching, shearing, drawing, bending, slitting, knurling, notching, trimming, piercing etc. Double action press, description and its field of application, die and punch, types of dies, specifications of a press, safety precautions to be observed while working on a press.

Mechanical Working : Introduction - hot and cold working Principle of recrystallization.

UNIT-IV

Metal Rolling : Principle of metal rolling , basic components of a simple rolling process equipment. Types of deformation during rolling. roller material, selection and desirable properties, principles of thread rolling- description with sketches, manufacture of seamless tubes by rolling. types of rolling mill. Rolling defects

Metal Drawing : Basic Principle of drawing of metals, differentiate between the drawing and deep drawing of metals, principle of wire drawing and example.

Extrusion : Definition, Classify the methods of extrusion, their limitations, advantage and disadvantage. Tube extrusion, impact extrusion, application of extrusion processes. Extrusion defects .

Forging : Types of forging, Die forging, differentiate between the cold die and hot die forging, advantage of forming by forging, common defects and their reasons. Limitations of forging, press forging, drop forging, upset forging, die material, applications of forging processes in engineering.

UNIT-V

Metal Joining : Introduction, Classification of metal joining processes

Welding :-classification, Plastic, fusion and forge welding, Weldability of metals, metallurgy of welding

Resistance welding : Spot, seam, butt, projection, percussion techniques.

Gas welding and gas cutting : Principle of operation and technique, gas cutting.

Arc Welding : Carbon arc, TIG, MIG, Submerged arc , Atomic hydrogen, Eletro-slag, Plasma arc welding processes, Electrodes- types and selection , flux and their uses. Special welding techniques- Welding of different metals. Defects in welds, testing and inspection. Accident prevention in gas and arc welding Equipments & tools used in metal arc welding, specification and functions. Soldering, Brazing and Adhesive bonding

LIST OF EXPERIMENTS

1. Making a split/solid pattern from wood.
2. Making a core box. Carpentry /pattern shop
3. Tempering of sand, practice of green and dry sand making. pattern shop
4. Practice of core making and baking Moulding shop
5. Practice of open mould in a two boxes, using split pattern and solid pattern, Locating the core Moulding shop
6. Demonstration of metal melting in pit furnace& casting process. Foundry
7. Simple forming practice (Making a square bar out of a given round bar, making of a chisel and bolt) Blacksmith shop
8. Practice of sheet cutting with the help of straight and bent snips. Making small rectangular prism and cylinder. Blacksmith shop
9. Practice of edge preparation for welding. Fitting
10. Practice of Welding of corner, edge and Tee joint Welding
11. Practice of making gas flames with nozzles and making simple joints. Welding

Note:- The teacher is free to select the number of practical covering all the topics depending upon the availability to time. And equipments

REFEREES

1. Process And Materials of Manufacture -by Lindberg.
2. Workshop Technology -by Hazara & Choudhary.
3. Materials And Manufacturing process - by Dalela.
4. Manufacturing Processes - by Yankee.
5. Manufacturing Process - by S.E. Rusinof
6. Welding Engineering - by B.E. Rossi.
7. Production Engineering - P.C. Sharma
8. Manufacturing Technology - P.N. Rao
9. Production Technology - R.K. Jain

TEXT BOOKS

1. Foundry Engineering -by P.L. jain.
2. Nirman Prakram (Hindi) - by P.N. Vijayvargiy
(Deepak Prakashan, Morar, Gwalior

Diploma (Engg.)
Mechanical Engineering
Semester-III
BASIC ELECTRICAL AND ELECTRONICS

UNIT-I: FUNDAMENTALS OF ELECTRICAL ENGINEERING

Concept of electric current, potential and potential difference (Voltage). Sources of D.C. and A.C. Electric energy. Methods of voltage generation and standard voltages used in generation transmission and distribution. Electrical Power, energy and their units.

D.C. CIRCUITS: Ohm's Law, Concept of resistance, conductance, resistivity, conductivity and their units. Effect of temp. on resistance. Temperature coefficient of resistance (Definition only) Connections of resistances. Series, Parallel connections and their combinations. (Simple Numericals) Kirchoff's Voltage Law, Kirchoff's Current Law (Simple Numerical)

A.C. CIRCUITS: Generation of single phase and three phase sinusoidal voltage. Vector representation. Concept of Cycle, Frequency, time period, amplitude, phase and phase difference. Define instantaneous value, average value, RMS value and peak value of sinusoidal electrical quantities. Derive relationship between them . Form factor and peak factor (Definition only). Current voltage and power in pure resistive, inductive and capacitive circuit. Concept of Reactance , impedance and power factor in R.L., R. C. and RLC Series circuit. (Simple Numericals). Causes and effect of poor power factor. Methods of improving power factor. 3 phase AC supply- three phase three wire and three phase four wire system. Relationship between V_L and V_{PH} , I_L and I_{PH} and three phase power in star and delta connected load.(Simple Numerical)

UNIT-II: A.C. MACHINES

Single Phase Transformer : Construction, working principle. EMF Equation (Derivation with simple numerical), Turn ratio, Step up and step down transformers and their application.Losses , efficiency and regulation (No derivation). Three Phase Induction Motor : Construction, types , principle of operation. Concept of Slip (Simple Numerical), Applications, Starters: DOL and Star Delta. Single Phase Induction Motor : Methods of making a single phase motor self start. Types of single phase induction motor- capacitor start, capacitor run and shaded pole and their applications. Synchronous Machines : Synchronous motor- construction, principle of operation, comparison with three phase induction motor. Synchronous generator (alternator) – Construction, principle of operation, speed and frequency, synchronous speed.

UNIT-III: MEASURING INSTRUMENTS

Classification of Measuring Instruments, absolute and secondary instruments. Indicating, Integrating and Recording instruments, their examples. Elementary idea about working principles and construction of MI and MC type Ammeter and voltmeter. Electrodynamometer type watt meter. Induction type energy meter , electronic energy meter. Application of Megger and earth tester.Multimeter,

UNIT-IV: ELECTRIC WIRING

Types of Wiring and their Applications in brief. Size of conductor , S.W. gauge. Accessories like switches, fuses, holders, sockets and MCB's. Staircase Wiring , Fluorescent tube light wiring .

ELECTRIC SAFETY

Electric shock and its prevention , effect of electrical current on human body, shock treatment, need of earthing.

UNIT-V : ELECTRONIC DEVICES AND CIRCUITS

Semiconductor PN Junction Diode, Zener Diode, PNP and NPN transistor , UJT, FET, MOSFET and SCR. Their layer diagram, symbol, V-I characteristics and applications. Electronic Circuits : Concept of biasing of diode and transistor. Single Phase Half wave and Full wave rectifier(I/O waveform), Concept of ripple, filter circuit (shunt capacitor and series inductor) . Transistor as an amplifier, concept of gain, Zener regulator, regulated power supply (Block diagram only).

REFERENCES

1. Fundamental of Electrical Engineering and Electronics – B.L. Thareja , S. CHAND Publication
2. Basic Electrical Engineering – V.K. Mehta , S. CHAND Publication
3. Principles of Electronics – V.K. Mehta , S. CHAND Publication
4. Basic Electrical Engineering – V. N. Mittle, TMH
5. Electrical Machines Vol I & II – S.K.Bhattacharya, TTTI, Chandigarh
6. A Curse book in Electrical & Electronic Measurement and Instrumentation , A.K Sawhney.
7. Principles of Electrical Engg. and Electronics – V.K. Mehta , S. CHAND Publication
8. Electrical Technology – S.L.Uppal, Khanna Publication
9. ELectrical Measurement – J.B. Gupta, Dhanpat Rai & Sons.

LIST OF EXPERIMENTS

1. Verification of Kirchoff's Law
2. To Measure Voltage Current and power in single phase AC circuit.
3. To calculate Impedance, power and power factor by measuring voltage across each element
4. Study of different parts of DC machine . Study of three point starter for DC motor.
5. Study of different parts of Induction Motor (Single Phase/ Three Phase)
6. To determine transformation ratio of a given single phase transformer. Study and operation of DOL and Star Delta Starter.
7. To measure slip for a given three phase induction motor.
8. To measure insulation resistance by Megger.
9. To measure earth resistance by earth tester.
10. To make connection for fluorescent tube light circuit.

Diploma (Engg.)
Mechanical Engineering
Semester-III
MECHANICAL DRAFTING AND AUTOCAD

RATIONALE : *This course in mechanical Drafting has been prepared with a view to develop elementary drafting skill in the students. Looking to the professional needs of the technicians, more emphasis has been laid on the use of I.S. Code of practice and reading and interpretation of drawings. The topics on multi view representation dimensioning and tolerance, Free hand sketching and sections of M/c parts are included to build foundation for production drawing. The topic of pipe drafting will help the students to understand the importance and functions of piping system in industry.*

Computer Graphics is a modern concept in Mechanical Drafting and knowledge of computer interface like AutoCAD is needed like primary education to draw and present drawing in electronic data form.

UNIT-I

Projection and multi view Representation: Projection orthographic projection. First and third angle projection, conversion of pictorial views in to orthographic views, conventional representation symbol as per IS: 696.

Sectional Views : Full section, half section, partial or broken section, revolved section, removed section, offset section. Sectioning conventions, section lines. Hatching procedure for different materials as per IS code 686 1972. Sectional views of Machine parts. (Use 1st and 3rd angle projections both)

Tolerance, Machining And Welding Symbols : Application of tolerances. (Use I.S. Code 696) Machining marks, finish marks, countersinking, counter boring spot facing, figures and notes for same. Representation of characteristics machining (circularity, Angularity etc.) (Ref IS 969) Representation of welded joints, welding symbols,

UNIT-II

Introduction to Auto CAD: Coordinate system. Draw command- line ,arc, circle rectangle, polygon, point, ellipse, hatch, table. Modify commands-erase, copy, offset, array, trim, extend, break, join, chamfer, fillet, move, rotate, scale, stretch, lengthen. Dimensioning Tray settings: snap, grid, ortho, polar, osnap Format commands: line type, point style, units, layers, drawing limit, dimension style

Application of Auto CAD: practice of assembly drawings using Auto CAD

Gear Drawing : Gear terminology such as pitch, pitch circle diameter module, addendum, root circle diameter, hole depth, blank diameter etc. construction of involutes teeth profiles, pinion and rack meshing, spur gear meshing.

UNIT-III

Pipe Drafting : Various symbols used in pipe line work as per IS code of Practice, C.I. flanged joint, socket and spigot joint, gland and stuffing box, expansion joint, pipe fitting typical pipe bends, pipe supports and accessories.

Graph and Charts : Introduction, Classification of chart, graphs and diagrams, quantitative and qualitative charts and graphs, Drawing and curve titles, legends notes etc. procedure for making a graphical representation in graphs, bar charts area (Percentage) charts, pie chart,

UNIT-IV

Production Drawing: Detailed drawing, assembly drawing, scale, finish tolerances, notes etc. Title block, tool list, gauge list. Preparation of production drawing for pattern shop. Forging shop, machine shop, preparation of assembly drawing from detailed drawing.

exploded views, sectional pictorial views, assembly drawing of nut and bolt, plumber block, flange coupling, stepped pulleys, foot-step bearing, Universal coupling, connecting rod, piston of I.C. engines, cotter joint, Knuckle joint. Preparation of detailed drawing from assembly drawings and assembled pictorial views, Interpretation of production drawing.

Note :- All the sheets should be working drawing complete with material list according to I.S.I. code. 75% drawing sheet should be drawn in first angle projection and rest 25% drawing sheet should be in third angle projection and No. of sheet At least must be from, Unit-I (5), Unit-II (2), Unit-III (2), and Unit-IV (6),

REFERENCES

1. Fundamentals of Engineering Drawing by Warren J. Luzadder (Prentice-Hall).
2. Mechanical Drawing by Giesecke, Mic- hell Specer, Hill. (Collier Macmillan Internal Edition)
3. Engineering Graphics by Giesecke/Mitchell/ Spencer/ Hill/ Loving (Macmillan)
4. Inside AUTO CAD by Daniel Raker and Harbest Rice(BPB Publisher)
5. Computer Graphics and CAD Fundamentals By Noel M Morries (Wheeler

TEXT BOOK

1. Mechanical Drawing By N.D.Bhatt
2. Mechanical Drawing By P.S.Gill
3. Mechanical Drawing By R.K.Dhawan

Diploma (Engg.)

Mechanical Engineering Semester-III STRENGTH OF MATERIALS

UNIT-I : Simple Stress and Strains

Introduction types of loads and deformation, types of stresses and strain. Hooke's law, stress strain diagram for ferrous and non ferrous materials modulus of elasticity. rigidity and bulk modulus of materials Stress in bars of varying cross sections, composite sections and compound sections Thermal stresses and strains, thermal stresses in composite sections. Poisson's ratio, volumetric strain, relation between different modulus, strain energy, resilience, proof resilience, modulus of resilience suddenly applied loads and impact loads.

UNIT-II

S.F. and B.M. Diagrams : Definition, types of loading types of beams, shear force and bending moment sign conventions S.F. and B.M. diagrams for cantilever simply supported and overhanging beams with point or concentrated loads uniformly distributed loads and combination of point and U.D.L. Point of contra flexure, numerical problems.

Principal Planes and Principal Stresses : Stresses on inclined plane subjected to direct shear or combination of stresses in two mutually perpendicular planes. Principal planes and principal stresses, analytical and graphical methods.

UNIT-III

Bending Stresses in Beams : Theory of simple bending as assumptions made in simple bending theory position of neutral axis, surface moment or resistance. Modulus of section of symmetrical sections such as rectangular, circular and I sections, bending stresses in symmetrical sections. Simple problems. Reinforced concrete beams, beam of uniform strength.

Shear Stresses in Beams.: Introduction shear stress equation, assumptions made, distribution of shear stresses over various sections, such as rectangular, circular and I, L & T sections, Simple numerical problems.

Deflection of Beams : Introduction Strength and stiffness of beam curvature of bent beam, Derivation of equation for slope and deflection of beam in case of cantilever and simply supported beam loaded with point loads U.D.L. and combination. Simple numerical problems. Importance of deflection and practical applications.

UNIT-IV

Torsion of Shaft : Definition of torsion relation between stress, strain and angle of twist assumptions made strength of solid and hollow circular shaft, polar moment of inertia. Calculation of shaft diameter on the basis of strength and stiffness for the given horse power transmitted torsional rigidity. Maximum torque comparison of solid and hollow shaft size of a shaft for a given torque.

Spring: Definition types and use of springs, leaf spring, helical and spiral springs, Stiffness of a spring and maximum shear stress, deflection of spring . Spring Classification based on size shape and load.

UNIT-V

Columns and struts :Definitions crippling load different end conditions, slenderness ratio, equivalent length, Euler's theory Rankine's formulae, radius of gyration, Rankine constant for different materials Limitations of Rankine formula simple problem B.I.S. code for columns.

Stresses in Frames : Definition of frame, perfect, deficient and redundant frame. Assumptions made in finding stress in method of sections and joint method,

Thin Cylinders : Hoop stress longitudinal stress on inclined plane subject subjected to direct, shell, volume strain change in value, cylindrical vessels subjected to internal pressure, simple numerical problems.

NAME OF EXPERIMENT

1. Study and demonstration of Universal Testing Machine & its attachments
2. Tension Test on mild steel, Aluminium & compression test on Bricks and Concrete block on Universal Testing Machine.
3. Direct Shear Test of mild steel on Universal Testing Machine.
4. Brinell Hardness Test on Mild Steel.
5. Rockwell hardness Test on Hardened Steel.
6. Izod & Charpy - Impact tests of a standard specimen
7. Torsion Test on Mild steel bar.

REFERENCES

- 1 Strength of Materials. by B.C. Punmia.
- 2 Strength of Materials by Sadhu Singh.
- 3 Strength of Materials by S. Ramamuruthan.
- 4 Strength of Materials by I.B. Prasad.
- 5 Strength of Materials by Ryder.
- 6 Strength of Materials by Timoshenko & Young

TEXT BOOKS

- 1 Strength of Materials . by R.S. Khurmi
- 2 Strength of Materials by K.D. Saxena
- 3 Laboratory Experiments In Strength of Materials by B.D. Sharma
- 4 Dravya Samarthya (Hindi) by K. D. Saxena (Deepak Prakashan, Morar Gwalior)

Diploma (Engg.)

Mechanical Engineering

Semester-IV

FLUID MECHANICS & HYDRAULIC MACHINES

RATIONALE: This course is intended to introduce basic principles of fluid mechanics. It is further extended to cover the application of fluid mechanics by the inclusion of fluid machinery especially water turbine and water pumps. Now a days the principles of fluid mechanics find wide applications in many situations directly or indirectly.

The use of fluid machinery, turbines pumps in general and in power stations in getting as accelerated fill up. Thus there is a great relevance for this course for mechanical technicians.

The Mechanical technicians have to deal with large variety of fluids like water, air, steam, ammonia and even plastics. The major emphasis is given for the study of water. However the principle dealt with in this course will be applicable to all incompressible fluids.

UNIT-I

Fundamentals of Fluid Flow : Definition of fluid, ideal and practical, compressible and incompressible fluids, fluid properties- density, specific weight, specific gravity, dynamic and kinetic viscosity, types of flow- laminar and turbulent, steady and unsteady, uniform and non-uniform. Continuity equation, Simple numerical problems on continuity equation

Pressure and Its Measurement: Concept of pressure, intensity of pressure, Pascal's law, pressure head, gauge pressure, vacuum pressure, absolute pressure, manometers- Piezometer, U-tube manometer inclined manometer, differential manometer ,inverted U- tube manometer Pressure gauges, Bourdon tube pressure gauge. Simple numerical problems on differential manometers.

UNIT-II

Basic Equation of Fluid Flow: Various form of energies applicable to fluid flow, potential energy, kinetic energy, pressure energy, total energy of fluid flow, Concept of datum pressure, velocity and total head of a fluid particle in motion. General steady flow energy equation, Bernaulli's theorem, assumptions made in deriving Bernaulli's theorem and derivation of Bernaulli's theorem, practical applications of Bernaulli's equation: venturimeter, orifice-meter, pitot tube, flow nozzle- Their construction, working and limitation. Simple problems on venturimeter, orifice meter, pitot tube.

UNIT-III

Flow Through Orifices and Mouth Pieces and flow measurement: Definition and types of orifices, Vena contracta, coefficient of contraction., velocity, discharge and resistance . Torricell's theorem experimental determination of C_c , C_v and C_d . Head loss due to sudden enlargement, contraction and obstruction in pipe. Mouth pieces, Time of emptying vessel by orifice (cylindrical, conical) Flow from one vessel to another large orifices. Flow measurement by Rota meter, Volume flow meter

Flow Through Notches and Weirs : Weirs and notches definition, Classification, flow over rectangular weir with and without velocity of approach, calibration of rectangular weir, different formula for large rectangular weir. Time required to empty a reservoir with rectangular weir, V-notch. Advantages of triangular notch over rectangular notch. Trapezoidal notch. Broad crested and submerged weirs. Practical application of weirs. Spillway and Siphon spillway, guage weir.

UNIT-IV

Flow Through Pipes : Laminar and turbulent flow, Raynold's number, differentiation of

laminar and turbulent flow on the basis of Reynold's number, loss of head due to friction in pipes, Darcy's formula and Chezy's equation. Hydraulic gradient and total energy line. Flow through long pipes, pipes in series and parallel simple problems based on above formulae water hammer and its effect surge tank.

Water Turbines : Meaning Classification Impulse and reaction turbine, Comparison description and working of Pelton, Francis and Kaplan turbines, Fanlaws specific speed & Selection of turbines.

UNIT-V

Water Pumps : Centrifugal and reciprocating- principle construction, working classification and layout. Comparison of centrifugal and reciprocating pumps. Specific speed, selection of pumps. Use of air vessels in reciprocating pump, indicator diagram, horse power calculation in case of reciprocating pump. Horse power calculation in case of centrifugal pump. Operating characteristics.

Hydel Power Station: Schematic diagram, function of various elements, advantage over other power stations.

REFERENCE BOOKS

1. Fluid Machines by M. Manohar
2. Hydraulics & Hydraulic Machines by Dr. Jagdish lal (Metropolitan)
3. Hydraulics & Hydraulic Machines by Priyani.
4. Fluid Machines With Engineering Applications by R.L. Draught lery & A.C. Jugersoll. (McGraw Hills)
5. Journal of experiments in Hydraulic Laboratory by V. N. Rao & Husan New Heights.

TEXT BOOKS

1. Fluid Mechanics by Dr. M.L. Mathur (Std. Publications).
2. Taral Yantriki Avum Machinery (Hindi) by G.B. Bamanker. (Deepak Prakashan, Gwalior).
3. A text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines. By Khurmi (S. Chand & Co.)

LIST OF EXPERIMENTS

1. To measure the pressure of water in pipe by (a) Piezometer (b) different types of monometers
2. To verify Bernaulli's equation.
3. To determine discharge through a given venturimeter.
4. To determine discharge through a given orifice meter.
5. To determine discharge through a Pitot tube.
6. To determine Cc, Cv and Cd for different types of orifices and mouth pieces.
7. To determine loss of head due to : (a) Sudden enlargement. (b) Friction in pipes.
8. To determine discharge through different types of notches.
9. Study of Pelton wheel, Francis turbine, and Kaplan turbines.
10. To determine performance characteristics.
11. Study of reciprocating pump.
12. To determine h.p. of reciprocating pump.
13. Study of centrifugal pump.
14. To determine operating characteristics of centrifugal pump.

Diploma (Engg.)

Mechanical Engineering Semester-IV

THERMAL ENGINEERING

RATIONALE: Mechanical engineers have to work with various power producing & power absorbing devices like boilers, turbines, compressors, pumps etc. In order to understand the principles, construction & working of these devices, it is essential to understand the concept of energy, work, heat & conversion between them. Hence it is important to study the subject of Thermal Engineering which is a core subject. It includes the study of various sources of energy, basic laws & concept of thermodynamics, gas laws, properties of steam & generation. Heat transfer forms the basis for different power engineering application. Boilers find application in different process industries. Steam turbines and condensers are the major component of any steam power plant. Mechanical engineer should understand working and application of these devices.

UNIT-I

Dimensions and systems of units: Basic and Derived units for common engineering variables and properties like mass, length, time, temperature, area, volume, velocity, acceleration, force, pressure, work, heat, energy, power etc.

Ideal Gases and Gas Processes: Definition of an ideal gas, gas law, characteristics gas equation, specific and universal gas constants specific heat constant pressure and specific heat, constant volume. Ideal gas processes- isobaric isothermal, isentropic, polytropic and throttling process as applied to open and closed systems. Representation of these processes on P-V, T-S and H-S diagrams. Computation of change in enthalpy, entropy and internal energy. Net heat transfer and work done.

Basic Concepts of thermodynamics: Definition and importance of thermodynamics, thermodynamic system open, closed and Isolated system, boundary and surrounding forms of energy. Point and path functions, properties of system intensive and extensive properties thermodynamic state, thermodynamic process, cycles thermodynamic definition of work, heat and thermodynamic equilibrium, Zeroth law of thermodynamics, Quasi-static process, work done during Quasi Static process.

UNIT-II

First Law of Thermodynamics: Concept of heat reservoir, heat source and heat sink, Statement of first law, Mathematical representation, applications of first law to open and closed system. Concept of internal energy and its calculation, relationship between heat transfer, work transfer and change in internal energy. Differentiation between shaft work, flow work and displacement work; Steady flow energy equation and its application to various units such as boiler, nozzle, turbine compressor enthalpy

Second Law of Thermodynamics: Limitation of first law. Statements of second law Kelvin, Planck and Clausius statements, Concept of heat pump, refrigerator and heat engine thermal efficiency. Parameters affecting thermal efficiency, means of increasing efficiency, COP. Equivalence and irreversible processes. Factors which make a process irreversible. Reversible cycle. Carnot cycle its efficiency and limitation ; Carnot theorem Clausius Inequality, concept of entropy, Principle of increase of entropy, determination of increase of entropy, principle of increase of entropy, determination of increase of entropy, Statement of third law of thermodynamics.

UNIT-III

Two Phase System: Pure substance phase, phase changes steam as a two phase system steam formation and its representation on temp- enthalpy plane. Properties changes, representation of wet dry and saturated and superheated steam on P.V., T.S. and H.S. planes. Dryness fraction of steam, methods of determination of dryness fraction separation and throttling calorimeter. Use of steam tables and Mollier's diagram . Determination of change in properties such as entropy enthalpy internal energy and work and heat transfer in the following processes- isobaric, isochoric, isothermal, isentropic, polytropic, throttling, and representation of various processes on P.V. and H.S. planes.

Steam Generators: Definition, classification, working of Babcock and Wilcox Boiler and Lancashire, Boiler Mountings and accessories.

UNIT-IV

Thermodynamic Cycles: Air Standard cycles- definition and purpose standard efficiency, Carnot, Otto Diesel dual and Brayton cycles, their representation on P.V. & T.S. Diagrams. Derivation of air Standard efficiency and their comparison and limitation of each cycle. Vapour power cycle - Carnot cycle its limitation, Rankine cycle modified Rankine cycle- their representation on P.V.T.S. and H.S. Planes, derivation of expression for thermal efficiency.

UNIT-V

Internal Combustion Engines: Introduction, classification I.C. Engine Components and their function, working of two stroke and four- stroke cycle engines and their comparison. Indicator diagram, Calculation of IHP, BHP thermal efficiency, Mechanical efficiency and relative efficiency, Governing, Cooling and lubrication of I.C. Engines.

Heat Transfer: Modes of heat transfer; Conduction convection and Radiation. Fourier's law of heat conduction, temperature gradient, expression for determination of heat transfer across a flat plate, thermal conductivity and thermal resistance. Newton's law for heat transfer by convection, free and forced convection. Heat transfer by radiation Stefan-Boltzmann Law of thermal radiation.

Define the terms- absorptivity, reflectivity and transmissivity; black body, emissive power, grey body. Heat exchanger; Shell and tube, Plate type and their applications

REFERENCE BOOK

- 1 Engineering Thermodynamics by P. K. Nag, Tata McGraw Hill Ltd.
- 2 Engineering Thermodynamics, C. P. Gupta, Rajendra Prakash
- 3 Thermal Engineering by P.L. Ballani. (Khanna Publisher's N. Delhi)
- 4 A Course in thermodynamics And Heat Engines by Kothanandran, Khajuria and Arora (Dhanpat Rai & Sons Delhi)
- 5 Treatise On Heat Engineering by Vasandani & Kumar (Metropocitan Book Co. Ltd, New Delhi)
- 6 Thermodynamics by G.T. Van Wylen (john Wiley & Sons)

TEXT BOOKS

1. Thermodynamic And Heat Engines Vol. I & II by R. Yadav. (Central Book Depot, Allahabad)
2. Heat Power by Kashitish Chandra Pal (Orient Longman Hyderabad)
3. Tapiya Abhiyantriki (Hindi) by G.B. Bamankar (Deepak Prakashan, Morar Gwalior) .

LIST OF EXPERIMENTS

1. Study and trial on solar water heating system
2. Report on visit to wind power generation plant / biogas plant / hydraulic power plant.
3. Trace the flue gas path and water-steam circuit with the help of boiler model and write a report.
4. Study or Report on visit to sugar factory / Dairy / steam power plant with specifications of boiler and list of mountings and accessories..
5. Study of separating and throttling calorimeter.
6. Study of steam turbine.
7. Study of different types of I.C. engines (four stroke and two stroke C.I. and S.I.)
8. Study of various systems of I.C. engines.
 - (a) Fuel supply system
 - (b) Cooling system
 - (c) Ignition system
 - (d) Government system.
 - (e) Lubrication system
9. Study of
 - (a) Fuel pump
 - (b) Fuel injector
 - (c) Carburetor.
10. Study and compare various heat exchangers such as radiators, evaporators, condensers, plate heat exchangers etc.
11. Numerical on vapour processes and ideal gas processes (minimum two problems on each)
12. Two phase systems equilibrium diagram on p-v , T-s, h-s plane
13. Two phase systems equilibrium diagram on p-v , T-s, h-s plane

Diploma (Engg.)

Mechanical Engineering

Semester-IV

THEORY OF MACHINES

RATIONALE: The work of mechanical and production engineer is not only to supervise, run and plan production processes, but also include fault diagnosis and prevention of breakdowns. This can only be done, if he is familiar with the working of basic mechanism used on shop floors and in machines, how they fail and what are the loads coming on different members and different joints of the machines.

The aim of the course is to provide acquaintance of the basic mechanism and machines to the students. This will enhance their capability of fault diagnosis and of taking corrective measure, which in turn will reduce the down time

UNIT-I

Simple Mechanism: Introduction of theory of machines, definitions- statics, dynamics, kinematics, kinetics, kinematic pair, kinematic chain, mechanism, machine inversions, relation between number of links, number of joints and number of pairs, Four bar chain and its inversion, Slider crank chain and its inversions.

Velocity and Acceleration of Points and Links : Angular and linear velocity, relative and absolute velocity, velocity in links. Instantaneous centre, locating instantaneous centre of rotation, velocity determination of four bar mechanism by relative velocity method, Acceleration of link centripetal and tangential, total relative and absolute acceleration. Velocity and acceleration diagrams for four bar and other mechanisms. Klein's construction for single slider crank mechanism. Analytical method of calculating the velocity and acceleration of piston in a reciprocating engine mechanism.

UNIT-II

Dynamic force analysis, Crank Effort Diagrams and Flywheel: Dynamics of reciprocating engine mechanism. Inertia force due to reciprocating mass, piston effort crank effort, turning moment on crank shaft, Analytical and graphical methods of construction of turning moment diagrams for steam and I.C. engines. Fluctuation of energy and speed. Coefficient of fluctuation of energy and speed. Flywheel and its function . Calculation of moment of inertia. weight of flywheel for steam and I.C. engines.

Brakes and Dynamometers: Brakes - need, types, braking force, braking torque. band brakes, block brakes, internally expanded brakes, dynamometer- meaning, need and types . Simple numerical calculation on above items

UNIT-III

Power Transmission : Drives : meaning, Classification, belt, chain, rope and gear drives. Flat and ' V ' belt, ratio of tensions . Slip length of belt calculation for open and cross belt drive. H.P. transmitted. Effect of centrifugal force, centrifugal tension, total tension maximum stress in belt. Maximum Power transmitted. Velocity for maximum H.P. condition. V-Belt drives, advantages and disadvantages of V-Belt drives. Rope Drives: Types, ratio of tensions, Designation of ropes as per B.I.S.

Governors : Functional difference with flywheel. Classification : Watt, porter, proell and hartnell- their construction and working. Sensitivity, stability, power and effort, hunting phenomenon and isochorism of governor.

UNIT-IV

Cams and Followers : Need, Classification. motion of follower Displacement, velocity and acceleration diagrams uniform velocity, uniform acceleration and retardation. Simple harmonic motion. Cam profile for radial. offset knife edged follower.

Balancing of Machine Parts: Concept Static and dynamic balancing of rotating parts. Simple numerical problems on static balancing of several masses in single plane graphical and analytical method.

UNIT-V

Vibrations: Introduction elements of vibration. System classification and explanation of the types of vibration according to the actuating force on the body like undamped vibration. Free damped vibration and forced damped vibration. Classification and explanation of the types of vibration according to the number of degrees of critical speed of shaft.

Gear and Gear Train: Introduction , classification of gears , gear terminology , law of gearing ,velocity of sliding , forms of teeth – cycloid profile teeth , involutes profile teeth, path of contact, arc of contact. Interference in involutes gear , minimum no of teeth in gear and pinion classification of gear train . Function of idler. Calculation of velocity ratio, train value of gear train- simple, compound epicyclic and reverted gear train, motor car gear box.

REFERENCE BOOKS

- 1 Theory of Machines by J.M. Shah & H.M. Jadhvani.
- 2 Theory of Machines by Abdulla Shariff
- 3 Theory of Machines by M.R. Malhotra & H.C. Gupta. (Technical India Pub.)
- 4 Theory of machines by P.L. Ballani .
- 5 Theory of Machines by Thomas Bevan .
- 6 Theory of Machines by S. S. Ratan.

TEXT BOOKS

- 7 Theory of Machines By R.S.Khurmi
- 8 Theory of Mechanism and Machine By Jagdish Lal

LIST OF EXPERIMENTS

1. Study of inversions of four bar chain mechanism
2. Study of inversions of single slider crank chain mechanism
 - (a) crank slotted lever mechanism
 - (b) Whitworth quick return motion mechanism
3. Dynamic force analysis of single cylinder four stroke engine.
4. Study of flywheel
5. Study of governor
6. Study of different cam and follower
7. Study of different gear trains
8. Study of power transmission methods
9. Study of different types of break and dynamometer
10. Study of types of vibration and their measurement methods
11. Study of dynamic balancing procedure of rotating parts

Diploma (Engg.)

Mechanical Engineering Semester-IV

INDUSTRIAL MANAGEMENT

RATIONALE: Diploma pass-outs are generally engaged in middle level management. It is found necessary to impart the diploma pass-outs at final year level certain concepts, principles, procedures and understanding of management techniques so that he is brought out to a fairly high level of competency in "supervisor-ship."

The course has two aspects - behavioral science and mathematical approach towards management. Behavioral science includes communication skills, grievance handling, motivation, morale and leadership. Mathematical approach includes PPC, CPM, PERT and Inventory management. It has been felt necessary to provide the students knowledge about newer trends in management like TQM, JIT, ISO and role of Computers.

It is hoped that the course will help the students to be successful in middle management role.

UNIT-I

INTRODUCTION : Definition and functions of management. Management theories - Decision, Quantitative, Mathematical and Behavioral Science.

SYSTEM THINKING : System definition and parameters. Different production and non-production systems, system design, different types of models under system thinking.

MATERIALS MANAGEMENT : Introduction, function, purchase systems, stock turn-over, ordered quantity. Inventory, need of inventory control, EOQ and simple numerical problems on EOQ. Safety stock, different techniques of inventory control, ABC analysis (simple treatment only). Stores management - storing procedure and store records.

UNIT-II

PRODUCTION PLANNING AND CONTROL : Production systems, characteristics of each type, production and consumption rate. PPC functions, Gantt chart, advantages and preparation of Gantt chart (simple cases only), Critical ratio scheduling.

VALUE ANALYSIS : Concept of cost and value, types of value, objectives and procedure of value analysis, VA test, DARSIRI method of VA.

PROJECT PLANNING BY NETWORK : Network definition, objectives. CPM and PERT, activity, event, network formation, Fulkerson's rule, dependency of activities, dummy activity, duration, EST, EFT, LST, LFT, EPO, LPO, Total float and Free float. Network analysis in tabular form.

UNIT-III

INDUSTRIAL RELATIONS : Need, objectives and functions of personnel management, job analysis and job description, recruitment procedure, selection, difference between recruitment and selection, training and its advantages.

Communication in industry - its need and importance, techniques and barriers of communication. Grievances - its meaning and factors responsible for grievances, procedure for handling grievances. Strikes and Lock-out. Motivation - meaning and its benefits, techniques of motivation. Morale - definition and importance, factors responsible for high morale. Job satisfaction - factors influencing job satisfaction

SUPERVISION AND LEADERSHIP : Meaning and role of Supervisor in an industry. Older workers and their supervision. Concept of Leadership, qualities of good leader, leadership styles.

UNIT-IV

ORGANISATIONAL DYNAMICS : Characteristics and principles of Organisation, Modern organisational approach, types of organisation, meaning and significance of various types of organisation, resistance to change, factors for reducing the resistance to change.

OPERATIONS RESEARCH : Definition and concept of OR, methods of OR, simple Linear Programming problem formulation and solution by Graphical method.

UNIT-V

NEW TRENDS IN MANAGEMENT : Role of computers in management, Introduction to Management Information System (MIS).

Total Quality Management (TQM) - Introduction, stages of development - Inspection, Quality Control, Quality Assurance, Total Quality Control, TQM. Introduction to ISO-9000. Deming's PDCA Cycle (Plan, Do, Check and Action). Japanese Quality Management, culture, Kaizen Strategy (continuous improvement), Quality Circle, Just In Time (JIT) - concept and application.

REFERENCE BOOKS

1. Learning Package on Industrial Management Publisher : TTTI, Bhopal.
2. CPM and PERT - Principles and Applications By L.S.Shrinath
3. Industrial Organisation and Management By K.K.Ahuja
4. Modern Production Operation Management By Buffa Willey Eastern Ltd. (latest edition)

TEXT BOOKS

1. Production Operation Management By Goel B.S. Pragati Prakashan.
2. Industrial Engg. and Management By O.P.Khanna. Khanna Publisher.

Diploma (Engg.)
Mechanical Engineering
Semester-IV
ENTREPRENEURSHIP

RATIONALE: Since long entrepreneurship has been recognized as an essential ingredient of economic development . Concept of entrepreneurship has varied from time to time to suit the changing ethos of socio-economic reality. It was applied to business for the first time in 18th century, to designate a dealer who buys and sells goods at uncertain prices. Later on an entrepreneur was considered a dynamic agent of change, or the catalyst who transformed increasingly physical, natural and human resources, into corresponding production possibilities. In recent years, managerial aspects of entrepreneurship are being emphasized. It employs innovativeness, an urge to take risk in the face of uncertainties, and intuition, i.e. a capacity of seeing things in a way which afterwards proves to be true.

The course is kept in soft core under DCS, DME and DEE/ Videography/ Arch/CDDM/ Garment/ MOM/ Prod/ RAC/ MOM/CTM/ Auto/ Comp/ ETE/ IT/Opto/ Print/ Texttile technology to bring to surface certain common characteristics such as perception of economic opportunity, technical and organizational skills, managerial competence, and motivation to achieve result.

UNIT-I

INTRODUCTION TO ENTERPRENEURSHIP

- Definition of Entrepreneur / Entrepreneur
- Difference between Entrepreneurship / Entrepreneurship
- Need for Entrepreneurship
- qualities of successful entrepreneur
- Myths about Entrepreneurship
- Classification of entrepreneurs on the basis of different criteria
- Reasons for the failure of entrepreneurs

UNIT-II

INDUSTRIES AND BUSINESS ORGANIZATIONS

- Concept of Industry or Enterprise
- Classification of Industries
- (a) On the basis of capital investment, Tiny (Micro) Industry, Small Scale, Medium Scale, Large Scale
- (b) Others, Rural Industry, Cottage Industry
- (c) Forms of Business Organization, Proprietorship, Board & Co-operative, Partnership, Public Ltd. Private Ltd., IT Sector, Government Co-operative / Undertakings
- (d) Tiny small scale Industry, Definition, Its significance in National Development. Govt. policies for SSI promotions, Sector / Product for SSI.

UNIT-III

INSTITUTIONAL ASSISTANCE

- (a) Types of Institutional assistance:- Infra - structural assistance, Technical Assistance
Financial assistance, Marketing Assistance
- (b) Information / guidance & Training
 - SISI
 - MPCON
 - CED- MA
 - Infrastructure
 - D/C
 - ASK
 - CSIR
 - NRDC (c)
 - AVN/AKVN (e) Finance

- SIDBI
- NABARD

- KVIB
- MPWDC

MPFC
NSIC M.P.A.V.V.N.

(d) Marketing

- MP- AGRO
- NSIC
- PM.LUN
- EXPORT COPPORATION
- KVIP
- MPHSVN MPLDC

(e) Quality Control

- BIS - FPO - MPLUN F.D.A. - AG. MKT. Board

INCENTIVES / CONCESSION / FACITLITIES AVAILABLE

- Seed money
- Incentive / subsidies
- Others (Phones, Lands etc)

UNIT-IV

PLANNING OF AN INDUSTRIAL UNIT (SSI)

- Pre- Planning Stage:- Scanning the environment, Market survey, Seeking information, product / project selection
- Implementation Stage:- PPR Preparation, DIC registration, Arrangement of Land, Arrangement of Power, Obtaining NOC / Licenses from various departments, DPR Preparation, Seeking financial assistance, Commercial Production
- Post Implementation stage:- Permanent registration from D.I.C., Availing Subsidies, Diversification / Modification, Setting up of marketing channel / Distribution.

UNIT-V

ACHIVEMENT MOTIVATION

- Historical perspective
- Concept of achievement motivation
- Significance of achievement motivation
- Development of achievement motivation

FINANCIAL MANAGEMENT OF AN INDUSTRIAL UNIT (SSI)

- Tools of financial analysis
- Ratio analysis
- Fund Flow / Cash flow analysis
- Working capital and concepts
- Financial accounting

REFERENCES

1. Entrepreneurial Development Vol. I,II,III By Vasant desai Himalaya Publicaton

TEXT BOOKS

2. CEDMAP (Center of Entrepreneurial development Madhya Pradesh)
3. Udyamita Vikas By Anand Prakashan

Diploma (Engg.)

Mechanical Engineering Semester-V

PROCESS PLANNING ESTIMATING AND COSTING

RATIONALE: An engineer is supposed not only to design and produce a product in any industry, but also to give weight age for the economic factors. Knowledge of different manufacturing process only may not fulfils the need in field, but also to select the best process suiting to the technical and economic requirement of situation along with the right type of process selection. Estimation of material and manpower requirement and factors affecting the cost of production are other areas which are quite important from the production point of view. The curriculum of this course of process planning, estimating and costing has been designed to take care of these requirements.

UNIT-I Introduction to Planning

Process engineering, its scope and relation with product engineering and manufacturing, production system, types and characteristics.

Selecting and Planning the Process of Manufacture: Function, fundamental rules for the manufacturing process, basic design of product, influence of process engineering on product design, rechecking specifications, how materials selected affect process cost, using materials more economically, material cost balance sheet, eliminating operations, combined operations, selecting the process tooling, availability of equipment, make or buy decisions.

Determining the Manufacturing Sequence: Operation, classifications and the manufacturing sequence, purpose of major process sequence.,

Operation Routing - Routing uses, routing descriptions.

UNIT-II

Elements of Costs and their Allocation : Definition and objective of Estimating & costing, desirable conditions for a costing system, advantages of costing, elements of cost, , direct material cost, direct labour cost, direct expenses, prime cost overheads, indirect materials, indirect labour, indirect expenses administrative and selling expenses, analysis of total cost fixed cost and variable cost. Break even analysis.

Depreciation: Definition & Concept, causes of depreciation methods of depreciation calculation.

Profit: Profit methods of increasing profit, effects of the methods on production, market and sales.

Budget : Definition, departmental budget and purpose of budgetary control.

UNIT-III

Overhead Allocation: Definition and classification of overheads, methods of overheads allocation viz-direct material cost, direct labour cost, man hour rate and machine hour rate, selection of appropriate method limitation of various methods.

Actual Cost Estimation: Process Materials and Manpower – Terminology associated with estimation, Calculation of volume, weight and cost of materials.

UNIT-IV

Machine Shop: Process, Materials and Man power - Terminology used in machine shop estimation, use of standard table to determine time elements for various machining processes, use of formulas to calculate actual machining time for different operations of machine tools, Calculation of production operation time per product per cycle, batch production time, **Welding shop** – process , materials and Man-power Gas and Arc. Welding terminology, production operation time, labour cost, materials cost, cost elements, batch production cost.

UNIT-V

Forging Shop: Process, Materials and Man power - Forging gross and net weight of forging, forging losses, materials cost, labour cost and batch production cost.

Foundry Shop: Process, Materials and Man- power - Pattern cost, production time for casting, material cost of casting, moulding cost, batch production time.

Sheet Metal Shop Estimation: Sheet Metal shop labour cost, materials cost, production time in piece work.

REFERENCE BOOKS

- 1 Mechanical Estimation and Costing by R.L. Shrimali & P.C. Jain (Jain Pub. House)
- 2 Mechanical Estimation And Costing (Resource Persons of Hill Publishing Co. T.T.T.L, Madars Tata McGraw Hill)
- 3 Machine Shop Estimation by Nordoff .
- 4 Learning Packing In Costing And Estimating (T.T.T.I. Bhopal Publication)
- 5 Process Engineering For Manufacturing By Eary and Johnson (Prentice Hall)
- 6 Fundamentals of Process Engineering by Benjamin W. Nicbel, Alon & Ropy
- 7 Produce Design And Process Engineering (McGraw Hill)

TEXT BOOKS

- 1 Cost Control by G. R. Sharma. (National Productivity Council)
- 2 Engineer' s Glude to Costing (Institute of cost works Accounts)
- 3 Mechanical Estimating And Costing by T.R. Banga and & S. C. Sharma (Khanna Pub.)
- 4 Yantriki Abhiyantriki Abhikalpan (Hindi) by K. D. Saxena. (Deepak Prakashan, Morar, Gwalior) .

Diploma (Engg.)

Mechanical Engineering

Semester-V

MACHINE TOOL TECHNOLOGY

RATIONALE: The course "Machine Tool Technology" is of vital importance to practicing of exposing technicians. The course not only gives the opportunity of exposing the fundamentals, but also the latest developments. The focus has been cast to improve effectiveness of the course by introducing various industrial applications.

The accent at technical level should be upon practical and demonstration. Indeed equal emphasis has been placed on this by allocating most of the available time for this course to the practical in the workshop. The study of this course will enable the students to acquire the capability of solving complex problems in the field of manufacturing.

UNIT-I

Introduction :- Concept of machine tool technology, needs, area of use etc.

Metal Cutting Theory :- Stages in cutting, factors affecting cutting, types of chips, built up edge (BUE) formation conditions and effect upon surface finish, definition of cutting force, feed force, radial force with the help of merchant circle diagram. Power requirement for each type of force. Tool geometry and influence of tool angles, desirable properties of cutting tool materials and their influences on the choice of tool material.

Primary and secondary function of cutting fluids and properties of cutting fluids commonly used, types of cutting fluids. Cutting variables, tool wear and tool life. Taylor's tool life equation and cutting speed calculation. Economy of metal cutting.

UNIT-II

Lathe:- Basic difference between centre, turret and Capston lathes, constructional details and specification. working principles and features of mechanical hydraulic and electrical copying system, rate of production, skill requirement, accuracy and cost of production. Working principles and types of automatic lathes, work holding and tool holding and tooling used for Capston and turret lathes, operation planning and tool layout for internal, external threading.

Shaper, Drilling & Boring Machine:- Shaper- Construction, operation. application, Types of Drilling Machines, construction, operation and application, Horizontal and vertical boring machines constructional features, Jig boring machine, its construction, operation and application.

UNIT-III

Milling Machines:- Define milling, Classification of milling machines, Principles, parts and their functions, types of table movement in universal milling machine, specifications of milling M/C. Conventional and climb milling, different milling operations and their application, milling cutters and tool angles, specification and cutter materials, use of arbor, collets and adapters machine attachments, methods of mounting the cutter, work holding devices, dividing heads. Direct, simple and differential indexing, selection of cutters, speed feed, procedure for setting up operations and inspections, maintenance of milling.

Grinding Machines and Finishing processes :- Definition of grinding and cutting action in grinding, types of abrasive materials and their properties, binding materials, grinding wheel classification and standard marking system, conditions for selection of grinding wheels. Balancing of grinding wheels, glazing and loading, methods of dressing and tracing, Principles of working of grinding machines, types of grinding process, functions of tool and work holding devices, feed arrangement, table drive in surface and cylindrical grinders. Types of lubricants and coolants used in grinding, grinding defects, their remedy and safety practices. Definition of honing, lapping, super finishing methods, equipments involved, Materials used, tolerances obtained and limitations, applications of honing and lapping processes.

UNIT-IV

Special purpose Machines:- Difference between forming and generation of gears, principle of gear shaping, hobbing and shaving, rate of production accuracy and limitations. Thread production : thread rolling and thread milling. Broaching Machines : Definition of Broaching, types of broaches, broaching machines, advantages and limitations.

Jigs and Fixtures :- Functions of Jigs and fixtures, 3-2-1 principle of location, Design criteria for simple jigs and fixtures

UNIT-V

Machine Tool Drives :- Requirements of machine tools, elements of machine tools and their purpose Drive Systems : Stepped and step less drives, advantages and limitations of the gear box drives, function of feed box, types of feed gear boxes, working and advantages. Principle of straight line motion, multi-handle, single lever and pre-selective control system

Plastic Moulding:- Types of plastic, Compression moulding, Transfer moulding , Injection moulding, Blow moulding, Vacuum forming, Extrusion

LIST OF EXPERIMENTS

S.N	EXPERIMENTS
1.	Making Square section using Shaper
2.	Demonstration of Drilling, Tapping, and Reaming in drilling machine
3.	Demonstration of Internal key way cutting in Milling machine
4.	Demonstration of Machining for press fit in lathe machine
5.	Grinding to the required accuracy by grinding machine

6.	Machining for clearance Fit
7.	Study of NOMICULATE OF SINGLE POINT CUTTING TOOL
8.	Demonstration of LATHE OPERATIONS -PLAIN TURNING, STEP TURNING, TAPER TURNING,KNURLING AND CHAMFERING
9.	Demonstration of LATHE OPERATION-THREAD CUTTING

REFERENCE BOOKS

1. Workshop Technology Vol. I & II by Hajra Chaudhary, (Media Promoters & Publishers Pvt. Ltd. Mumbai)
2. Workshop Technology Vol. I , II and III by W.A.J. Chapman, (ELBS)
3. Manufacturing Processes & Systems by Phillip F. Ostwald & Jairo Minoz (John Willey & Sons.)
4. Production Technology – HMT Handbook (HMT)
5. Production Technology by Jain Gupta, (Khanna Publishers, New Delhi)
6. Manufacturing Processes by Begeman Amstead, (Wiley.)
7. Manufacturing Processes by Rusinoff, (Tata McGraw Hill Publishing Co. Ltd.)
8. Advanced Manufacturing Technology by Kalpakjian (Addison Wesley)
9. Manufacturing Technology – Metal Cutting & Machine Tools by P. N. Rao (TMH).
10. Workshop Technology Vol. II by Bawa H. S. (TMH).

TEXT BOOKS

11. Manufacturing Science and Technology Vol. I & II. by Suresh Dalela (Umesh Publication).
12. Workshop Technology Vol. I and II by B. S. Raghuvanshi (Dhanpat Rai & Sons).
13. Production Technology by R. K. Jain (Khanna Publishers, Delhi).
14. Vijayvargiya P.N.”Machine Tool” Shilp Vigyan (Hindi) (Deepak Prakashan, Morar Gwalior .)

Diploma (Engg.)

Mechanical Engineering

Semester-V

ENGINEERING MEASUREMENTS & MAINTENANCE PRACTICE

RATIONALE: This subject has earned its importance in the curriculum due to major activities of inspection department. Now a days in almost all factories search is going on for answer to the problems of production materials, design, improved machines, better way of making and assembling parts. Many of these answers are provided by Metrology through accuracy in production high standards of inspection, new and improved use of instrument etc. Metrology therefore is a fast growing, changing and increasingly significance field.

The other part of this subject is maintenance practices. Maintenance of machines prolongs their life as well as their performance. Well maintained machines minimize the breakdowns and production held-ups, thus help in achieving the production targets.

UNIT-I

Inspection: -Meaning and application of inspection, daily life examples of inspection, concept of inspection as applied in industries. Effect of absence of inspection in an industry. Classification of inspection, function, meaning and advantages of each concept of inspection applied to metrology. Definition & meaning of precision. accuracy and error, need of precision measurement in industry, relationship between cost and accuracy, Interchangeability and selective assembly.

General Measurement Concept:- Limits, fits and tolerances, selection of fit, calculation of fundamental deviation, tolerance and limits, selection of limits, tolerances and allowances.

UNIT-II

Linear Measurement:- Standards of length, classification and use of slip gauges, wringing process, precautions to be observed while using slip gauges, classification of linear measuring instrument, direct and indirect, construction and working of vernier callipers, micrometers, vernier height gauge, dial vernier and dial height gauge, finding least count, precautions. Dial gauge-types, construction, principle, accuracy and precautions, comparators - principle, types, working and field of application of Mechanical, electrical, optical and pneumatic comparators.

Angular Measurement:- Need of angular measurement, various instruments used. Methods of measurement and field of application of protractor, angle gauges, Sine bars, spirit levels, clinometers and angle dekkor.

UNIT-III

Straightness, Flatness, Squareness and Roundness Testing:- General concept straight edge method, light gap and feeler gauge method, wedge method, use of V- Block and dial indicator for checking roundness.

Surface Roughness:- Definition of primary and secondary texture, CLA value, R.M.S value, Types of surface measuring instrument, Working principle of Tomlinson mechanical surface finish recorder.

Screw Thread Measurement:- Types of screw threads, threads nomenclatures, errors in screw thread, equipment required for measuring pitch, effective diameter and angle-procedure, advantages, limitation and precautions of each method

UNIT-IV

Limit Gauges:- Definition of gauge and gauging, necessity of gauging in industrial practice, types according to use (shop inspection and reference gauge), limit gauges for specific use - screw pitch gauge, template feeler gauge, working tolerance of gauges, maximum and minimum metal conditions to tolerance. Selection and specification as per IS 2251, 3455, 3484. Wear allowances and its selection for design, Taylor's principle for design of 'Go' and 'No Go' gauges. Calculation of gauge dimensions from formula given in IS 3455 and selection of parameters necessary for calculation.

Transducers:- Meaning, function, primary and secondary transducers. Classification-mechanical electrical, active, passive. Comparison of electrical and mechanical transducers, Working principle and application of resistance type, inductance type, capacitance type and piezo electric type.

Temperature measurement:- Principle on which temperature measuring devices work-example of each type. Comparison of resistance thermometer and thermistor. Thermocouple-Principle, material, and working. Working principle of optical and radiation pyrometers.

UNIT-V

Introduction to Plant Maintenance:- Introduction to maintenance, its need and scope, functions of the maintenance department. Different maintenance practices, procedure of corrective or break down maintenance, scheduled maintenance, preventive maintenance and predictive maintenance, methods of keeping records for condition of equipment, maintenance and replacement of parts, standard data for maintenance form, time standards (time to complete the maintenance job).

Fault Tracing:- Trouble Shooting and Remedies, Sequence of activities in fault finding, methods and procedures of repair, various measures to prevent repetition of similar faults. Various remedial actions.

Maintenance Cost:- Definition, classification, Kelvin graph, procedures for obtaining cost data, maintenance cost control.

Wear and its effect:- Definition of wear and types of wear, causes of wear, effects of wear on performance, wear reduction and component replacement.

Lubrication and Lubricating Systems:- Need, properties of lubricant, selection criteria, principle of lubrication, centralized and decentralized lubrication systems, boundary, layer and hydrodynamic lubrication, use of greases and oil. Methods of preserving lubricants, handling of lubricants.

LIST OF EXPERIMENTS

- 1-Study of Indian standards IS: 919 recommended for limit and fits.
- 2-Demonstration of concept of interchangeability using different objects.
- 3-Measurement of diameter, length, thickness etc. Using different calipers and steel rule.
- 4-Measurement of various parameters of different objects using vernier caliper & Micro-meter.
- 5-Measurement of various parameters of different objects using combination set.
- 6-Build up gauge blocks to produce different dimensions.
- 7-Measure different angles using vernier protractor.
- 8-Measure of unknown angle with the help of a sine bar and a slip gauge set.
- 9-Measure different angles using angle gauges.

- 10-Check for flatness, and parallelism of an object using a dial indicator and surface plate.
- 11-Check for roundness of an object using a dial indicator and a V-block.
- 12-Examine the surface texture of the machined surface by a microscope.
- 13-Use of plug and ring gauges for checking holes and shafts.
- 14-Demonstration and explanation of different types of transducers.
- 15-Study of different types of pyrometers.
- 16-Visit of large/ medium/small scale industries for collecting the information regarding various measurement techniques and instruments .
- 17-Maintenance practice on lathe and shaper m/cs .
- 18-Fault tracing and trouble shooting on tube light , table fan, Room heater, hand drill m/c etc.
- 19-Measurement of wear on cylindrical objects by micrometer and Dial indicator & V-block.
- 20-Lubrication practices on different machine tools.
- 21-Visit of large /Medium /Small scale industries for collecting information regarding record keeping for condition of equipment , maintenance scheduling & various practices , lubrication plan , tools & equipments used , safety measure etc.,

REFERENCE BOOKS

1. Engineering Metrology. by R.K. Jain (Khanna Pub. Delhi)
2. Engineering Metrology. by I.C. Gupta (DANPAT RAI & SONS)
3. Inspection & Gauging by Kennedy (The Industrial Press, 93, Wortinstreet, New york)
4. Engineering Metrology by K.J. Hume. (Macdonald & Co. Ltd. London)
5. Practical Metrology by K.J. Hume . (Macdonald & Co. Ltd. London)
6. Industrial Instrumentation by D.P. Eckman (Wiley Easter Ltd. New Delhi)
7. Measurement Techniques in Mechanical Engineering by R.J. Sweeny (jon wiley & Sons, New York Addison Wesley Pub. London)
8. Mechanical Measurement by Becjwith Buck (Addison Wesley Pub. London)
9. Instruments For Measurement Control by W.G. Holzbock (Rainold Pub. Co-operation)
10. Mechanical & Industrial Measurement R.K. Jain (Khanna Publishers New Delhi)
11. Maap Vigyan Avum Yantrikaran (Hindi) by Yogendra Varshneya. (Deepak Prakashan, Morar,Gwalior)
12. Industrial maintenance – H.P. Garg (S. CHAND & Company Ltd)
13. Commentary on Factories Act with M.P. Rules by Krishanlal Sethi (The law-years Home Indore -7)
14. An Introducton to Safety Engineering and Management by N.V. Krishnan (CPS Pub. Pvt. Ltd. Calcutta)

TEXT BOOKS

1. Guide to Efficient Maintenance Management by H.V. Mstwatt.
2. Modern Maintenance Management by Miller and Bood.
3. Maintainability by Benjamin S. Blanshard, E. Edward, Lowery
4. Maintenance Engineering Hand Book by Morrow.
5. Repair of Industrial Equipment by B. G. Edberg, G. Peklis.
6. Sanyantra Anurakshan Avum Suraksha Abhiyantriki (Hindi) by Yogendra Varshney (Deepak Prakashan, Morar, Gwalior)

Diploma (Engg.)

Mechanical Engineering Semester-V

MODERN PRACTICES IN MANUFACTURING AND MANAGEMENT

RATIONALE: Innovations and improvements are a continuous process. Apart from basic understanding of principles of Engineering and conventional practices, a Diploma Engineer is also required to be exposed to recent developments and concurrent practices in the fields of manufacturing. In the recent past there has been a significant change in approach in industry in the form of emphasis on Quality systems to increase the productivity and profitability. It has now become necessary to adapt proper quality management system to compete and survive. In this course introduction to recent manufacturing practices and management approaches is outlined.

UNIT-I

Unconventional Machining Methods: Limitations of conventional machining. Working Principle, operating parameters and application of unconventional machining. Electro Chemical Machining, Chemical Machining, Electric Discharge Machining, Electron beam Machining, Ultra Sonic Machining, Abrasive Jet Machining, LASER Beam Machining, Plasma Arc Machining.

Coating & Deposition processes: plating & related processes, physical vapor deposition, chemical vapor deposition, Organic Coating,

Rapid Prototyping: Need, Fundamentals, Technologies and applications.

UNIT-II

Manufacturing Automation: Introduction to Numerical control, Computer Numerical control, Direct Numerical Control, CNC Millings M/c, CNC Turning M/c, Turn mill centers, flexible manufacturing system, Preliminary idea of robotics. Introduction to G and M code as used in part programming. Use of Canned cycles. Simulation of parts, drawing generated through CAD, its modeling and transfer

Flexible Manufacturing systems: Elements, Limitations, Feature & Characteristics, New development.

Robotics: Introduction to robotics, concept, and application, A4 level automation

UNIT-III

Total Quality Management (TQM)-Evolution, definition, preparation stages in TQM implementation, Integrated TQM model, customer satisfaction, Employee involvement. Continuous Process Improvement, 5s, Kaizen, and KANBAN, Supplier Partnership, Performance Measures. Just in Time systems (JIT) – Introduction, application and advantages

Total Productive Maintenance (TPM)- Introduction, Plan, New Philosophy Improvement needs, Six Major losses Life cycle costing, work groups.

UNIT-IV

Introduction to Quality Standards: ISO 9000- Introduction History, Indian Equivalence, System requirements for ISO 9001, 9002, 9003, steps for installation, How to apply. QS 9000 Quality Management systems. ISO 14001- Introduction, Environment Management system, Background, vocabulary and Application, OHSAS 18001- Occupational Health and Safety Assessment Series. Introduction, scope, related terms, structure and operating features

TS 16949 – Quality system certificate consisting following standard

APQP – Advance product quality planning

FMEA - Failure mode and effect analysis

MSA – Measurement system analysis

UNIT-V

Lean manufacturing : System design for Lean manufacturing adopting.

Why Why analysis (5W 1 H) : Use of Why Why analysis to know the actual cause of failures and problems.

Six Sigma systems: Basics of Six Sigma, competitive advantage of implementing six sigma systems. Briefs of what, why and how six sigma works to initiate and sustain greater productivity, profitability and customer satisfaction rates.

LIST OF PRACTICALS

1-Visit to a nearby installation / Study and practice at least two of the following:

- a. ECM
- b. CM
- c. EDM
- d. EBM
- e. USM
- f. Laser and Beam Machining
- g. Abrasive Jet Machining
- h. Plasma Arc Machining

2-Visit to a nearby installation having coating facilities/practical on coating process.

3-Visit to a nearby installation / Study and practice at least two of the following:

- a. NC
- b. CNC
- c. DNC
- d. CNC Milling
- e. CNC Turning

4-Manual part programming (for simple jobs) on a CNC Milling or Turning machine.

5-Visit to a nearby factory and estimation of six major losses on the critical machine

6-Prepare a plan for getting ISO 9001 Certification for an Industry.

7-Seminar on TQM Philosophy, TPM.

8-Seminar on Six Sigma practice.

REFERENCE BOOKS

1. Fundamentals of Manufacturing processes , G. K. Lal & S. K. Choudhary, Narosa Publishing House.
2. A Text book of production Technology (Manufacturing Processes) by P.C. Sharma, S. Chand & Co.
3. Manufacturing Technology Vol. II By P.N. Rao, Tata McGraw Hill Publishing Co.
4. Fundamentals of Modern Manufacturing By Mikell P. Groover, Wiley Student Edition.
5. Quality Management By Donna C.S. Summers Pearson Prentice Hall
6. Total Quality Management By L. Sugandhi & Anand A. Samuel Prentice Hall of India

Diploma (Engg.)
Mechanical Engineering
Semester-V
INDUSTRIAL ENGINEERING

RATIONALE: Industrial engineering is such a subject which can significantly contribute towards the cost-saving and help in increasing the productivity. Adequate opportunities have been planned for the technician to apply theory to solve practical/ simulated industrial problems.

The course is kept under applied technology with a view to appreciate the changes and alternation proposed by Industrial engineering for shop floor methods and process.

UNIT-I

Introduction: Definition of industry and industrial engineering, scope and role of industrial engineering fields of applications.

Productivity: Production and productivity, production systems and their impact on productivity, its significance and benefits of higher productivity. Long term and short term factors affecting productivity, productivity cycle.

Work Study: Introduction, its relation with productivity aims, objectives and application of work study, basic procedure and techniques of work study . Human factors in work study Role of manager, supervisor and workers. Working conditions, environment of industry affecting work study.

Method Study: Definition objectives, basic procedures of methods study. Recording techniques, operation process chart, flow process chart, machine chart, flow diagrams, string diagrams, two hand process charts, questioning technique procedure to develop, install and maintain new methods.

UNIT-II

Principles of Motion Economy: Meaning, basic rules design of efficient work place- layout, classification of human body movements and their preferred order.

Material Handling and Plant Layout : Importance and its effects on productivity, requirements of good material handling system, classification and selection of material handling equipment. Requirements of good layout.Effect of bad layout, Factors affecting plant layout, types of layout, advantages and limitations of each type of layout selection of layout, factors affecting the plant location.

UNIT-III

Micro Motion Study: Definition and objectives, techniques of micromotion study, therbligs and their symbols, use of therbligs, SIMO chart and its application.

Work Measurement: Definition, Basic procedure and technique to work measurement. Stop watch time study, types of stop watch study, factors considered in selecting a job for time study, qualified and representative workers, procedure of stop watch time study, job element and their need of identification, general rules for breakdown of job into elements, work cycle, methods of time measurement, performance rating, its meaning, standard rating , rating of operators, conditions for operators variation at work place rating scales, rating factors, calculation of basic time. Allowances- purpose, types. of standard time synthesis method- meaning, data,

complication, advantages and limitations.

PMTS- Definition principle and use, calculation of standard time.

MIM - Meaning, tables and use. Application of MIM analysis for LH-RH charts, calculation of standard time.

Work/ Activity Sampling: Definition, statistical basics, determination of number of observation for given accuracy, sources of error, application and calculation of standard time.

UNIT-IV

MOST Technique for work measurement: Definition of terms, concept of the MOST, Basic MOST sequence models, Time Units, Parameter Indexing, Method Accuracy and Sensitivity, Levels of Work Measurement, Compatibility of MOST systems, Application of MOST

Job Evaluation, Wages and Incentives: Definition, need and scope of job evaluation. Job evaluation systems and their comparative merits and demerits and limitations.

Wage: Definition, wage components, wage fixation, real, minimum and fair wage. Financial and non- financial incentives and their examples. Wage plans- Halsey, Taylor, differential plan, Gantt task and bonus plan, 100 % premium plan.

Statistical Quality Control: Definition of quality and total quality, three stages of quality, quality control and SQC, difference between inspection and quality control, concept of variability, natural variation, its importance to quality control , classification of quality, characteristics, basic tools of SQC and their application, frequency distribution, measures of central tendency and dispersion, their need and calculations.

Normal Curve : Definition, characteristics, calculation of area under normal curve and its application, statistical tolerance their calculation and application. Process capability meaning calculation and use.

UNIT-V

Control Charts for Variables: Statistical basic for control Charts for variables, construction of X and R Charts- their interpretation, use of X and R chart in establishment of process capability.

Control Charts for Attributes: Limitation of X and R charts, Meaning and use of attributes, their advantages, Calculation, construction, interpretation and application of p- chart, c- chart, ph-chart. Need of calculating the revised values of mean, and control limits and their calculation.

Acceptance Sampling: Meaning different techniques procedure involved sampling inspection meaning and comparison with 100 % inspection. Factors affecting sampling and their effects. Single and double sampling plans, use of IS codes. **O.C. Curves :** Meaning, terms used, their definition, construction and use of O.C. curves. Selection of sampling plans.

LIST OF EXPERIMENTS

- 1 Preparation of flow process chart for existing and improved process.
- 2 Preparation of man and machine chart for existing and improved process.
- 3 Preparation of L.H. and R.H. charts for existing and improved process.
- 4 Use of decimal minute watch.
- 5 Performance rating.

- 6 Establishing standard time for given operation using time study techniques.
- 7 Use of Shewharts bowl and actual production for frequency distribution.
- 8 Preparation of X and R charts.
- 9 Preparation of p- chart and c- chart.
- 10 Work measurement using MOST
- 11 Acceptance sampling by attributes (single and double sampling plans)
- 12 Determination of the percentage utilization of equipment (work sampling) .
- 13 Application of principals of motion economy

REFERENCE BOOKS

- 1 Work Study by M.D. Schmid & Subrammaniam
- 2 Motion and Time Study by Ralph M. Barnes John Willey New York
- 3 Wage Administration by D.K. Roy. (N.P.C. Publication).
- 4 Quality Assurance Engineering by M.D. Schmid & Subramaniam.
- 5 S.Q.C. by R.C. Gupta.

TEXT BOOKS

- 6 Industrial Engineering & Management by O. P. Khanna.
- 7 Industrial Engineering by Saxena.
- 8 Material Handling Equipment (N. Rudenki Place Pub)
- 10 Audyogiki Abhiyantran (Hindi) by J.C. Varshneya. (Deepak Prakashan, Gwalior)
- 11 Audyogik Engineering (Hindi) by K.D. Saxena . (Deepak Prakashan, Gwalior)

**Diploma (Engg.)
Mechanical Engineering
Semester-VI**

DESIGN OF MACHINE ELEMENTS

RATIONALE: The course includes the study of various aspect of design and how object fails during working. After studying this subject student must be able to design the various component of machine in actual working condition.

The aim of the course is to provide acquaintance of the basic load impacts and failure modes to the students. This will enhance their capability of fault diagnosis and of taking corrective measure, which in turn will reduce the down time.

UNIT-I

Introduction to Machine Design: Machine and machine elements, bolt, nut, axle, shaft, bearing, coupling, clutch, belt, rope, chain, gear etc. Specific purpose of piston connecting rod, crank shaft, turbine blade etc. Factors influencing design of machine elements - Strength stiffness, light weight, wear resistance minimum size, availability, processebility, safety, compliance with standards. Basic design procedure. Selection of mechanism, material, shape and size. Preliminary design, applying checks, revision of design final design. Factors influencing selection of materials. Type of failures, types of forces. Types of loading. Safe design stress and factors of safety.

Design of Machine Elements Subjected to Direct and Shear Loads: Introduction members subjected to direct loads – bolt, column, rod, cotter and knuckle joints, members subjected to shear loads rivet, cotter knuckle pin, root of threaded bolt , coupling, bolt, key. Function, application and design of knuckle and cotter joint.

UNIT-II

Design of Machine Elements Subjected to Bending Moment, Twisting Moment and Combined Bending and Twisting Moment :- Introduction to pure bending, fundamental equation of pure bending viz :

$$M/I = f/y = E/ R$$

Design of shaft, key, flange coupling, leaf and helical spring, pulley arms, axle

UNIT-III

Design of Riveted Joint: Type of fastening - temporary and permanent, types of riveted joint - lap and butt joint, definition of common terms like pitch, back pitch, efficiency, margin. Modes of failure of riveted joints.

Design of Simple Welded Joints: Definition of welding advantages of welding over riveted joints, types of welded joints, strength of the butt weld, types of fillet joints and strength of fillet joint problem solving.

UNIT-IV

Design of Threaded Joints: Types of threads and their proportions, Types of bolts, proportion of nut and bolt dimensions, design of bolt, designation of threads as per I.S. codes.

Design of Clutch: Pivots and Collars friction. Horse power lost assuming uniform pressure and uniform wear. Clutch- need, classification and construction and working of single and multi plate clutches, horse power transmitted by single and multi plate clutches.

UNIT-V

Selection of Rolling and Sliding contact Bearing: Types of rolling contact bearing , Ball bearing Roller bearing, bearing designation, bearing installation. Application of bearing. Basic principle of Hydro dynamic and Hydro static bearing. Bearing modulus and Bearing characteristics number.

REFERENCE BOOKS

1. Machine Design by Sharma and Agrawal.
2. Introduction to Machine Design by Bhandari Tata Mcgraw Hill
3. Machine Design by Pandya and Shah

TEXT BOOKS

1. Machine Design by R.K. Jain.
2. Machine Design by Shigley..
3. Machine Design by R S Khurmi

Diploma (Engg.)

Mechanical Engineering Semester-VI

REFRIGERATION & AIR CONDITIONING

RATIONALE: Now-a-days more emphasis is being given for the thermal environmental control for:

1. Providing comfort to people in homes, offices, shops, industries and traveling in cars, railways, buses etc.
2. Storing food-stuff vegetables, fruits, milks medicines, blood etc.,
3. Production of commodities like beverages, wines, bakery products and chemicals.,
4. Liquefaction of gases.,
5. Food preservation for longer period.,
6. Air conditioning for computers.,
7. Manufacturing processes like precision, machining, printing textiles etc.
8. Cryogenic surgery.,
9. Production of low temperature (150K) cryogenic temperatures.

UNIT-I

Introduction to Refrigeration: History of refrigeration, meaning and need of refrigeration, difference between refrigeration and Cryogenics, production of refrigeration by various methods. Refrigeration systems and their classification on the basis of use, size and application.

Thermodynamics of Refrigeration: Revision of I and II law of thermodynamics, comparison between heat engine, heat pump and refrigerator using heat reservoir, heat source, sinks & work. Unit of refrigeration, refrigeration effect, work input, co-efficient of performance, Reversed carnot cycle with gas and vapour as working substance. P-V, T-S and schematic diagrams. Calculation of refrigeration effect, work C.O.P and Heat rejection. Practical difficulties with carnot cycle. with gas and vapour as working substance. Vapour compression refrigeration cycle its schematic diagram and representation on P-V, T-S and P-H diagrams. Wet, dry and superheated vapour compression. Use of tables and charts of common refrigeration for calculating work input, refrigeration effect and C.O.P deviation of actual vapour compression system from, theoretical cycle and reasons for deviation. Effect of sub-cooling and superheating on vapour compression system.

UNIT-II

Basic Components of Vapour Compression Refrigeration Systems: Basic components of vapour compression refrigeration system and their function- compressor, condensor, expansion device and evaporator.

Compressor : Classification, reciprocating- open and hermetically sealed rotary, and their field of application. Working of single and double acting reciprocating compressor. Working of hermetically sealed compressor.

Condensor : Types (Water cooled, air- cooled evaporative) and their field of application and brief description., **Expansion:** Types of evaporators (Dry expansion and flooded type, and

principle of their working and application.

Vapour Absorption Refrigeration System: Comparison between vapour compression and vapour absorption system, the theoretical and practical vapour absorption system, Lithium bromide- water absorption system. Three fluid system. (Electrolux systems)

UNIT-III

Properties of Commonly Used Refrigerants: Definition, primary and secondary refrigerants, designation of refrigerant, examples of each type. Desirable properties of good refrigerant Azeotropic mixtures. Environmental problems related to halogenated hydrocarbons as refrigerants. New developments.

Refrigeration Plants: Layout and working of Ice plant, cold storage. Water cooler and household refrigerator.

Refrigeration Fittings, Tools, Charging and Leak Detection:

Tubing, Materials heat treatment specifications. Tools: Use and types of cutter, spring and mechanical bender- flaring and swaging tools pinch of tool, wrenches, Pliers etc. Fittings: Flared tube fittings, unions, elbows tee.

Joints: Making soldered and brazed joints. Installation and removal of servicing gauge and testing manifold: Working of suction and discharge compressor service valves.

UNIT-IV

Charging of Refrigerant: evacuating a refrigeration system, removing, refrigerant form a refrigeration system leak detection methods.

Introduction to Air Conditioning : Meaning of air conditioning, application of Air conditioning in theatres, community halls, industry, restaurants, hospitals and windows air conditioner.

UNIT-V

Psychometry: psychometric - definition, terminology, psychometric charts and tables, using psychometric charts for solving simple problems.

Air Conditioning Systems: Central and unit air conditioning, residential and commercial air conditioning system. Types of fans and ducts - air distribution systems. Thermal insulator, methods and insulation cladding.

Maintenance and Repairing of Refrigeration and Air Conditioning Units: Fault location in vapour compression system and air conditions. Repair and maintenance of house hold refrigerators. Water coolers and air conditioners.

LIST OF EXPERIMENTS

1-Handling and use of tools such as- Tube cutter, tube bender, (Spring and mechanical type). Flaring and Swaging tool, wrenches, pliers, service valves, service gauges, preparation of soldered and brazing joints.

2-Study of water cooler with respect to

(a) Refrigerant used and flow path.

(b) Electric circuit

Diploma (Engg.)
Mechanical Engineering
Semester-VI (Elective-I)
AUTOMOBILE ENGINEERING

RATIONALE: In the last thirty years, there have been many important developments in the automotive vehicles. The automobile industry is getting momentum and requiring trained personnel. To meet the growing need of automobile industry, this course is kept under elective category of diploma in mechanical engineering based on semester system.

The Course will provide opportunities to students to understand the theoretical background of auto vehicles and will help in starting an automobile service enterprise or enter in automobile industry.

UNIT-I

Introduction: Meaning of automobile, elements of automobile, classification of automobile, layout of chassis, various operating systems used in automobile.

Auto Engines: Meaning of I.C. Engines, Classification on the basis of cycle, fuel used, ignition system, number of cylinders, number of strokes etc. Otto/ Diesel cycles. Two stroke and four stroke engines, merits and demerits, scavenging comparison of petrol and diesel engines. Cooling systems, firing order. Valve timing diagrams. Engine rating. Lubrication, factors affecting lubrication, Lubrication systems, Fuel Supply system, fuel pump - SPU electric pump. Carburettor, air fuel ratio, Solex and amal carburettor.

UNIT-II

Auto Electric System: Wiring diagram of a car and functions of various components used in the electric circuits, function and working principle of a starter and generator, function of voltage- current regulator, ignition timing, spark plugs- their classification, gap setting and common ignition troubles, their causes and remedies. Automobile battery - construction and working, electronic ignition system of modern vehicles.

Transmission System: Clutch : necessity, function of its components, Types –single & multi plate and centrifugal clutches, clutch actuating mechanism and fluid flywheel. Gear Boxes : necessity, Types of gear boxes and their working. Importance of gear shifting mechanism, gear box troubles, their causes and remedies.

UNIT-III

Final Drives System: Drive mechanism in cars, purpose and working of propeller shaft, construction of propeller shaft. Types of universal joints. Rear axle assembly : function of differential - constructional features and working. Arrangement of semi floating and fully floating rear axle, and their troubles.

Braking system: Introduction, classification of brakes, construction & working of mechanical brake, hydraulic brake, Electric brake , advantages and disadvantages of each type of brakes, Servo brake system.

UNIT-IV

Front Axle and Steering: Function of front axle, axle type, wheel alignment and its elements toe- in, toe -out. King pin inclination. Ackerman steering principle. Camber and castor angle . Elements of steering - types and working ,Under and over steering, power steering and advanced steering systems.

Frame and Suspension: Frames : necessity, function, Classification, suspension system, types, leaf, coil spring. Telescopic shock absorber. Air suspension, independent

suspension system. Tyres : structure of tyre section, rating of tyres, tyre- pressure measurement, material and specification. Tyre wear and remedies.

UNIT-V

Miscellaneous:

(i) **Maintenance of Vehicles** : need, classification maintenance procedure of engine, transmission system, electrical system, braking system and steering mechanism.

(ii) **Garage and Service Station:** Types, layout, equipment tools and service procedure.

(iii) **Exhaust Gas, Pollutants:** Their hazards and controls with reference to motor vehicle act. Motor Vehicle act, registration of vehicles, driving license and Traffic Signals.

LIST OF EXPERIMENTS

1- Study of automobile chassis and function of various components.

2- Study of various components used in auto vehicles.

- (a) Engine (b) Transmission system (c) Final Drive
(d) Braking system (e) Electrical system (f) Steering Mechanism

3- Study of various elements of scooter/ car/bus servicing.

4- Engine tuning and adjustment for smooth, idle speed of a scooter/moped/ motor cycle/ car etc.

5- Starting troubles and their rectifications.

6- Rectification procedure for :

- (a) Air bleeding. (b) Brake adjustment. (c) Problems in Carburettor. (d) Wheel alignment.

7- Battery, servicing and charging.

8- Repair of punctured tyre and re-treading of tyres.

9- Study of auto servicing centre.

- (a) Layout (b) Instruments/ Tools used (c) Servicing procedures.

10- Visit of a local auto service centre and prepare a report in respect of :

- (a) Layout (b) Instruments/ Tools used
(c) Servicing/ Reconditioning/ Maintenance procedure.

REFERENCE BOOKS

- 1- I.C. Engines by Dr. A.C. Rad and S.B. Bechar
- 2- Automobile Engineering- T.R. Banga & Nathu Singh (Khanna Publicers)
- 3- Automobile Engg. – K.M. Agrawal (Vol. I & II)
- 4- Automobile Engineering by Prof. S.M. Pande and K.K. Jain (Deepak Prakashan, Morar Gwalior)
- 5- IS: 202-1602-1960 Code for testing of variable speed I.C. Engines for automobile purpose.
- 6- IS : 1634-1964 Helical springs for automobile suspension.
- 7- IS : 2742-1964 Automobile brake lining.
- 8- IS : 3511-1966 Cylinder bore diameters for I.C. Engine.
- 9- IS : 4552-1963 Portable Jacks for automobile, Mechanical and hydraulic. acting telescope type.
- 10- IS : 2028-1963 Open jaw Spanners.

TEXT BOOKS

- 1 Automobiles Engineering Vol. I & II by Dr. Kirpal Singh. (Standard Publisher)
 - 2 Automobiles Engineering by R.S. Gupta (Satya Prakashan)
- Automobile Engineering by R. P. Sharma (Dhanpat Rai & Sons)

Diploma (Engg.)

Mechanical Engineering Semester-VI (Elective-I)

CAD/CAM

RATIONALE: Computer based numerically controlled machine tools are increasingly finding place in industries. Further integration of the computer Aided Design Drafting (CADD), Which has been in use in the industry for some years now, with (CAM) Operations has lead to efficient product design & prototyping and shorter production runs. The need to absorb, CAD/ CAM technology for its effectiveness has, therefore, become imperative.

UNIT-I

Introduction to CAD/ CAM :

Automation and its types; Definitions : CAD,CAAD CAM, CIM and CAE; Concept of CAD/CAM; Computers in industrial Manufacturing; General Design procedure and application of computers in it.; Benefits of CAD/CAM.

Hardware of CAD/CAM System

Basic structure; Hardware components of CAD workstations and their functions: CPU, Memory devices, input devices, display devices, output devices and storage devices; Hardware components of CAM system and their functions: CNC controller and CAD interfacing, CNC components. Conveyers and robot units; Functions of each hardware unit in CAM.; Block diagram of integrated CAD/CAM system.

UNIT-II

Introduction to CAD software:

Block diagram of graphics software configuration; Functions of a graphic package; 2D transformation translation, rotation and scaling with numerical examples; 3D Modeling: Wire frame and solid type.

UNIT-III

Introduction to Conventional Numerical Control:

Definition of NC; Basic components of an NC system : Program, MCU and Machine tools; The NC procedure; NC coordinate systems, fixed zero and floating zero, Absolute and incremental positioning; NC motion control systems; Components of MCU, Open and closed loop axis positioning systems; Applications of numerical control in Machine Tools; Advantages of NC systems

UNIT-IV

Introduction to NC Programming:

NC Part program and different codes used in it: N,G,M,F,S,T codes and co-ordinates; Writing Program blocks using NC program codes; Manual and Computer assisted part programming; Introduction to NC part programming languages like APT Different statements in APT language and writing program through it

UNIT-V

NC Control technology:

Different type of computer controls : CNC, DNC and Adaptive; General Configuration,

functions, and advantage of CNC, straight and hybrid CNC; General Configuration, types, functions, and advantage of DNC, BTR and Special Machine control unit DNC; Introduction, types and benefits of adaptive control, ACC and ACO systems

LIST OF EXPERIMENTS

- 1-Study of CAD Hardware system using physical and visual aid
- 2-Auto CAD commands and their applications in various types of designs/ drawings. ten/fifteen experiments
- 3-Solid modeling using parametric software
- 4-Demonstration of CNC machine for identifying machine zero, drive systems, safety precautions, and dry run of demo part programme
- 5-Tool setting, Job setting , part programme execution on CNC machine.
- 6-Material job handling using Robot system and conveyor assembly.

REFERENCE BOOKS

1. CAD/CAM Computer- Aided Design and Manufacturing by M.P. Groover, & E.W. Zimmer, Sr. (Prentice-Hall of India pvt. Ltd. (EEE), New Delhi, 1986)
- 2 Illustrated Auto CAD by T.W. Berghauser and P.L. Schlieve.
- 3 Understanding CAD/CAM- Design with Computer by D.J. Bowman, and R.N. MC-Dougal (BPB Publications, Delhi) .
- 4 CAD/CAM by Kuldeep Sareen & Chandadeep Grewal (S,Chamd & Co, Delhi)
- 5 Computer-Aided Design Engineering & Manufacturing (CRC Press)

TEXT BOOKS

- 1 Inside Auto CAD by Deniel Raker and Harbest Rice (BPB Publications, Delhi (Latest edition)
- 2 BPB Publications, Delhi. by Mastering Auto CAD (BPB Publications, Delhi)

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POWER PLANT ENGINEERING

UNIT-I

Steam Power Plant: Energy conversion in a thermal power station. Limitations on conversion of heat into work, direct conversion devices, central power station, industrial power station, captive power station, advantages. Classification of power station on the basis of prime-movers., Elements of steam power plant, function of each element- generating unit, prime mover, auxiliary equipment and turbo generator. Revision & Improvement of thermal efficiency of Rankine cycle by lowering exhaust pressure, increasing boiler pressure and superheating of steam. Simple problems on Rankine efficiency.

Reheat cycle: Representation on T-S and H-S planes, flow diagram and advantages. Simple regenerative cycle: flow diagram, representation on T-S and H-S planes, bleeding and feed water heating and pumping.

Steam Generators: Classification according to working pressure Accessories - Super heater, economizer, pre-heater and draft equipment, superheat control methods, pulverized fuel-necessity, storing system. High pressure boiler in modern steam power plant need, features and functions of Velox, Benson, Lamaunt, Leoffler high pressure boiler.

UNIT-II

Steam Primemover: Steam nozzle-Types, velocity of steam at outlet, weight of discharge, area of cross- section at throat and outlet, critical pressure ratio, nozzle efficiency, concept of primemover, steam turbine- Revision of steam turbine in terms of principle of working, methods of compounding and governing, losses in steam turbines, lubrication system of steam turbines.

Condensing Unit: Steam Condenser, functions, type-jet and surface. Limitations and advantages, elements of condensing unit-cooling towers.

UNIT-III

Steam Power Station Control and Safety: Effect of load variation on shaft speed, steam admission, valve opening, steam flow rate, steam pressure and combustion control system., Necessity of controlling factors in load variation, control system (area system, centralized control system) functions of annunciator panel system, basic elements of control system, controls and instruments located in a modern central station. Control room, records and their purpose, log sheets or log book.

Nuclear Power Stations: Nuclear reactions - fission, fusion, mass defect, binding energy, chain reaction, types of nuclear materials - fissile materials, fertile materials, process of conversion of fertile materials, breeding moderation. Nuclear reactor - Function- elements of a nuclear reactor- Reacted core, moderator, thermal - Shielding reflector, reactor vessel, fuel, coolant flow, control rods, biological shielding coolants (Caseansnon-boiling liquid, boiling liquid), Fluids - Helium, Co₂, O₂ under pressure, pressurised water (Ordinary, heavy) liquid metals (Li, Si, Pb, Na) and their alloys, boiling water., Operation - Fast reactors, thermal reactor, breeding reactor. Nuclear fuel - Heterogeneous, Homogeneous.

Moderator: Water moderator, heavy water moderator, graphite moderator and Berylling moderator.

Health hazards in nuclear power station- Unit of radiation safe and dangerous zones of radiations,

safety precautions in a nuclear power station- Medical requirements Entry requirements: In contamination zones, precaution during changing of fuel. Nuclear waste disposal.

UNIT-IV

Diesel Power Plants: Advantages and disadvantages as a primemover for power generation, essential components of diesel power plant and function. Cooling and lubrication system, fuel injection system- Basic requirements, fuel injection system -common rail system, individual pump system, distribution system, data recording, performance.

Hydro Electric Plants: Types, Comparison of low, medium and high heat plants, elements of hydro power plants, governing of turbines, performance of water turbines, site selection.

UNIT-V

Gas Turbine Powers Plants: Advantages of gas turbines over I.C. Engine as prime movers, Brayton or Joule cycle, schematic diagrams for open and closed cycles, representation of cycle on P.V. and T.S. diagram. Thermal efficiency in terms of terminal temperature and pressure, effect of pressure ratio on thermal efficiency, advantages and disadvantages of open and closed cycle gas turbines, important components of a gas turbine power plant, methods of improving thermal efficiency, essential auxiliaries and controls of a gas turbine power plant, fuels for gas turbines.

LIST OF EXPERIMENTS

1-Study of constructional and working details of

- (a) Simple steam power plant. (b) Nuclear power plant. (c) Gas power plant
- (d) Diesel power plant. (e) Hydro electric plant.

2-Study of controls provided in power plants listed above.

3-Draw balance sheet for diesel engine.

4-Performance and characteristics of steam/ hydraulic turbines.

5-Visits of various power plants located in Madhya Pradesh and submit report in terms of

- (a) Detailed layout (b) Capacity. (c) Elements of each unit. (d) Control systems provided.
- (e) Berometers which are being controlled. (f) Doses occuring in various units.
- (g) Maintenance of schedule. (h) Lubrication systems, uses.

REFERENCE BOOKS

1. A Course in Power Plant Engineering By T. Morse.
2. A Course in Power Plant Engineering By Nagpal.
3. A Course in Power Plant Engineering By Agrawal.

TEXT BOOKS

1. Course in Power Plant Engineering By S.Domkundwar.

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NON – CONVENTIONAL, SOURCES OF ENERGY

UNIT I.

1. **Introduction to Energy Sources:** Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources.

2. **Solar Energy :** Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaics - solar cells & its applications.

UNIT II

1. **Wind Energy :** Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

2. **Energy from Biomass:** Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.

UNIT III

1. **Geothermal Energy:** Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India

2. **Energy from the ocean:** Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy.

UNIT IV

1. **Magneto Hydro Dynamic (MHD) Power Generation :** Principle of MHD power generation, MHD system, materials for MHD generators and future prospects.

2. **Fuel Cells:** Introduction, operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells.

UNIT V

1. **Hydrogen Energy:** Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas,

2. **Energy Management:** Energy economics, energy conservation, energy audit, general concept of total energy system, scope of alternative energy system in India.

Reference Books:

1. Solar Energy: Fundamentals and Applications by H.P. Garg & Jai Prakash, Tata McGraw Hill
2. Solar Energy: Principles of Thermal Collection and Storage by S,P Sukhatme, Tata McGraw Hill
3. Alternative Energy Sources by B.L. Singhal Tech Max Publication
4. Fuel Cells by Bockris and Srinivasan; McGraw Hill

Text Books:

1. Non-conventional energy sources by G.D. Rai, Khanna Publishers
5. Non Conventional Energy Resources by S.Hasan Saeed and D.K.Sharma

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PROJECT

RATIONALE: The necessity of the project work has been emphasized on group work. Proper group functioning is a prerequisite for maximising output from a problem-solving group in work environment, proper organisation of project work should be able to simulate such a situation that the students may be able to effectively work in groups and thus gain confidence to effectively take up responsibilities in their careers. The students will prepare a final project report.

1. Specification on Minor Projects : To prepare a write up or feasible report containing not more than 1500 words, using appropriate diagrams & Illustrations, and in simple language to be understood by non- technical readers, about an engineering topic .

Suggested Topics : Feasibility of non conventional sources of energy for a particular application.

Solar heaters (Gobar gas Plant)

Technicians role in village feasibility of certain projects.

2. Prepare a comparative study report about alternative materials available for a particular application.

Suggested Topics : Electrical conductors. Cutting tools for high speed, machining.

Furniture making

Cooking utensile.

3. Prepare a technical paper to be read to the rest of the class, about the process of conversion of raw material in to a finished product.

Suggested Topics : Rubber tyres.

Production of mechanical engineering products. Lubricating oils

Production of plastic buckets. Production of stainless steel products. Detergents.

Products involving special welding or costing processes.

4. Prepare a survey of equipment, available for a particular engineering situation, make a comparative study and suggest a suitable choice.

Suggested Topics : Material handling equipment

Machine tool for given product. Measuring instruments.

5. Prepare a simple machine or component as per given drawing specification.

Suggested Jobs : A simple drilling machine model.

A punching Machine.

An inexpensive hardness tester. Simple materials testing equipment.

6. Reclaiming a worn out component or equipment and putting it to use. Suggested Job : A worn out cam shaft bearing assembly. A rejected I.C. Engine used in a motor cycle. Re- conditioning a discarded pump.

7. Construction of simple laboratory equipment/ teaching aids.

PROJECT WORK

The following points, concerning the project should be noted :

1. A record of all calculations, drawings and designs must be kept.
2. Student will work either individually or in a group of 2, 3
3. A Written report must be available to the supervisor at the end of the course. This report should be neatly written and produced in a suitable folder which bears the name of the polytechnic, the title of the project and the name of the contributor and the dates of the work. Although the reports will obviously vary from project to project, yet, they should in general, conform to the following pattern :
 - (a) Summary: A summary of the report which should not exceed one page in length.
 - (b) Index: The report should be logically indexed.
 - (c) Introduction: This should introduce the reader to the objectives of the exercise.
 - (d) Main body: this will vary considerably from project to project and will contain all design calculations, drawings. results etc.
 - (e) Conclusion: This will state the main conclusions of the exercise.
 - (f) Bibliography: A list of all references used. In general, you will find that a well presented brief concise and logical report will score a higher assessment than a badly presented, lengthy muddled and illogical report.