CURRICULUM FOR

DIPLOMA IN MECHANICAL ENGINEERING

(THIRD TO SIXTH SEMESTER)

Implemented from Students admitted 2019-20

Under

Semester system

SEMESTER: THIRD
CATEGORY: MEPC
SUBJECT CODE: DME 31
SUBJECT NAME: **BASIC MECHANICAL ENGINEERING**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To understand General Principles of Mechanical Engineering.
- To understand laws of thermodynamics, thermal and thermodynamic Processes.
- To understand working principles of power developing and power absorbing devices.
- To understand basic materials and manufacturing processes.

UNIT- 1

Materials: Classification of engineering material, composition of cast iron and carbon steels on iron-carbon diagram and their mechanical properties; Alloy steel and their applications; stress-strain diagram, Hooks law and modulus of elasticity. Tensile, shear, hardness and fatigue testing of materials. **(12 Hours)**

UNIT-2

Measurement: Temperature, pressure, velocity, flow, strain, force and torque measurement, concept of measurement error & uncertainly analysis, measurement by Vernier caliper, micrometer, dial gauges, slip gauges, sine-bar and combination set; introduction to lath, drilling, milling and shaping machines.

(12 Hours)

UNIT-3

Fluids: Fluid properties, pressure, density and viscosity; pressure variation with depth, static and kinetic energy; Bernauli's equation for incompressible fluids, viscous and turbulent flow, working principle of fluid coupling, pumps, compressors, turbines, positive displacement machines and pneumatic machines. Hydraulic power & pumped storage plants for peak load management as compared to base load plants. **(12 Hours)**

UNIT-4

Thermodynamics: First and second law of thermodynamics; steam properties, steam processes at constant pressure, volume, enthalpy & entropy, classification and working of boilers, efficiency & performance analysis, natural and induced draught, calculation of chimney height. Refrigeration, vapor absorption & compression cycles, coefficient of perform (COP), refrigerant properties & eco friendly refrigerants.

(12 Hours)

UNIT-5

Reciprocating Machines: Steam engines, hypothetical and actual indicator diagram; Carnot cycle and ideal efficiency; Otto and diesel cycles; working of two stroke & four stroke petrol & diesel IC engines

w.e.f.-July-2010 Academic Session-2010-11 18 **. (12 Hours)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Understand basics of thermodynamics and components of a thermal power plant

CO2 Understand basics of heat transfer, refrigeration and internal combustion engines

CO3 Understand mechanism of thermal power plant and boiler operation

CO4 Identify engineering materials, their properties, manufacturing methods encountered in engineering practice

CO5 Understand functions and operations of machine tools including milling, shaping, grinding and lathe machines.

REFERENCE BOOKS:-

1. Narula; Material Science; TMH

2. Agrawal B & CM; Basic Mechanical Engg. Wiley India

3. Nag PK, Tripathi et al; Basic Mechanical Engg; TMH

4. Rajput; Basic Mechanical Engg;

5. Sawhney GS; Fundamentals of Mechanical Engg; PHI

6. Nakra and Chaudhary; Instrumentation & measurement; TMH

7. Nag PK; Engineering Thermodynamics; TMH 8. Ganesan; Combustion Engines; TMH List of Suggestive core

EXPERIMENTS

1. Tensile testing of standard mild steelspecimen.

2. Experiments on Bernoulli's theorem.

3. Flow measurements by ventury and orifice meters.

4. Linear and angular measurement using, Vernier; micrometer, slip gauge, dial gauge and sine-bar.

5. Study of different types of boilers and mountings.

6. Experiment on mini-boiler (50 Kg/Hour)

7. To find COP of a refrigeration unit.

8. Study of different IC engines & measurement of B.H.P. using rope/belt dynamometer.

9. Analysis of exhaust gases on petrol, diesel & biodiesel engine

SEMESTER: THIRD

CATEGORY: MEPC

SUBJECT CODE: DME 32

SUBJECT NAME: **MATERIALS TECHNOLOGY**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To understand crystal structures and atomic bonds.
- To understand the properties of different types of ferrous metals and alloys.
- To understand the properties of different types of non-ferrous metals and alloys.
- To understand various metallic failures and acquire the knowledge of testing of materials.
- To understand the concept of corrosion and its prevention.

COURSE CONTENTS

UNIT-I

Requirement of Engineering materials, mechanical properties and their testing : 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. **(10 Hours)**

UNIT-II

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 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. **(10 Hours)**

UNIT-III

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, harden ability, Jominy end quench test and interpretation of its results. T.T.T. curves interpretation and use, Isothermal heat treatment processes -mar tempering, austempering, spherodising and patenting. **(10 Hours)**

UNIT-IV

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 steals as per B.I.S. codes. **(10 Hours)**

UNIT-V

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

Non- Metallic Materials: introduction to Ceramic Refractory, Rubbers Insulators and Lubricants. **(10 Hours)**

UNIT-VI

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

Plastic processing methods different methods.

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. **(10 Hours)**

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1 Explain about crystal structures and atomic bonds.

CO2 Describe about classification of ferrous metals and their properties.

CO3 Explain about non-ferrous metals, cutting tool materials and composites along with their properties.

CO4 Describe about the various metallic failures and knowledge in testing of materials.

CO5 Explain the principle of corrosion, their types and its prevention methods along with the various surface engineering processes.

REFERENCE

1 Engineering physical Matallurgy-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. New Delhi.)

8 Engineering Metalluragy by R. Higgins (ENS).

9 Materials Science by B.S. Narang (Pub. CBS pub. & Distributions New Delhi)

10 Padarth Prodyogiki (Hindi) by P.N. Vijayvergiya (Deepak Prakashan, Gwalior) .

LIST OF EXPERIMENTS

1 Preparation of micro specimen.

2 To study micro structural characteristics of gray cast iron white cast iron and malleable cast iron.

3 To study effect of normalising, annealing on the hardness and microstructure of high carbon steel.

4 To study the effect of carbon and temperature on hardening of steel.

5 To study the effect of temperature on the properties during tempering of steel.

6 To study the effect of quenching media on hardness of steel.

7 To study the carbonizing and case hardening of steel.

8 Joining hardenability test and its industrial use.

9 To Study the microstructure of some important brasses and bornzes.

10 To observe the micro structural characteristics and other properties of various cast irons and prepare a report there of, for indus

SEMESTER: THIRD EMESTER

CATEGORY: MEPC

SUBJECT CODE: DME 33

SUBJECT NAME: **FLUID MECHANICS & HYDRAULIC MACHINES**

TOTAL HOURS-60

COURSE OBJECTIVES:

• To understand fluid flow & related machinery for power generation, water supply and irrigation.

• To Select and use appropriate flow measuring device.

• To Select and use appropriate pressure measuring device.

• To understand and analyze the performance of pumps and turbines.

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. **(12 Hours)**

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. **(12 Hours)**

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 Cc, Cv and Cd. 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. **(12 Hours)**

UNIT -III

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 oftriangular notch over rectangular notch. Trapezoidal notch. Broad crested and submerged weirs. Practical application of weirs. Spillway and Siphon spillway, guage weir.

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. **(12 Hours)**

UNIT -IV

Impact of Jets : Impact of Jet on flat and curved plates stationary and moving, work done by Pelton wheel, velocity triangle, simple numerical problems on axial, radial flow.

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

Water Pumps : Centrifugal and reciprocating- principle construction, workingclassification 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. **(12 Hours)**

UNIT -V

Model Analysis :Geometric, Kinetic and dynamic similarity. Simple Problems.Hydel Power Station : Schematic diagram, function of various elements, advantage over other power stations. **(12 Hours)**

COURSE OUTCOMES

At the end of the course, the student will be able to:

229 Mechanical Engineering Curriculum Structure

CO1 Measure various properties such as pressure, velocity, flow rate using various instruments.

CO2 Calculate different parameters such as co-efficient of friction, power, efficiency etc of various Systems.

CO3 Describe the construction and working of turbines and pumps.

CO4 Test the performance of turbines and pumps.

CO5 Plot characteristics curves of turbines and pumps.

SEMESTER: THIRD EMESTER

CATEGORY: MEPC

SUBJECT CODE: DME 33

SUBJECT NAME: **FLUID MECHANICS & HYDRAULIC MACHINES**

LIST OF EXPERIMENTS

S.No.	EXPERIMENT
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.

REFERENCES

1. A text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines. by Khurmi (S. Chand & Co.
2. Fluid Machines by M. Manohar
3. Hydraulics & Hydraulic Machines by Dr. Jagdish lal (Metropolitan)
4. Hydraulics & Hydraulic Machines by Priyani.
5. Fluid Machines With Engineering Applications by R.L. Draught lery & A.C. Jugersoll. (McGraw
6. Journal of experiments in Hydraulic Laboratory by V. N. Rao & Husan New Heights.

7. Fluid Mechanics by Dr. M.L. Mathur (Std. Publications).

8. Taral Yantriki Avum Machinery (Hindi) by G.B. Bamanker. (Deepak Prakashan, Gwalior)

SEMESTER: THIRD

CATEGORY: MEPC

SUBJECT CODE: DME 34

SUBJECT NAME: **MANUFACTURING ENGINEERING**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To understand the importance of cutting fluids & lubricants in machining.
- To study various types of basic production processes. To select, operate and control the Appropriate processes for specific applications.
- To understand the concept of gear making and list various gear materials.
- To understand the importance of press tools and understand various die operations.
- To understand Grinding and finishing processes.

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. **(12 Hours)**

UNIT -II

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.

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. **(12 Hours)**

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. **(12 Hours)**

UNIT -IV

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

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. **(12 Hours)**

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. **(12 Hours)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Know and identify basic manufacturing processes for manufacturing different components.

CO2 Operate & control different machines and equipments.

CO3 Produce jobs as per specified dimensions and inspect the job for specified dimensions.

CO4 Select the specific manufacturing process for getting the desired type of output.

CO5 Adopt safety practices while working on various machine

SEMESTER: THIRD EMESTER

CATEGORY: MEPC

SUBJECT CODE: DME 34

SUBJECT NAME: **MANUFACTURING ENGINEERING**

LIST OF EXPERIMENTS

S.No.	NAME OF EXPERIMENT	SHOP
1	Making a split/solid pattern from wood. Making a core box.	Carpentry/pattern shop
2	Tempering of sand, practice of green and dry sand making.	pattern shop
3	Practice of core making and baking	Moulding shop
4	Practice of open mould in a two boxes, using split pattern and solid pattern, Locating the core .	Moulding shop
5	Demonstration of metal melting in pit furnace& casting process.	foundary
6	Simple forming practice (Making a square bar out of a given round bar, making of a chisel and bolt)	Blacksmith shop
7	Practice of upsetting of a round on power hammer.	Blacksmith shop
8	Practice of sheet cutting with the help of straight and bent snips. Making small rectangular prism and cylinder.	Blacksmith shop Tinsmith
9	Practice of making of washer of any size on a flypress.	Blacksmith shop Tinsmith
10	Practice of piercing, notching and circle cutting with the help of Metal master machine.	Blacksmith shop Tinsmith
11	Practice of piercing, notching and circle Cutting with the help of Metal master machine.	Blacksmith shop Tinsmith
12	Practice of piercing, notching and circle cutting with the help of Metal master machine.	Blacksmith shop Tinsmith
13	Practice of edge preparation for welding.	Fitting
14	Demonstration and practice of bead laying (Welding) on a Flat pieces	Fitting
15	Practice of Welding of corner, edge and Tee joint	Welding
16	Welding ' V' butt joint.	Welding
17	Practice of joining wires and rods of different size on spot welding machine.	Welding
18	Practice of making gas flames with nozzles and making simple joints.	Welding

REFERENCES

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

10. Foundry Engineering by P.L. jain.

11. Nirman Prakram (Hindi) by P.N. Vijayvargiya. (Deepak Prakashan, Morar, Gwalior)

SEMESTER: THIRD

CATEGORY: MEPC

SUBJECT CODE: DME 35

SUBJECT NAME: **MECHANICAL DRAFTING AND AUTOCAD**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To understand the fundamentals and use CAD.
- To conceptualize drafting and modeling in CAD.
- To interpret the various features in the menu of solid modeling package.
- To synthesize various parts or components in an assembly.
- To prepare CNC programmes for various jobs.

COURSE CONTENTS

UNIT -I

Projection and multi view Representation: Projection orthographic projection. First and third angle projection, superfluous view, choice of views, auxillary views- views -full and partial, conversion of pictorial views in to orthographic views, conventional representation 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 assembled parts.Choosing from IC engine parts, couplings, clutches, brackets, bearing etc. (Use 1st and 3rd angle projections both). **(12 Hours)**

UNIT -II

Dimensioning Tolerance, Machining And Welding Symbols : Types of dimensions (size and location) dimensioning terms and notations. (use of I.S.Code 696 &2709) general rules for dimensioning and practical hints on dimensioning systems of dimensioning. Dimension of cylinder holes arcs of circle narrow space, angles, counter sunk hole, screw threads taper etc. 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, tolerance of forms and positions. Procedure of drawing fits, limits, size, tolerance, clearance etc. **(12 Hours)**

UNIT -III

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, plummer 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. **(12 Hours)**

UNIT -IV

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. ng

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

Presentation: Block, creating layout, insert layout ,ploting/printing

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. **(12 Hours)**

UNIT -V

Gear Drawing: Gear terminology such as pitch, pitch circle diameter module, addendum, root circle diameter, hole depth, blank diameter etc. construction of cycloidal, involute teeth profiles, pinion and rack mashing, spur gear mashing. **(12 Hours)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Explain the 3D commands and features of a CAD software

CO2 Create 3D solid model and find the mass properties of simples solids

CO3 Demonstrate the working of CNC turning and milling machine

CO4 Develop the part program using simulation software for Lathe and Milling

CO5 Assess the part program, edit and execute in CNC turning and machining centre

SUGGESTED TERMS –WORK

S.No.	TOPIC
1	Projection and multi views representation
2	Sectional views
3	Dimensioning, tolerance, machining and welding symbols
4	Production drawing
5	Pipe drafting
6	Gear Drawing
7	Graphs and charts
8	Computer graphics

REFERENCES

1 Fundamentals of Engineering Drawing by Warren J. Luzadder (Prentice-Hall).

2 Machanical Drawing by Giesecke, Mic- hell Specer, Hill. (Collier Macmillan Internal Edition)

3 Engineering Graphics by Giesecke/Mitchell/ Spencer/ Hill/ Loving (Macmillan).

4 Mechanical Drawing By N.D.Bhatt

5 Mechanical Drawing By P.S.Gill

6 Mechanical Drawing By R.K.Dhawan

7 Inside AUTO CAD by Daniel Raker and Harbest Rice(BPB Publisher)

8 Computer Graphics and CAD Fundamentals By Noel M Morries(Wheeler)

SEMESTER: THIRD EMESTER
CATEGORY: MEDL
SUBJECT CODE: DME 36
SUBJECT NAME: **DEVELOPMENT OF LIFE SKILLS-II**

AIM :-

1. To develop the abilities and skills to perform at highest degree of quality as an individual as well as a member of core group or team. To enhance capabilities in the field of searching, assimilating information, managing the given task, handling people effectively, solving challenging problems.
   Model curriculum for post SSC Programm in Diploma in Mech. Engg. 2011.

OBJECTIVE :-

S.No	**The students will be able to:**
1.	Developing working in teams
2.	Apply problem solving skills for a given situation
3.	Use effective presentation techniques
4.	Apply techniques of effective time management
5.	Apply task management techniques for given projects
6.	Enhance leadership traits
7.	Resolve conflict by appropriate method
8.	Survive self in today's competitive world
9.	Face interview without fear
10.	Follow moral and ethics
11.	Convince people to avoid frustration

CONTENTS

1 SOCIAL SKILLS
SOCIETY, SOCIAL STRUCTURE, DEVELOP SYMPATHY AND EMPATHY. **(08 Hours)**

2 Swot Analysis – Concept, How to make use of SWOT. **(08 Hours)**

3 Inter personal Relation
Sources of conflict, Resolution of conflict ,
Ways to enhance interpersonal relations. **(08 Hours)**

4 Problem Solving

I) STEPS IN PROBLEM SOLVING,

1) Identify and clarify the problem,
2) Information gathering related to problem,
3) Evaluate the evidence,
4) consider alternative solutions and their implications,
5) Choose and implement the best alternative,
6) Review

II) Problem solving technique.(any one technique may be considered)

1) Trial and error,
2) Brain storming,
3) Lateral thinking **(09 Hours)**

5 Presentation Skills

Body language --
Dress like the audience
Posture, Gestures, Eye contact and facial expression.
Voice and language – Volume, Pitch, Inflection, Speed, Pause
Pronunciation, Articulation, Language,
Practice of speech.
Use of aids –OHP, LCD projector, white board **(09 Hours)**

6 Group discussion and Interview technique –
Introduction to group discussion,

Ways to carry out group discussion,
Parameters— Contact, body language, analytical and logical thinking, decision Making
INTERVIEW TECHNIQUE
Necessity,
Tips for handling common questions. **(09 Hours)**

7 Working in Teams

Understand and work within the dynamics of a groups.
Tips to work effectively in teams,
Establish good rapport, interest with others and work effectively with them
To meet common objectives,
Tips to provide and accept feedback in a constructive and considerate way ,
Leadership in teams, handling frustrations in group.

8 Task Management

Introduction,
Task identification,
Task planning ,organizing and execution,
Closing the task **(08 Hours)**

COURSE OUTCOME:

C01-Student become social.

C02-Student understand the use of SWOT

C03- Student become aware of enhancing interpersonal relation

C04 - Student become aware of problem solving technique

C05-Student develops presentation skill.

C06- Student becomes aware of group discussion and interview technique.

C07-Student learns to work in team.

C08-Student becomes proficient in finishing task.

LIST OF ASSIGNMENT:

1) SWOT analysis:- Analyze yourself with respect to your strength and weaknesses, opportunities and threats. Following points will be useful for doing SWOT.
   a) Your past experiences,
   b) Achievements,
   c) Failures,
   d) Feedback from others etc.
2) Undergo a test on reading skill/memory skill administered by your teacher.
3) Solve the puzzles.
4) Form a group of 5-10 students and do a work for social cause e.g. tree plantation, blood donation, Environment protection, camps on awareness like importance of cleanliness in slump area, Social Activities like giving cloths to poor etc.(One activity per group)
5) Deliver a seminar for 10-12 minutes using presentation aids on the topic given by your teacher.
6) Watch/listen an informative session on social activities. Make a report on topic of your interest using Audio/visual aids. Make a report on the programme.
7) Conduct an interview of a personality and write a report on it.
8) Discuss a topic in a group and prepare minutes of discussion. Write thorough description of the topic Discussed
9) Arrange an exhibition, displaying flow-charts, posters, paper cutting, photographs etc on the topic

Given by your teacher.

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Adams Time management	Marshall Cooks Viva Books		VIVA BOOKS
Basic Managerial Skills for All	E.H. Mc Grath , S.J		Pretice Hall of India, Pvt Ltd
Body Language	Allen Pease		Sudha Publications Pvt. Ltd
Creativity and problem solving	Lowe and Phil		Kogan Page (I) P Ltd
Decision making & Problem Solving	by Adair, J		Orient Longman
Develop Your Assertiveness	Bishop Sue		Kogan Page India
Make Every Minute Count	Marion E Haynes		Kogan page India
Organizational Behavior	Steven L McShane and Mary Ann Glinow		Tata McGraw Hill
Organizational Behavior	Stephen P. Robbins Pretice		Hall of India, Pvt Ltd
Presentation Skills	Michael Hatton (Canada – India Project)		ISTE New Delhi
Stress Management Through Yoga and	---		Sterling Publisher Pvt Ltd
Meditation Target setting and Goal Achievement	Richard Hale ,Peter Whilom		Kogan page India
Time management	Chakravarty , Ajanta		Rupa and Company
Working in Teams	Harding ham.A		Orient Longman

INTERNET ASSISTANCE

1. http://www.mindtools.com
2. http://www.stress.org
3. http://www.ethics.com
4. http://www.coopcomm.org/workbook.htm
5. http://www.mapfornonprofits.org/
6. http://www.learningmeditition.com http://bbc.co.uk/learning/courses/
7. http://eqi.org/
8. http://www.abacon.com/commstudies/interpersonal/indisclosure.html
9. http://www.mapnp.org/library/ethics/ethxgde.htm
10. http://www.mapnp.org/library/grp_cnfl/grp_cnfl.htm
11. http://members.aol.com/nonverbal2/diction1.htm
12. http://www.thomasarmstron.com/multiple_intelligences.htm
13. http://snow.utoronto.ca/Learn2/modules.html
14. http://www.quickmba.com/strategy/swot/

SEMESTER: FOURTH

CATEGORY: MEPC

SUBJECT CODE: DME 41

SUBJECT NAME: **ENGINEERING MEASUREMENTS AND METROLOGY**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To study advances in technology, measurement techniques, types of instrumentation devices,
  Innovations, refinements.
- To study the principles of instrumentation, transducers & measurement of non-electrical parameters like temperature, pressure, flow, speed, force and stress.

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.

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. **(12 Hours)**

UNIT -II

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

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, 3 484 Wear allowances and its selection for design, Taylor1s principle for design of I Go I and I No Go1 gauges. Calculation of gauge dimensions form formula given in I S 3455 and selection of parameters necessary for calculation. **(12 Hours)**

UNIT -III

Transducers: Meaning, function, primary and secondary transducers . Classification- mechanical electrical, active, passive . Comparision 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 thermister. Thermocouple- Principle, material, and working. Working principle of optical and radiation pyrometers.

(12 Hours)

UNIT -IV

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, stand ard 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. **(12 Hours)**

UNIT -V

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. **(12 Hours)**

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1 Define accuracy, precision, calibration, sensitivity, repeatability and such relevant terms in Metrology.

CO2 Distinguish between various types of errors.

CO3 Understand the principle of operation of an instrument and select suitable measuring device for a particular application.

CO4 Appreciate the concept of calibration of an instrument.

CO5 Analyze and interpret the data obtained from the different measurements processes and Present it in the graphical form, statistical form.

REFERENCE BOOKS

1. Engineering Metrology. by R.K. Jam (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. Hand book of Industrial Metrology by R.S.T.M.E. (Prentice Hall of India) a. .Metrology & Gauging S.A.J. Parsons. . (Macdonald & Erass. Ltd. London).
7. Industrial Instrumentation by D.P. Eckman (Wiley Easter Ltd. New Delhi)
8. Measurement Techniques in Mechanical Engineering by R.J. Sweeny i. (jon wiley & Sons, New York Addson Wesley Pub. London)
9. Mechanical Measurement by Becjwith Buck (Addson Wesley Pub. London)
10. Instruments For Measurement Control by W.G. Holzbock (Rainold Pub. Co-operation)
11. Mechanical & Industrial Measurement R.K. Jam (Khanna Publishers New Delhi)

SEMESTER: FOURTH

CATEGORY: MEPC

SUBJECT CODE: DME 42

SUBJECT NAME: **STRENGTH OF MATERIALS**

TOTAL HOURS-60

COURSE OBJECTIVES:

• To understand the concept of Simple Stresses and Strains.

• To understand the concept of Strain Energy.

• To understand the concept of Shear Force and Bending Moment Diagrams.

• To understand the concept of Theory of Simple Bending and Deflection of Beams.

• To understand the concept of Torsion in Shafts and Springs.

• To understand the concept of Thin Cylindrical Shells

.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 modules 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, modules of resilience suddenly applied loads and impact loads.

Mechanical properties and their testing

Mechanical properties of materials, destructive including Tensile test, compression test, hardness test, torsion test, impact test fatigue test, endurance limit, bending test, shear test and non- destructive testing methods. **(12 Hours)**

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.

(12 Hours)

UNIT -III

Bending Stresses in Beams

T heory of simple bending as assumptions made in simple bending theory position of neutral axis,surface moment or resistance. Modules 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. **(12 Hours)**

UNIT -IV

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.

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. **(12 Hours)**

UNIT -V

Spring

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

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 graphical method Bows notation, solution of problems using three methods.

(12 Hours)

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Compute stress and strain values and find the changes in axial, lateral and volumetric dimensions of bodies of uniform section and of composite section under the influence of normal forces.

CO2 Calculate thermal stresses, in bodies of uniform section and composite sections.

CO3 Define resilience, proof – resilience and modulus of resilience and obtain expressions for

Instantaneous stress developed in bodies subjected to different loads.

CO4 Compute shear force and bending moment at any section of beam and draw the S.F. & B.M Diagrams of for UDL and Point loads.

CO5 Calculate the safe load, safe span and dimensions of cross section.

CO6 Compare strength and weight of solid and hollow shafts of the same length and material and compute the stress and deflection of the closed coil helical spring.

LIST OF EXPERIMENTS

01 Study and demonstration of Universal Testing Machine & its attachments

02 Tension Test on mild steel, Aluminium & compression test on cast iron on Universal Testing Machine.

03 Direct Shear Test of mild steel on Universal Testing Machine.

04 Brinell Hardness Test on Mild Steel.

05 Rockwell hardness Test on Hardened Steel.

06 Izod & Charpy - Impact tests of a standard specimen

07 Torsion Test on Mild steel bar.

08 Drawing sheet on shear force & bending Moment diagrams for a given loading (At least four problems.).

09 Estimation of principal stresses and maximum shear strain for a given combined loading by analytical & Mohr's circle method. (At least two problems.).

REFERENCES

1 Strength of Materials. by B.C. Punmia.

2 Strength of Materials . by R.S. Khurmi.

3 Strenght of Materials by Sadhu Singh.

4 Strength of Materials by K.D. Sexena.

5 Strength of Materials by S. Ramamuruthan.

6 Strength of Materials by I.B. Prasad.

7 Strength of Materials by Ryder.

8 Strength of Materials by Timo shanko & young

9 Laboratory Experiments In Strength of Materials by B.D. Sharma.

10 Dravya Samarthya (Hindi) by K. D. Saxena (Deepak Prakashan, Morar Gwalior)

SEMESTER: FOURTH

CATEGORY: MEPC

SUBJECT CODE: DME 43

SUBJECT NAME: **THERMAL ENGINEERING**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To understand the working and applications of Gas turbines & Jet Propulsion.
- To understand the methods of computing various properties of steam.
- To understand the working of various Steam Boilers, functions of various accessories and mountings of boilers.
- To understand the Working of Steam Nozzles and Steam turbines.
- To understand the necessity of compounding and governing of a turbine.

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.

Sources of energy:

Brief description of energy sources Classification of energy sources, Renewable, Non-Renewable, Fossil fuels, including CNG, LPG; Solar Energy- Its nature, merits and demerits, potential; Flat plate and concentrating collectors & their application. Solar Water Heater, Solar Air Heater, Photovoltaic Cell, Solar Distillation; Wind, Tidal, Geothermal, Biogas, Biomass, Bio-diesel, Hydraulic, Nuclear, Fuel cell – list of fuel cells

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.

(12 Hours)

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. **(12 Hours)**

UNIT-III

Ideal Gases and Gas Processes:

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.

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

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. **(12 Hours)**

UNIT-IV

Steam Generators:

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

Steam Nozzle, Condensers and Turbines:

Steam nozzle and its use, Condenser-Classification, construction and working of surface condenser, Classification, working principle of steam turbines, difference between impulse and reaction turbine, compounding of steam turbine, velocity diagram (introductory and its use) Governing of steam turbine. **(12 Hours)**

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.

(12 Hours)

COURSE OUTCOMES

At the end of the course, the student will be able to:

Mechanical Engineering Curriculum Structure 240

CO1 Explain the working cycle of gas turbines, and the working of Jet and Rocket Engines apart
from identifying the fuels used for Jet and Rocket propulsion.

CO2 Compute the work done, enthalpy, internal energy and entropy of steam at given conditions
using steam tables and Mollier chart.

CO3 Distinguish between water tube and fire-tube boilers and explain the function all the mountings and accessories.

CO4 Calculate Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.

CO5 State the necessity of governing and compounding of a turbine.

CO6 Explain the principle of working of a steam turbine and distinguish between the impulse turbines and reaction turbines..

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 Study of flow of heat in natural environment at least 10 cases and relation to second law of thermodynamics

REFERENCES

1. Engineering Thermodynamics by P. K. Nag, Tata McGraw Hill Ltd. Engineering Thermodynamics, C. P. Gupta, Rajendra Prakash
2. Thermal Engineering by P.L. Ballani. (Khanna Publisher's N. Delhi)
3. A Course in thermodynamics And Heat Engines by Kothanandran, Khajuria and Arora (Dhanpat Rai & Sons Delhi)
4. Treatise On Heat Engineering by Vasandani & Kumar (Metropocitan Book Co. Ltd, New Delhi)

5. Thermodynamics by G.T. Van Wylen (john Wiley & Sons) 6. Thermodynamic And Heat Engines Vol . I & II by R. Yadav. (Central Book Depot, Allahabad) 7. Heat Power by K

SEMESTER: FOURTH
CATEGORY: MEPE

SUBJECT CODE: DME 44(A)

SUBJECT NAME: **COMPUTER AIDED DESIGN AND MANUFACTURING**

TOTAL HOURS-60

COURSE OBJECTIVES:

To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture.

• To understand concepts of drafting and modelling using CAD.

• To understand the need for integration of CAD and CAM.

• To understand the concepts of flexible manufacturing system

UNIT-I:

Fundamentals of CAD/CAM: Automation; Design process; Application of computers for design;Benefits of CAD; Computer configuration for CAD applications; Design workstation; Graphic terminal; CAD Software: Definition of system software and application software; CAD database and structure.

Geometric Modeling: 3D-Wire frame modeling; Wire frame entities and their definitions; Interpolation,and Approximation of curves; Concept of Parametric and Non-parametric representation of curves; Curve fitting techniques. **(12 Hours)**

Unit-II:

Surface Modeling: Algebraic and Geometric form; Parametric space of surface; Blending functions; Parametrization of surface patch; Subdividing; Cylindrical surface; Ruled surface; Surface of revolution; Spherical surface; Composite surface; Bezier surface; Solid Modelling: Definition of cell Composition and spatial occupancy enumeration; Sweep representation; Constructive solid geometry; Boundary representations. **(12 Hours)**

Unit-III:

NC Control Production Systems: Numerical control; Elements of NC system; NC part programming;Methods of NC part programming; Manual part programming, Computer assisted part Programming; Post processor; computerized part program. **(12 Hours)**

Unit-IV:

Group Technology: Part families; Parts classification and coding; Production analysis; Machine cell design; Computer aided process planning: Retrieval type and Generative type; Machinability data systems; MRP and its Benefits. **(12 Hours)**

Unit-V:

Flexible manufacturing system: F.M.S equipment; Layouts; Analysis methods and benefits;

Computer aided quality control; Automated inspection: Off-line, On-line, Contact, Non-contact; Coordinate Measuring machines; Machine vision; CIM system and Benefits.

(12 Hours)

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Develop mathematical models to represent curves and surfaces and Model engineering Components using solid modeling techniques.

CO2 Understand geometric transformation techniques in CAD.

CO3 Develop programs for CNC to manufacture industrial components.

CO4 Understand the application of computers in various aspects of Manufacturing viz., Design,

Proper planning, Manufacturing cost, Layout & Material Handling system.

CO5 Utilize Flexible manufacturing system tools.

REFERENCE BOOKS:

1. CAD/CAM Principles and Applications, P.N.Rao, Tata McGraw-Hill
2. Computer Aided Design and Manufacturing, Groover M.P. & Zimmers Jr, Prentice hall of India
3. CAD/CAM/CIM, RadhaKrishna P. & Subramanyam, Wiley Eastern Ltd

SEMESTER: FOURTH
CATEGORY: MEPE

SUBJECT CODE: DME 44(B)

SUBJECT NAME: **POWER PLANT ENGINEERING**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To introduce students to different aspects of power plant engineering.
- To familiarize the students to the working of power plants based on different fuels.
- To expose the students to the principles of safety and environmental issues.

UNIT-I

Introduction to Power plant: Introduction to power plant; Indian Energy scenario in India; Location of power plant; Choice of Power plant; Classification of power plants. **(12 Hours)**

UNIT-II

Economics of power plant: Terminology used in power plant: Peak load, Base load, Load factor, Load curve; Various factor affecting the operation of power plant; Methods of meeting the fluctuating load in power plant; Load sharing- cost of power-tariff methods; Performance and operating characteristics of power plant.Mechanical Engineering Curriculum Structure 264.

(12 Hours)

UNIT-III

Hydro power plant: Introduction to Hydro electric power plant; Rainfall, Runoff and its Measurement, Hydrograph, flow duration curve; Selection of sites for hydro electric power plant;General layout of Hydro electric power plant and its working; Classification of the Plant-Run off river plant, storage river plant, pumped storage plant; Advantages and disadvantages of hydro electric power plant. **(12 Hours)**

UNIT-IV

Diesel and Gas turbine plant: The layout of diesel power plant; Components and the working of diesel power plant; Advantages and disadvantages of diesel power plant; Gas turbine power Plant-Schematic diagram, components and its working; Combined cycle power generation-Combined gas and steam turbine power plant operation (only flow diagram).

Nuclear power plant: Introduction; Nuclear Power-Radio activity-Radioactive charge-types of reactions; Working of a nuclear power plant; Thermal fission Reactors- PWR, BWR and gas cooled reactors; Advantages and Disadvantages of Nuclear power plant. **(12 Hours)**

UNIT-V

Environmental impact of Power plant: Social and Economical issues of power plant; Green

house effect; Acid precipitation-Acid rain, Acid snow, Dry deposition, Acid fog; Air, water, Thermal pollution from power plants; Radiations from nuclear power plant effluents.Power plant safety: Plant safety concept; Safety policy to be observed in power plants; Safety practices to be observed in boiler operation; Safety in oil handling system; Safety in Chemical handling system; Statutory provision related to boiler operation. **(12 Hours)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Understand power plant engineering and its classification

CO2 Understand the working of thermal power plant and Know the importance of thermal Power plant

CO3 Understand the components, working of hydro-electric, diesel and gas turbine power plants and its importance Production Engineering Curriculum Structure 320

CO4 Understand the working of nuclear power plant and various environmental aspects related to power plant.

CO5 Understand and appreciate the safety aspects related to power plant

REFERENCE BOOKS:

1. Power plant Engineering-P.K. Nag 4th edition, Tata McGraw Hill Education, 2014.

2. Power plant Engineering – Frederick T. Morse, Litton Educational Publishing Inc. 1953.

3. A Course in Power Plant Engineering – Subhash C. Arora, S. Domakundwar, Dhanpat Rai, 1984.

4. Power Plant Engineering – P.C. Sharma, S.K.Kataria & sons, 2009.

5. Power System Engineering – R.K. Rajput, Firewell Media,2006

SEMESTER: FOURTH

CATEGORY: MEPE

SUBJECT CODE: DME 45(A)

SUBJECT NAME: **MATERIAL HANDLING SYSTEM**

TOTAL HOURS-60

COURSE OBJECTIVES:

• To know the operational features of the material handling equipment & its practical applications.

• To understand, select, operate and maintain the material handling equipments.

• To understand different material handling processes used in industries.

• To understand & appreciate safety instrumentation for equipment.

UNIT-I:

Introduction to Material Handling System: Main types of Material handling equipments & their applications; Types of load to be handled; Types of Movements; Methods of stacking, loading & unloading systems; Principles of Material Handling Systems; Modern trends in Materials handling. **(12 Hours)**

UNIT-II:

Hoisting Machinery & Equipments: Construction, Working & Maintenance of different types of hoists such as Lever operated hoist, Portable hand chain hoist, Differential hoists, Worm geared and Spur geared hoists, Electric & Pneumatic hoists, Jumper; Construction, Working & Maintenance of different types of cranes such as Rotary cranes, Trackless cranes, Mobile cranes, Bridge cranes, Cable cranes, Floating cranes & Cranes traveling on guide rails; Construction, Working & Maintenance of Elevating equipments such as Stackers, Industrial lifts, Freight elevators, Passenger lifts, and Mast type's elevators, Vertical skip hoist elevators. **(12 Hours)**

UNIT-III:

Conveying Machinery: Construction, Working & Maintenance of Traction type conveyors such as Belt conveyors, Chain conveyors, Bucket elevators, Escalators; Construction, Working & Maintenance of Traction less type conveyors such as Gravity type conveyors, Vibrating & Oscillating conveyors, Screw conveyors, Pneumatic & Hydraulic conveyors, Hoppers gates & Feeders. 267 Mechanical Engineering Curriculum Structure

Surface Transportation Equipment: Construction, Function, Working of Trackless equipment such as Hand operated trucks, Powered trucks, Tractors, Automatic Guided vehicle, Industrial Trailers; Construction, Function, Working of Cross handling equipment such as Winches, Capstans, Turntables, Transfer tables, Monorail conveyors. **(12 Hours)**

UNIT-IV:

Components of Material Handling Systems: Flexible hoisting appliances such as Welded load chains, Roller chains, Hemp ropes, Steel wire ropes, Fastening methods of wire & chains, Eye bolts, Lifting tackles, Lifting & Rigging practices; Load handling attachments: a) Various types of hooks-Forged, Triangular eye hooks, Appliances for suspending hooks b) Crane grab for unit & piece loads c) Electric lifting magnet, vacuum lifter. d) Grabbing attachment for loose materials e) Crane attachment for handling liquids/molten metals; Construction & Working of Arresting gear & Brakes; Construction & use of electromagnetic shoe brakes, Thruster operated shoe brakes, Control brakes.

(12 Hours)

UNIT-V:

Mechanism used in Material Handling Equipment: Steady state motion; Starting & stopping of motion in following mechanisms: Hoisting mechanism, Lifting Mechanism, Traveling Mechanism,Slewing Mechanism, Rope & chain operated Cross- Traverse Mechanism.

Selection of Material Handling Equipment: Factors affecting choice of material handling equipment such as Type of loads, Hourly capacity of the unit, Direction & length of travel, Methods of stocking at initial, final & intermediate points, Nature of production process involved, Specific load conditions & Economics of material handling system. **(12 Hours)**

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1 Understand constructional & operational features of various materials handling systems.

CO2 Identify, compare & select proper material handling equipment for specified applications.

CO3 Know the controls & safety measures incorporated on material handling equipment.

CO4 Appreciate the role of material handling devices in mechanization & automation of industrial process.

CO5 Understand & appreciate safety instrumentation for equipment

Reference Books:

1. Material handling (Principles & Practice) – Allegri T. H., CBS Publisher, New Delhi.
2. Plant Layout & Materials Handling – Apple J. M., JohnWiley Publishers.
3. Material Handling Equipment – N. Rundenko, Peace Publisher, Moscow.
4. Material Handling Equipment – M. P. Alexandrov, MIR Publisher, Moscow.
5. Material Handling Equipment – Y. I. Oberman, MIR Publisher, Moscow.

SEMESTER: FOURTH

CATEGORY: MEPE

SUBJECT CODE: DME 45(B)

SUBJECT NAME: COMPUTER INTREGRATED MANUFACTURING

TOTAL HOURS-60

COURSE OBJECTIVES:

- To understand General Principles of Mechanical Engineering.
- To understand laws of thermodynamics, thermal and thermodynamic Processes
- To understand working principles of power developing and power absorbing devices
- To understand basic materials and manufacturing processes

COURSE CONTENT

UNIT-I

Concept of Computer Integrated Manufacturing (CIM); Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors. **(12 Hours)**

UNIT-II

Computer Aided Design (CAD): CAD hardware and software; product modelling, automatic Mechanical Engineering Curriculum Structure 256 drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre. **(12 Hours)**

UNIT-III

Computer Aided Manufacturing (CAM), Computer assisted NC part programming; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirements planning (MRP). **(12 Hours)**

UNIT-IV

Computer aided production scheduling; computer aided inspection planning; computer aided inventory planning, Flexible manufacturing system (FMS); concept of flexible manufacturing. **(12 Hours)**

UNIT-V:

Integrating NC machines, robots, AGVs, and other NC equipment; Computer aided quality control; business functions, computer aided forecasting; office automation. **(12 Hours)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Understand the formulation of Liner Programming

CO2 Analyze and Convert the problem into a mathematical model.

CO3 Understand the dual LP and Primal Dual relation problems

CO4 Understand and implement the transportation problems at workplace

CO5 Solve the assignment problems, solving linear programming approach using software

REFERENCE BOOKS:

1. CAD, CAM, CIM - P.Radhakrishnan and S.Subramanyan, New Age International Publishers.
2. Computer Integrated Manufacturing - Paul G. Rankey, Prentice Hall.
3. Robotics Technology and Flexible Automation – S.R. Deb, Tata McGraw Hill.

IVth - SEMESTER

CATEGORY: - MEMC

SUBJECT CODE: -DME-48

SUBJECT NAME: - ESSENCE OF INDIAN KNOWLEDGE TRADITION

TOTAL HOURS-60

COURSE OBJECTIVE

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. Part-I focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

COURSE CONTENTS

- Basic structure of Indian Knowledge System:
- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case studies–

REFERENCES

Knowledge traditions and practices of India, CBSE Publication V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya• Vidya Bhavan, Mumbai. 5th Edition, 2014 Swami Jitatmanand, Modern Physics and Vedantharatiya Vidya Bhavan• Swami Jitatmanand, Holistic Science and Vedantharatiya VidyaBhavan• Fritzof Capra, Tao of Physics• Fritzof Capra, The Wave of life• VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay• Foundation, Velliarnad, Arnakulam Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata• GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya,• Vidyanidhi Prakashan, Delhi 2016 RN Jha, Science of

Consciousness Psychotherapyand Yoga Practices, Vidyanidhi• Prakashan, Delhi 2016 P B Sharma (English translation), Shodashang Hridayan•

PEDAGOGY:

Problem based learning, group discussions, collaborative mini projects.

OUTCOME:

Ability to understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.

SEMESTER: FIFTH

CATEGORY: MEPC

SUBJECT CODE: DME 51

SUBJECT NAME: **MODERN PRACTICES IN MANUFACTURING AND MANAGEMENT**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To Practice the casting principles and operations in foundry.
- To Practice the operation of Lathe.
- To Practice the joining of metals using different Welding techniques.

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. **(12 Hours)**

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. **(12 Hours)**

UNIT-III

Total Quality Management (TQM)-Evolution, definition, preparation stages in TOM implementation, Integrated TOM model, costumer

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. **(12 Hours)**

UNIT-IV

Introduction to Quality Standards:ISO 9000- Introduction History, Indian Equivalence, System requirements for ISO 9001, 9002,9 003, steps for installation, How to apply. 05 9000 Quality Management systems. SO 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

a. APQP - Advance product quality planning

b. FMEA - Failure mode and effect analysis

MSA- Measurement system analysis **(12 Hours)**

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. **(12 Hours)**

LIST OF EXPERIMENTS

1. Visit to a nearby installation / Study and practice at least two of the following:
    a. ECM
    b . C M
    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 thefollowing:
    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 TOM Philosophy, TPM.
8. Seminar on Six Sigma practice.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

233 Mechanical Engineering Curriculum Structure

CO1 Prepare a mould sand mix and molten metal and calculate the amount of metal to be poured in the mould

CO2 Centre the job and select the proper tool to perform the job on lathe machine.

CO3 Calculate the taper angle and practice different taper turning methods on lathe.

CO4 Prepare the edges for welding and select the suitable electrode, voltage and current.

CO5 Operate the welding transformer and generator to perform various weld joint operations.

REFERENCE BOOKS

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

SEMESTER: FIFTH

CATEGORY: MEPC

SUBJECT CODE: DME 52

SUBJECT NAME: THEORY OF MACHINES AND MECHANISM

TOTAL HOURS-60

COURSE OBJECTIVES:

- To understand different types of cams and their motions and also to draw cam profiles for various motions.
- To understand the mechanism of various types of drives available for transmission of power.
- To understand the design of Brakes, Dynamometers, Bearings and Clutches and their function and working.
- To understand the need for balancing of masses in the same plane
- To Know different types of governors.

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.

(12 Hours)

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, dynamometermeaning, need and types . Simple

numerical calculation on above items. **(12 Hours)**

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. Chain Drive : Classification, designation of chain drives as per B.I.S. **(12 Hours)**

UNIT-IV

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

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. **(12 Hours)**

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 epicyclical and reverted gear train, motor car gear box. **(12 Hours)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Know different machine elements and mechanisms.

CO2 Understand Kinematics and Dynamics of different machines and mechanisms.

CO3 Select Suitable Drives and Mechanisms for a particular application.

CO4 Appreciate concept of balancing and Vibration.

CO5 Develop ability to come up with innovative ideas.

CO6 Understand different types of cams and their motions and also draw cam profiles for various motions

EXPERIMENTS

1 Crank slotted lever mechanism
2 Whitworth quick return motion mechanism
3 Dynamic force analyses of single cylinder four stroke engines.
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

REFERENCES

1 Theory of Machines by J.M. Shah & H.M. Jadhwani.
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.
7 Theory of Machines By R.S.Khurmi
8 Theory of Mechanism and Machine By Jagdish Lal

SEMESTER: FIFTH

CATEGORY: MEPC

SUBJECT CODE: DME 53

SUBJECT NAME: **INDUSTRIALENGINEERING AND MANAGEMENT**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To take the right decisions to optimize resources utilization by improving productivity of the
  Lands, Buildings, People, Materials, Machines, Money, Methods and Management effectively.
- To eliminate unproductive activities under the control of the Management, Supervisor, worker
  and the Design of Products and Processes.
- To use the Charts to record the Activities of the people, materials and Equipment to find alternative methods which minimize waste and to implement the best method.

UNIT-I

INTRODUCTION: Definition of industry and industrial engineering, scope and role of industrial engineering fields of a pplications.

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. **(12 Hours)**

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.

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 break down 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. Calculation 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.

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, **(12 Hours)**

UNIT-III

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 SOC. difference between inspection and quality control, concept of variability, natural variation, its importance to quality control , classification of quality, characteristics, basic tools of SOC 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.

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. **(12 Hours)**

UIT-IV

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

SYSTEM THINKING : System definition and parameters. Different production and nonproduction 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.

PRODUCTION PLANNING AND CONTROL : Production systems, characterstics of each type, production and consumption rate. PPC functions, Gantt chart, advantages and preparation of Gantt chart (simple cases only), Critical ratio scheduling. **(12 Hours)**

UNIT-V

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.

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. **(12 Hours)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Explain the different types of layout and plant maintenance with safety

CO2 List and explain the need of method study and work measurements

CO3 Explain the production planning and quality control, and its functions

CO4 Understand the basic principles, approaches and functions of management and identify concepts to specific situations

CO5 List and explain the different financial sources and methods of inventory management

REFERENCES

1. Learning Package on Industrial Management Publisher : TTTI, Bhopal.
2. CPM and PERT - Principles and Applications By L.S.Shrinath
3. Indutrial Engg. and Management By O.P.Khanna. Khanna Publisher.
4. Industrial Organisation and Management By K.K.Ahuja
5. Modern Production Operation Management By Buffa Willey Eastern Ltd. (latest edition)
6. Production Operation Management By Goel B.S. Pragati Prakashan.
7 Introduction To Industrial Engineering by Philip Hicks (McGraw Hills)
8 Productivity Means Property (Asian Productivity Organisation, Tokyo)
9 Introduction To Work Study (International Labour Office)
10 Work Study by M.D. Schmid & Subrammaniam
11 Motion and Time Study by Ralph M. Barnes John Willey New York
12 Work Study by Dalela.
13 Wage Administration by D.K. Roy. (N.P.C. Publication).
14 Quality Assurance Engineering by M.D. Schmid & Subramaniam.
15 S.Q.C. by E.L.Grant. 10 S.Q.C. by R.C. Gupta.
16 Industrial Engineering & Management by 0. P. Khanna.
17 Industrial Engineering by Saxena.
18 MOST Work Measurement Systems, Kjell B. Zandin, Marcel Dekkar Inc. New York
19 Material Handling Equipment (N. Rudenki Place Pub)
20 Learning Package In Industrial Engineering by O.D.C. , T.T.T.I Bhopal
21 Laboratory Manual Industrial Engineering by O.D.C. , T.T.T.I
22 Audyogiki Abhiyantran (Hindi) by J.C.Varshneya. (Deepak Prakashan, Gwalior)
23 Audyogik Engineering (Hindi) by K.D. Saxena. (Deepak Prakashan, Gwalior)

SEMESTER: FIFTH

CATEGORY: MEPE

SUBJECT CODE: DME 54 (A)

SUBJECT NAME: **HEAT TRANSFER**

TOTAL HOURS-60

COURSE OBJECTIVES:

• To understand General Principles of Mechanical Engineering

• To understand laws of thermodynamics, thermal and thermodynamic Processes

• To understand working principles of Thermal Machines and Power Transmitting Devices

• To understand basic materials and manufacturing processes

UNIT-I:

Conduction: Fourier law of heat conduction for isotropic material; Thermal conductivity; Derivation of the energy equation in three dimensions including transient effect; Nondimensional -

thermal diffusivity and Fourier number; Types of boundary conditions (Dirchlet, Neumann, mixed type); One dimensional solution with and without heat generation; Analogy with electrical circuits.

(12 Hours)

Unit-II:

Fins: rectangular and pin fins. Fin effectiveness and efficiency. Critical thickness of insulation. Lumped parameter approach and physical significance of time constant, Biot number, Validity of lumped parameter approach. Introduction to Heissler Chart. **(12 Hours)**

Unit-III:

Convection: Introduction, Newton's law of cooling; Momentum and energy equations in two dimensions; nondiemnsionalisation, importance of nondimensional quantities and their physical

significance. Velocity and thermal boundary layer thickness by integral method. Analogies between

momentum, heat and mass transfer. Natural convection, effect of coupling on the conservation equations. **(12 Hours)**

Unit-IV:

Radiation : Physical mechanism of thermal radiation, laws of radiation, dfeinition of black body, emissive power, intensity of radiation, emissivity, reflectivity, transmittivity, irradiation, radiosity.Radiation exchange between black bodies, concept of Gray-Diffuse Isotropic (GDI)

surface. Radiation exchange between GDI surfaces by radiation network and radiosity matrix method. Radiation shielding.Mechanical Engineering Curriculum Structure 260.**(12 Hours)**

Unit-V:

Heat exchangers: Types of heat exchangers, parallel and counterflow types, Introduction to LMTD. Correction factors, fouling factor. NTU method for heat exchangers. **(12 Hours)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Understand basics of thermodynamics and components of a thermal power plant

CO2 Understand basics of heat transfer, refrigeration and internal combustion engines

CO3 Understand mechanism of thermal power plant and boiler operation

CO4 Identify engineering materials, their properties, manufacturing methods encountered in engineering practice

CO5 Understand functions and operations of machine tools including milling, shaping, grinding and lathe machines.

REFERENCES

1. Fundamentals of Heat and Mass Transfer by F.P.Incropera and D.P.Dewitt, 4th ed., John Wiley & Sons.
2. Heat Transfer - A Basic Approach by M.N.Ozisik, McGrawhill.
3. Heat Transfer by J.P.Holman, 8th ed., McGrawhill.
4. Elements of Heat & Mass Transfer by Vijay Gupta, 2nd ed., New Age Inter

SEMESTER: FIFTH

CATEGORY: MEPE

SUBJECT CODE: DME 54 (B)

SUBJECT NAME: PRODUCTION & OPERATION MANAGEMENT

TOTAL HOURS-60

COURSE OBJECTIVES:

• One of the most critical areas for success in any business enterprise is how Production and Operations are managed.

• To study the statistics, economics, finance, organizational behaviour and strategy into a consolidated production and operation related decisions.

• To discuss the role of location strategy and the criteria for location decisions.

• To define quality and explain quality management, including TQM and its tools.

UNIT-I:

Process Planning and Process Engineering: Process Planning: Introduction, Function, Pre-requisites and steps in process planning, Factors affecting process planning, Make or buy decision,plant capacity and machine capacity. Process Engineering: Preliminary Part Print Analysis:

Introduction, Establishing the General Characteristics of work piece, determining the principal Process,Functional surfaces of the work piece, Nature of the work to be Performed, Finishing and identifying operations. Dimensional Analysis: Introduction, types of dimensions, measuring the Geometry of form, Baselines, Direction of specific dimensions. Tolerance Analysis: Causes of work piece variation, Terms used in work piece dimensions, Tolerance stacks. Work piece Control: Introduction, Equilibrium Theories, Concept of location, Geometric Control, Dimensional control, Mechanical control. **(12 Hours)**

UNIT-II:

Production Forecasting: Introduction of production forecasting, The strategic role of forecasting in supply chain, Time frame, Demand behavior, Forecasting methods- Qualitative and Quantitative,

Forecast accuracy.Scheduling:Introduction, Objectives in scheduling, Loading, Sequencing, Monitoring, Advanced Planning and Scheduling Systems, Theory of Constraints, Employee scheduling. **(12 Hours)**

UNIT-III:

Break-Even Analysis: Introduction, Break-even analysis charts, Breakeven analysis for process, plant and equipment selection.Aggregate Operations Planning: Aggregate production planning, Adjusting capacity to meet the demand, Demand management, Hierarchical and

collaborative planning, Aggregate planning for services. **(12 Hours)**

UNIT-IV:

Assembly Line Balancing: Assembly lines, Assembly line balancing, Splitting tasks, Flexible and U-shaped line layouts, Mixed model line balancing, Current thoughts on assembly lines, Computerized assembly line balancing. **(12 Hours)**

UNIT-V:

Material Management: Introduction, Importance and objectives, Purchasing and Stores: Policies and procedures, Vendor development, selection, analysis and rating. **(12 Hours)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Define operations management and explain its relationship to productivity. And also understand tools and techniques.

CO2 Describe the importance of forecasting and explain the effective application of the different
Forecasting approaches and methods.

CO3 Explain layout strategy and how operations managers determine facility arrangements and size.

CO4 Describe how operations managers achieve a reasonable work environment and set expectations related to employee productivity.

CO5 Understand make-or-buy decisions, and the selection and integration of suppliers. And how much to order and when to order.

REFERENCE BOOKS:

1. Production and Operations Management – K.Aswathappa, K.Shridhara Bhat, Himalaya Publishing House, 2014.

2. Production and Operations Management – Shailendra Kale, McGraw Hill Educations(India) Private Limited,2013.

3. Production and Operations Management – R.Paneerselvam, PHI Learning Private Limited, 2013.Mechanical Engineering Curriculum Structure 254

4. Operations Management – Joseph Monk, TMH Publishers, New Delhi, 2004.

5. Modern Production /Operations Management – Buffa Elwood S, John Wiley Publishers, Singapore,2002.

SEMESTER: FIFTH

CATEGORY: MEPE

SUBJECT CODE: DME 55 (A)

SUBJECT NAME: **AUTOMOBILE ENGINEERING**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To understand the basic structure and components of an automobile.
- To understand the concepts of cooling and lubricating systems.
- To understand the concepts of Ignition and transmission and steering systems.
- To understand the classification and necessity of suspension system.
- To identify different special vehicles.

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, scavanging 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. **(12 Hours)**

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 voltagecurrent 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. 4 Transmission System: Clutch : necessity, function of its components, Types –single & multi plate and centrifugal clutches, cluth 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. **(12 Hours)**

UIT-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. **(12 Hours)**

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 Frame and Suspension: Frames : necessity, function, Classification, suspension system, types, leaf, coil spring. Telescopic shock absorber. Air suspension, independent suspension system. **(12 Hours)**

UNIT V

Tyres : structure of tyre section, rating of tyres, tyre- pressure measurement, material and specification. Tyre wear and remedies. 9 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. **(12 Hours)**

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1 Identify the components of an automobile with their working

CO2 Explain the concepts of cooling and lubricating systems.

CO3 Explain the concepts of Ignition and Transmission and steering systems.

CO4 Identify different suspension systems and their applications.

CO5 Differentiate the special vehicles according to the usage.

RECOMMENDED BOOKS

1. Automobiles Engineering Vol. I & I I by Dr. Kirpal Singh.

2. (Standard Publisher) Automobiles Engineering by R.S. Gupta

3. (Satya Prakashan) Automobile machanism by Joseph Heither

4. Automobile Engineering by R. P. Sharma (Dhanpat Rai & Sons)

5. Automobile Mechanism by William H. Crouse I.C. Engines by Dr. A.C. Rad and S.B. Bechar Automobile Engineering- T.R. Banga & Nathu Singh (Khanna Publicers)

6. Automobile Engg. – RB. Gupta Automobile Engg. – K.M. Agrawal (Vol. I & II)

7. Automobile Engineering by Prof. S.M. Pande and K.K. Jain (Deepak Prakashan, Morar

Gwalior) IS: 202-1602-1960 Code for testing of variable speed I.C. Engines for automobile purpose. IS: 1603-1960 Performance of variab

SEMESTER: FIFTH

CATEGORY: MEPE

SUBJECT CODE: DME 55 (B)

SUBJECT NAME: ADVANCED THERMAL ENGINEERING

TOTAL HOURS-60

COURSE OBJECTIVES:

- To understand the present scenario of power in India.
- To recognize various load terminologies used in power plants.
- To understand hydro working principles
- To understand working of Diesel, Gas and Nuclear power plants.
- To understand the issues and safety precautions in power plants.

UNIT- I:

Gas Turbines: Air-standard Brayton cycle; Description with p-v and T-S diagrams; Gas turbines Classification: open cycle gas turbines and closed cycle gas turbines; comparison of gas turbine with reciprocating I.C. engines and steam turbines. Applications and limitations of gas turbines; General lay-out of Open cycle constant pressure gas turbine; P-V and T-S diagrams and working; General lay-out of Closed cycle gas turbine; P-V and T-S diagrams and working.

Jet Propulsion: Principle of jet propulsion; Fuels used for jet propulsion; Applications of jet propulsion;Working of a turbojet engine; Principle of Ram effect; Working of a Ram jet engine; Principle of Rocket propulsion; Working principle of a rocket engine; Applications of rocket propulsion; Compar239 Mechanical Engineering Curriculum Structure ison of jet and rocket propulsions. **(12 Hours)**

UNIT- II:

Properties of Steam: Formation of steam under constant pressure; Industrial uses of steam;

Basic definitions: saturated liquid line, saturated vapour line, liquid region, vapour region, wet region,superheat region, critical point, saturated liquid, saturated vapour, saturation temperature, sensible heat, latent heat, wet steam, dryness fraction, wetness fraction, saturated steam, superheated steam,degree of superheat; Determination of enthalpy, internal energy, internal latent heat, entropy of wet,dry and superheated steam at a given pressure using steam tables and Mollier chart for the following

processes: Isochoric process, Isobaric process, Hyperbolic process, Isothermal process, Isentropic process, Throttling process, Polytropic process; Simple direct problems on the above using tables and charts; Steam calorimeters: Separating, throttling, Combined Separating and throttling calorimeters – problems. **(12 Hours)**

UNIT- III:

Steam Generators: Function and use of steam boilers; Classification of steam boilers with examples; Brief explanation with line sketches of Cochran, Babcock and Wilcox Boilers; Comparison

of water tube and fire tube boilers; Description with line sketches and working of modern high pressure boilers Lamont and Benson boilers; Boiler mountings: Pressure gauge, water level indicator,fusible plug, blow down cock, stop valve, safety valve, (dead weight type, spring loaded type,high pressure and low water safety alarm); Boiler accessories: feed pump, economiser, super heater and air pre-heater; Study of steam traps & separators; Explanation of the terms: Actual evaporation, equivalent evaporation, factor of evaporation, boiler horse power and boiler efficiency; Formula for the above terms without proof; Simple direct problems on the above; Draught systems (Natural,forced & induced). **(12 Hours)**

UNIT- IV:

Steam Nozzles: Flow of steam through nozzle; Velocity of steam at the exit of nozzle in terms of heat drop using analytical method and Mollier chart; Discharge of steam through nozzles; Critical pressure ratio; Methods of calculation of cross-sectional areas at throat and exit for maximum.

discharge; Effect of friction in nozzles and Super saturated flow in nozzles; Working steam jet injector; Simple numerical problems. **(12 Hours)**

UNIT- V:

Steam Turbines: Classification of steam turbines with examples; Difference between impulse & reaction turbines; Principle of working of a simple De-lavel turbine with line diagrams-Velocity

diagrams; Expression for work done, axial thrust, tangential thrust, blade and diagram efficiency, stage efficiency, nozzle efficiency; Methods of reducing rotor speed; compounding for velocity, for pressure or both pressure and velocity; Working principle with line diagram of a Parson's Reaction turbine–velocity diagrams; Simple problems on single stage impulse turbines (without blade friction) and reaction turbine including data on blade height. Bleeding, re-heating and re-heating factors (Problems omitted); Governing of steam turbines: Throttle, By-pass & Nozzle control governing.

(12 Hours)

COURSE OUTCOMES

On completion of the course, the students will be able to

- understand the conceptual laws of thermodynamics for application in thermodynamic

cycles.

- understand and analyze different thermodynamic cycles and calculate their thermal efficiencies.
- understand the basics of boilers and perform simple calculations of boiler efficiencies.
- understand the steam distribution and utilization systems to identify the energy conservation opportunities.
- comprehend principles of steam turbines and calculation of turbine efficiencies; understand the basics of vacuum pumps and instruments for measurement of vacuum.

REFERENCE BOOKS:

1. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai & Publication, New Delhi
2. Thermal Engineering – R.K. Rajput, Laxmi Publication New Delhi
3. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002
4. Treatise on Heat Engineering in MKS and SI Units – V.P. Vasandani & D.S. Kumar, Metropolitan Book Co. Pvt. Ltd, New Delh

SEMESTER: FIFTH

CATEGORY: MEOE

SUBJECT CODE: DME 56 (A)

SUBJECT NAME: TOOL ENGINEERING

TOTAL HOURS-60

COURSE OBJECTIVES:

• To understand the concepts of cutting tools and cutting forces involved in metal cutting process.

• To understand tool angles of various cutting tools & their importance.

• To understand and evaluate the tool wear and tool life with the help of Taylors tool life equation.

• To understand the types of press, forming dies and their constructions.

• To understand the designing of strip layout for given component.

UNIT-I

Metal Cutting: Mechanics of Metal cutting; requirements of tools; cutting forces; types of chips; chip thickness ratio; shear angle ; simple numerical only; types of metal cutting process; orthogonal; oblique and form cutting;

Cutting fluids: types; characteristics and applications.

Tool wear: Types of wear; Tool life; Tool life equations. **(12 Hours)**

Unit-II

Machinability: definition; factors affecting machinability; machinability index.

Tool materials: Types; characteristics; applications; Heat treatment of tool steels; Specification of Carbide tips; Types of ceramic coatings.

Cutting Tool Geometry: Single point cutting tool; drills; reamers; milling; cutters. **(12 Hours)**

Unit-III

Types of dies and construction: Simple Die; Compound Die; Progressive Die; Combination,Die.

Punch & Die mountings: pilots; strippers; misfeed detectors; Pressure Pads; Knock outs; stock guide; Feed-Stop; guide bush; guide pins. **(12 Hours)**

Unit-IV

Die Design Fundamentals: Die Operations; blanking; piercing; shearing; cropping; notch255 Mechanical Engineering Curriculum Structure

ing; lancing; coining; embossing; stamping; curling; drawing; bending; forming; Die set; Die shoe; Die area; Calculation of clearances on die and punch for blanking and piercing dies; Strip layout; Calculation of material utilization factor. **(12 Hours)**

Unit-V

Forming Dies: Bending methods; Bending Dies; bend allowance; spring back; spanking;

bending pressure; pressure pads; development of blank length.

Drawing: operations; Metal flow during drawing; Calculation of Drawing blank size; variables affecting metal flow during drawing; single action and double action dies; combination dies.

Fundamentals of other Tools: Constructional features of - Pressure Die casting dies; metal extrusion

dies; injection molding dies; forging dies; plastic extrusion dies. **(12 Hours)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Select cutting tools and its material using data book and manufacturer's catalogue.

CO2 Estimate tool wear and tool life.

CO3 Use press tools and dies effectively.

CO4 Design strip layout for given component.

CO5 Decide appropriate cutting fluid for machining process improvement.

REFERENCES

1. Tool Design - Donaldson Anglin, Tata McGraw Hill.
2. Production Technology- H.M.T.Jain, Tata McGraw Hill.
3. A Text Book of Production engineering – P.C. Sharma, S.Chand & Co.
4. Production Technology, R.K.Jain, Khanna Publishers.

SEMESTER: FIFTH

CATEGORY: MEOE

SUBJECT CODE: DME 56 (B)

SUBJECT NAME**: FARM EQUIPMENT AND FARM MACHINERY**

TOTAL HOURS-60

COURSE OBJECTIVES:

• To find and characterize the machinery based on crop production.

• To find the field efficiency and capacities to calculate the economics of machinery.

• To find the machines usages for different tillage, and its power requirement calculations.

• To understand sowing, planting & transplanting equipment based on crop.

• To understand machinery materials and heat effects for different farm machinery equipment.

UNIT-I:

Introduction to farm mechanization. Classification of farm machines. Unit operations in crop production. Identification and selection of machines for various operations on the farm. Hitching systems and controls of farm machinery. **(12 Hours)**

UNIT-II:

Calculation of field capacities and field efficiency. Calculations for economics of machinery usage, comparison of ownership with hiring of machines. Introduction to seed-bed preparation and

its classification. Familiarization with land reclamation and earth moving equipment.**(12 Hours)**

UNIT-III:

Introduction to machines used for primary tillage, secondary tillage, rotary tillage, deep

tillage and minimum tillage. Measurement of draft of tillage tools and calculations for power requirement for the tillage machines. Introduction to tillage machines like mould-board plough, disc plough,chisel plough, sub-soiler, harrows, puddler, cultivators, identification of major functional components.Attachments with tillage machinery. **(12 Hours)**

UNIT-IV:

Introduction to sowing, planting & transplanting equipment. Introduction to seed drills,

no-till drills, and strip-till drills. Introduction to planters, bed planters and other planting equipment

like sugarcane, potato. Study of types of furrow openers and metering systems in drills and planters.

Calibration of seed-drills/ planters. Adjustments during operation. **(12 Hours)**

UNIT-V:

Introduction to materials used in construction of farm machines. Heat treatment processes

and their requirement in farm machines. Properties of materials used for critical and functional components of agricultural machines. Introduction to steels and alloys for agricultural application. Identification of heat treatment processes specially for the agricultural machinery components.

(12 Hours)

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Classify the Farm Machineries, equipment and materials

CO2 Describe the objectives of Farm mechanization.

CO3 Explain selection of the machineries

CO4 Discuss the forces acting on tillage tools and hitching systems

CO5 Understand the calibration, constructional features and working of various farm equipment.

REFERENCE BOOKS:

1. Principles of Farm Machinery - R.A. Kepner, Roy Bainer, and E. L. Berger
2. Farm Machinery and Equipment - H. P. Smith
3. Farm Machinery and equipment - C. P. Nakra
4. Engineering principles of Agril. Machines - Dr. Ajit K. Srivastav, Caroll E. Goering and Roger P. Rohrbach. Mechanical Engineering Curriculum Structure 266
5. Farm Machinery – an Approach - S. C Jain & Grace Phillips
6. Agril. Engineering through worked out examples - Dr. R. Lal and Dr. A.C. Dutta
7. Farm Power and Machinery Engineering - Dr.R. Suresh and Sanjay Kumar

SEMESTER: SIXTH

CATEGORY: MEPC

SUBJECT CODE: DME 61

SUBJECT NAME**: DESIGN OF MACHINE ELEMENTS**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To enable the student to design and draw simple machine components used in small and medium scale industries.
- To understand the basic philosophy and fundamentals of Machine Design.
- To understand the modes of failures of m/c components and decide the design criteria and equations.
- To analyze and evaluate the loads, forces, stresses involved in components and subassemblies and decide the dimensions.
- To develop analytical abilities to give solutions to engineering design problems.

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. **(12 Hours)**

UNIT-II

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.

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. **(12 Hours)**

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. 6 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. **(12 Hours)**

UNIT-IV

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. **(12 Hours)**

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.

(12 Hours)

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Analyze the various modes of failure of machine components under different load patterns.

CO2 Design and prepare part and assembly drawings.

CO3 Use design data books and different codes of design.

CO4 Select standard components with their specifications from manufacturer’s catalogue.

CO5 Develop drawings on CAD software.

REFERENCES

1. Machine Design by Sharma and Agrawal.

2. Machine Design by R.K. Jain. Machine Design by Shigley..

3. Machine Design by R S Khurmi

4. Introduction to Machine Design by Bhandari Tata Mcgraw Hill

5. Machine Design by Pandya and Shah

SEMESTER: SIXTH

CATEGORY: MEPC

SUBJECT CODE: DME 62

SUBJECT NAME: **PROCESS PLANNING, ESTIMATING AND COSTING**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To take the right decisions to optimize resources utilization by improving productivity of the Lands, Buildings, People, Materials, Machines, Money, Methods and Management effectively.
- To eliminate unproductive activities under the control of the Management, Supervisor, worker and the Design of Products and Processes.

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. **(12 Hours)**

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.

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. **(12 Hours)**

UNIT-III

Actual Cost Estimation: Process Materials and Manpower - Terminology associated with estimation, Calculation of volume, weight and cost of materia Is.:

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,

(12 Hours)

UNIT-IV

Welding shop- process, materials and Man-power Gas and Arc. Welding terminology, production operation time, labour cost, materials cost, cost elements, batch production cost.

Forging Shop: Process, Materials and Man power - Forging gross and net weight of forging, forging losses, materials cost, labour cost and batch production cost. **(12 Hours)**

UNIT-V

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. **(12 Hours)**

COURSE OUTCOMES:

C01-Understanding the process Engineering.

C02-Understanding elements of costs,break even analysis,depreciation, project & budget.

C03-Understanding the production planning and its functions.

C04-Understanding the aspects of welding shop and forging shop.

C05-Understanding the aspects of Foundry shop and Sheet metal shop**.**

REFERENCES

1 Cost Control by G. R. Sharma. (National Productivity Council)

2 Engineer1 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 Mechanical Estimation and Costing by R.L. Shrimali & P.C. Jam (Jam Pub. House)

5 Mechanical Estimation And Costing (Resource Persons of Hill Publishing Co. T.T.T.L, Madars Tata McGraw Hill)

6 Machine Shop Estimation by Nordoff.

7 Learing Packing In Costing And Estimating (T.T.T.I. Bhopal Publication)

8 Process Engineering For Manufacturing By Eary and Johnson (Prentice Hall)

9 Fundamentals of Process Engineering by Benjaman W. Nicbel, Alon & Ropy

10 Produce Design And Process Engineering (McGraw Hill)

11 Yantriki Abhiyantriki Abhikalpan (Hindi) by K. D. Saxena. (Deepak Prakashan, Morar, Gwalior).

SEMESTER: SIXTH

CATEGORY: HS

SUBJECT CODE: DME 63

SUBJECT NAME: **ENTREPRENEURSHIP**

TOTAL HOURS-60

COURSE OBJECTIVES:

1. Acquiring Entrepreneurial spirit and resourcefulness.
2. Familiarization with various uses of human resource for earning dignified means of living.
3. Understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation.
4. Acquiring entrepreneurial quality, competency, and motivation.
5. Learning the process and skills of creation and management of entrepreneurial venture.

UNIT-I

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

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. **(12 Hours)**

UNIT-II

INSTITUTIONAL ASSISTANCE (a) Types of Institutional assistance − Infra - structural assistance Technical Assistance − FInancial assistance − Marketing Assistance (b) Information / guidance & Training − SISI - ASK − MPCON - CSIR − CED- MA - NRDC (c) Infrastructure − D/C - AVN/AKVN (e) Finance − SIDBI - KVIB MPFC − NABARD - MPWDC 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) **(12 Hours)**

UNIT-IV

PLANNING OF AN INDUSTRIAL UNIT (S SI) • 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. **(12 Hours)**

UNIT-V

ACHIVEMENT MOTIVATION •

Historical perspective • Concept of achievement motivation • • 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. **(12 Hours)**

OUTCOME:

Upon completion of the course, the student will be able to demonstrate knowledge of the following topics:

1. Understanding the dynamic role of entrepreneurship and small businesses
2. Organizing and Managing a Small Business
3. Financial Planning and Control
4. Forms of Ownership for Small Business
5. Strategic Marketing Planning
6. New Product or Service Development
7. Business Plan Creation

REFERENCES

1. Entreprenerial Development Vol. I,II,III By Vasant desai Himalaya Publicaton
2. CEDMAP (Center of Entrepreneurial development Madhya Pradesh)
3. Udyamita Vikas By Anand Prakshan

SEMESTER: SIXTH

CATEGORY: MEOE

SUBJECT CODE: DME 64(A)

SUBJECT NAME: **REFRIGERATION & AIR CONDITIONING**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To give a good understanding of and thorough insight into all important aspects of thermal systems, energy control and the general issue of energy.
- To understand the principles & working of various power producing & power absorbing devices.
- To study, analyze and evaluate the operation and the performance of I.C. engines, compres231 Mechanical Engineering Curriculum Structure sors and refrigerators, to apply pinch technology and

to critically analyze and describe the global behavior of integrated thermal systems

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 form, theoretical cycle and reasons for deviation. Effect of sub-cooling and superheating on vapour compression system. **(12 Hours)**

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. **(12 Hours)**

UNIT-III

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)

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. (12 Hours)

UNIT-IV

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 benderflaring 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 values. Charging of Refrigerant: evacuating a refrigeration system, removing, refrigerant form a refrigeration system leak detection methods. **(12 Hours)**

UNIT-V

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

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.**(12 Hours)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

Mechanical Engineering Curriculum Structure 232

CO1 Know various sources of Energy and their applications.

CO2 Classify I.C. engines and understand their working and constructional features.

CO3 Draw the energy flow diagram of an I.C. engine and evaluate its performance.

CO4 Describe the constructional features of air compressor and working of different air compressors.

CO5 Know the applications of refrigeration and Classify air-conditioning systems.

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 (c) Water flow path (d) Specification of main components used. (e) Capacity of the unit.

3 Study of packaged/ Window/ Air conditioner with respect to- (a) Capacity. (b) Electric circuit (c) Air flow path. (d) Specification of main components used. (e) Refrigerant used.

4 Study of Ice-plat/ refrigeration cold storage with respect to- (a) Electric circuit (b) Refrigerant used and its flow path. (c) Capacity. (d) Specification

5 Leakage detection using ; (a) Soap and water. (b) Halide torch. (c) Vacuum method. (d) Pressure method.

6 Operating service valves and gauge manifold. 7 Removing refrigerant from systems. 8 Charging/Recharging the system refrigerator, water cooler, air conditioner. 9 Determination of refrigeration capacity. Power input, C.O.P of the given unit available in the institution. 10 Testing refrigeration and air conditioning system control components for proper functioning and replacement. (a) Capacitor (b) Starting and running windings of hermetically sealed compressor. (c) Overload (d) Relay (e) LP and HP (f) Thermostat.

REFERENCES

1 Refrigeration and Air Conditioning by C.P. Arora (Tata Mc Graw Hill) 2 Ashrae Guide and Data Book by Ashrae (Ashrae)

3 Andels Refrigeration and Air Conditioning Guide. by E.P. Anderson (Tarapowala)

4 Practical Refrigeration

5 Refrigeration and Air Conditioning by A.S. Sarao & P.C. Gaabi (Satya Prakashan)

6 Modern Refrigeration Practice by G.P. King (McGraw Hill)

7 A Course in Refrigeration & Air Condition by S. Lomkkundwar & S.C. Arora (Dhanpat Rai & Sons)

8 Refrigeration and Air Conditioning by R.C. Jorden & S.B. Priester (Prentice Hall)

9 Basic Refrigeration and Air Conditioning by D. Hazre & D.N. Chakravarty (Dhanpat Rai & Sons)

10 Principles of Refrigeration by R. W. Marsh (Taraporwala)

11 Refrigeration and Air Conditioning by P.L . Ballancey. (Khanna Publishers)

12 Principles of Refrigeration by D.P. Gupta Rajdhani.

13 I.S. : 1476 - 1971 Specification for Domestic Refrigerators (Mechanically Operated) by Indian Standard Institution, Manak Bhawan, 9 Bhadur Shah Zafar Marg, New Delhi- I (I.S.I)

14 I.S. 1391-1960 Room Air Conditioner by Indian Standards Institution, Manak Bhawan, 9 Bhadur Shah Zafar Marg, New Delhi -1 (I.S.I)

15 I.S. : 1474-1959 Comm. Refrigerator . by Indian Standards Institution, Manak Bhawan, 9 Bhadur Shah Zafar Marg, New Delhi-1 (I.S.I)

16 I.S. : 1474-197 1 Self Contained . by Indian Standards Institution, Manak Bhawan, 9 Bhadur Shah Zafar Marg, New Delhi-1 (I.S.I)

17 I.S. Drinking Water Coolers. by Indian Standards Institution, Manak Bhawan, 9 Bhadur Shah Zafar Marg, New Delhi-1 (I.S.I)

18 Refrigeration & Air Conditioning. by R.C. Patel.

SEMESTER: SIXTH

CATEGORY: MEOE

SUBJECT CODE: DME 64(B)

SUBJECT NAME: **INDUSTRIAL ROBOTICS & AUTOMATION**

TOTAL HOURS-60

COURSE OBJECTIVES:

• To introduce the basic concepts, parts of robots and types of robots.

• To make the student familiar with the various drive systems for robot, sensors and their applications

in robots and programming of robots.

• To select the robots according to its usage.

Mechanical Engineering Curriculum Structure 258

• To discuss about the various applications of robots, justification and implementation of robot.

• To Conceptualize automation and understand applications of robots in various industries.

UNIT-I:

Fundamentals of Robotics: Introduction; Definition; Robot anatomy (parts) and its working; Robot Components: Manipulator, End effectors; Construction of links, Types of joints; Classification of robots; Cartesian, Cylindrical, Spherical, Scara, Vertical articulated; Structural Characteristics of robots; Mechanical rigidity; Effects of structure on control work envelope and work Volume; Robot work Volumes, comparison; Advantages and disadvantages of robots. **(12 Hours)**

UNIT-II:

Robotic Drive System and Controller: Actuators; Hydraulic, Pneumatic and Electrical drives; Linear actuator; Rotary drives; AC servo motor; DC servo motors and Stepper motors; Conversion between linear and rotary motion; Feedback devices; Potentiometers; Optical encoders; DC tachometers; Robot controller; Level of Controller; Open loop and Closed loop controller; Microprocessor based control system; Robot path control: Point to point, Continuous path control and Sensor based path control; Controller programming. **(12 Hours)**

UNIT-III:

Sensors: Requirements of a sensor; Principles and Applications of the following types of sensors: Position sensors (Encoders, Resolvers, Piezo Electric); Range sensors (Triangulation Principle, Structured lighting approach); Proximity sensing; Force and torque sensing.

Introduction to Machine Vision: Robot vision system (scanning and digitizing image data); Image processing and analysis; Cameras (Acquisition of images); Videocon camera (Working principle

& construction); Applications of Robot vision system: Inspection, Identification, Navigation & serving.

(12 Hours)

UNIT-IV:

Robot kinematics and Robot Programming: Forward Kinematics; Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional); Deviations and Problems. Teach Pendant Programming; Lead through programming; Robot programming Languages; VAL Programming; Motion Commands; Sensor Commands; End effecter commands; and Simple programs. **(12 Hours)**

UNIT-V:

Automation: Basic elements of automated system, advanced automation functions, levels of automation.Industrial Applications: Application of robots in machining; welding; assembly and material handling. **(12 Hours)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Explain the robot anatomy, classification, characteristics of robot, advantages and disadvantages.

CO2 Explain the various robotic actuators on hydraulic, pneumatic and electrical drives.

CO3 Explain about various types of sensors and concepts on robot vision system.

CO4 Explain the concepts of robot programming languages and various methods of robot programming.

CO5 Explain the various applications of robots.

REFERENCE BOOKS:

1. Introduction to Robotics: Analysis, Systems, Applications – Saeed B. Niku, Pearson Education Inc. New Delhi 2006.
2. Industrial Robotics: Technology, Programming and Applications – M.P. Groover, Tata McGraw Hill Co, 2001.
3. Robotics Control, Sensing, Vision and Intelligence – Fu.K.S. Gonzalz.R.C and Lee C.S.G, Mc- Graw Hill Book Co, 1987.
4. Robotics for Engineers – Yoram Koren, McGraw Hill Book Co, 1992.
5. A Text book on Industrial Robotics – Ganesh S. Hedge, Laxmi Publications Pvt. Ltd., New Delhi, 2008.

6. Robotics Technology and Flexible Automation – S.R. Deb & Sankha Deb, Tata McGraw-Hill,2010.
7. Elements of Robotics Process Automation, Mukherjee, Khanna Publishing House, Delhi, 2018

SEMESTER: SIXTH

CATEGORY: MEOE

SUBJECT CODE: DME 65(A)

SUBJECT NAME: MECHATRONICS

TOTAL HOURS-60

COURSE OBJECTIVES:

- To understand the basic concepts and characteristics of measurement systems.
- To learn various types of sensors and transducers various mechanical, electrical and pneumatic actuation systems.
- To learn various mechanical, electrical and pneumatic actuation systems.
- To learn the concepts of digital communications and develop PLC programs.
- To evaluate the performance of mechatronic systems.

UNIT-I:

Introduction to Mechatronics: Mechatronics; Importance of Mechatronics; Systems: Measurement systems; Control systems and their types; Closed-loop control System; Automatic water level controller; Sequential controllers-washing machine

Measurement System terminology: Displacement, Position & Proximity Sensors; Velocity and Motion Sensors; Force Sensors; Fluid Pressure Sensors; Flow Sensors; Liquid Level Sensors; Temperature Sensors; Light Sensors; Selection of Sensors. **(12 Hours)**

Unit-II:

Mechanical Actuation Systems: Types of motion; Freedom and constraints; Loading; Gear Trains; Pawl & Ratchet; Belt & Chain drives; Bearings: Selection, Ball & Roller bearings; Mechanical aspects of motor selection.

Electrical Actuation Systems: Switches & Relays; Solenoids; D.C Motors; A.C.Motors; Stepper Motors: Specifications and Control of stepper motors; Servomotors: D.C Servomotor and A.C Servomotor.

Pneumatic & Hydraulic Systems: Power supplies; DCV; PCV; Cylinders; Rotary actuators.

(12 Hours)

Unit-III:

Mathematical Model: Introduction to Mathematical model; Mechanical System building blocks; Electrical System building blocks; Fluid System building blocks; Thermal System building blocks.

System Model: Engineering.Systems: Rotational, Translational Systems; Electro-Mechanical System;Hydro-Mechanical System.

Input/Output Systems: Interfacing; Input/output ports; Interface requirements: Buffers, Handshaking, Polling and interrupts, Serial interfacing; Introduction to PIA; Serial communications interface; Example of interfacing of a seven-segment display with a decoder.

(12 Hours)

Unit-IV:

Programmable Logic Controller (PLC): Definition; Basic block diagram and structure of PLC; Input/Output processing; PLC Programming: Ladder diagram, its logic functions, Latching and Sequencing; PLC mnemonics; Timers; Internal relays and Counters; Shift registers; Master and Jump Controls; Data handling; Analog input/output; Selection of PLC.

(12 Hours)

Unit-V:

Design Examples & Advanced Applications in Mechatronics: Design process stages;

Mechanical Engineering Curriculum Structure 270

Traditional Vs Mechatronics designs; Possible design solutions: Timed switch, Wind-screen wiper motion, Bath room scale; Case studies of Mechatronics systems: A pick-and-place robot, Car park barrier, Car engine management system, Automatic Camera and Automatic Washing Machine only.

Sensors for Condition Monitoring Systems of Production Systems: Examples of Monitoring methods: Vibration monitoring, Temperature monitoring, Wear behavior monitoring; Mechatronics control in automated manufacturing: Monitoring of Manufacturing processes, On-line quality monitoring, Model based systems, Hardware in-the-loop simulation, Supervisory control in manufacturing inspection, Integration of heterogeneous systems. **(12 Hours)**

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1 Explain the robot anatomy, classification, characteristics of robot, advantages and disadvantages.

CO2 Explain the various robotic actuators on hydraulic, pneumatic and electrical drives.

CO3 Explain about various types of sensors and concepts on robot vision system.

CO4 Explain the concepts of robot programming languages and various methods of robot programming.

CO5 Explain the various applications of robots.

Reference Books:

1. Mechatronics – W. Bolton, Pearson Education India.
2. A Text Book on Mechatronics – R.K.Rajput, S.Chand& Co, New Delhi.

3. Mechatronics – M.D.Singh & Joshi, Prentice Hall of India.
4. Mechatronics – HMT, Tata McGraw Hill, New Delhi.
5. Mechatronics System – Devadas Shetty, PWS Publishing
6. Exploring Programmable Logic Controllers with applications – Pradeep Kumar Srivatsava, BPB

SEMESTER: SIXTH

CATEGORY: MEOE

SUBJECT CODE: DME 65(B)

SUBJECT NAME: **HYBRID VEHICLE**

TOTAL HOURS-60

COURSE OBJECTIVES:

- To understand the basics of electric vehicle history and components.
- To understand properties of batteries.
- To understand the electrical machine properties and classifications.
- To understand the properties of electric vehicle drive systems
- To understand the concepts of hybrid electric vehicles.

COURSE CONTENT:

UNIT-I:

Electric Vehicles: Introduction; History of Hybrid and Electric Vehicles; Social and Environmental importance of Hybrid and Electric Vehicles; Components, Vehicle mechanics: Roadway fundamentals, Vehicle kinetics, Dynamics of vehicle motion; Propulsion System Design. **(12 Hours)**

UNIT-II:

Battery: Basics; Types; Parameters: Capacity, Discharge rate, State of charge, State of Discharge, Depth of Discharge; Technical characteristics, Battery pack Design, Properties of Batteries.

(12 Hours)

UNIT-III:

DC & AC Electrical Machines: Motor and Engine rating; Requirements; DC machines; Three phase A/c machines; Induction machines; Permanent magnet machines; Switched reluctance Machines. **(12 Hours)**

UNIT-IV:

Electric Vehicle Drive Train: Transmission configuration; Components: Gears, Differential, Clutch, Brakes; Regenerative braking, Motor sizing; Fuel efficiency analysis. **(12 Hours)**

UNIT-V:

Hybrid Electric Vehicles: Types: Parallel, Series, Parallel and Series configurations; Drive train; Sizing of components; Basics of Micro, Mild, Mini, Plug-in and Fully hybrid. **(12 Hours)**

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1 Describe about various types of sensors and transducers.

CO2 Explain the various mechanical, electrical and pneumatic actuation systems.

CO3 Explain the basic mathematical building blocks for mechanical, electrical, thermal and fluid actuation system and its interfacing of input/output requirements.

CO4 Explain the basic PLC architecture and PLC programming concepts.

CO5 Describe the design examples of mechatronics system. Explain the condition monitoring of production systems using sensors.

REFERENCE BOOKS:

1. Electric & Hybrid Vehicles – A.K. Babu, Khanna Publishing House, New Delhi, 2018

2. Electric & Hybrid Vehicles – Design Fundamentals - Iqbal Hussain, Second Edition, CRC Press,
2011.

3. Electric Vehicle Technology Explained - James Larminie, John Wiley & Sons, 2003.

4. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals - Mehrdad Ehsani, Yimin
Gao, Ali Emadi, CRC Press, 2010.

5. Electric Vehicle Battery Systems - Sandeep Dhameja, Newnes, 2000.

SEMESTER: SIXTH

CATEGORY: - PROJ-ME

SUBJECT CODE: -DME- 67

SUBJECT NAME: -MAJOR PROJECT

TOTAL - 60 HOURS

OBJECTIVES:

This course is aimed to provide more weightage for project work. The project work could be done in the form of a summer project or internship in the industry or even a minor practical project in the College. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.

VI TH -SEMESTER

CATEGORY-MEMC

SUBJECT CODE-DME-69

SUBJECT NAME - CONSTITUTION OF INDIA

Basic features and fundamental principles

TOTAL HOURS-60

COURSE OBJECTIVES:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights Perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional Role and entitlement to civil and economic rights as well as the emergence of nationhood in The early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik

Revolution in 1917 and its impact on the initial drafting of the Indian Constitution The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America. **(15 Hours)**

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one

hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India have played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world". **(15 Hours)**

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(15 Hours)

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. **(15 Hours)**

COURSE OUTCOMES:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] Under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

The judicial activism of the Supreme Court of Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers betwee the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21.