Faculty of Engineering and Technology

Radha Govind University

Chandausi, Sambhal (U.P.)

Evaluation Scheme & Syllabus for

Department of Mechanical Engineering

DIPLOMA –MECHANICAL ENGINEERING

II Year (III & IV Semester)

(Effective from session_____)

DIPLOMA IN MECHANICAL ENGINEERING STUDY AND EVALUATION SCHEME

2nd Year, 3RD Semester

SUBJEC CODE	SUBJECT SNAME	STUDY SCHEM E Periods /Wee k			Credits	MARKSINEVALUATION SCHEME						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMEN T			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
DME 301	THERMAL ENGINEERING-I	4	-	-	**3**	30	-	30	70	-	70	100
DME 302	FLUID MECHANICS & HYDRAULIC MACHINERY	4	-	-	**3**	30	-	30	70	-	70	100
DME 303	MEASUREMENTS AND METROLOGY	1	-	4	**3**	30	-	30	70	-	70	100
DME 304	OPEN ELECTIVE-I	2	-	-	**2**	30	-	30	70	-	70	100
DME 305	FLUID MECHANICS & HYDRAULIC MACHINERY LAB	-	-	4	**2**	-	25	-	-	25	25	50
DME 306	MEASUREMENTS AND METROLOGY LAB	-	-	**2**	**1**	-	25	25	-	25	25	50
DME 307	WORKSHOP PRACTICES LAB	-	-	**4**	**2**	-	25	25	-	25	25	50
DME 308	COMPUTER AIDED MACHINE DRAWING PRACTICE LAB	1	-	**6**	**4**	-	25	25	-	25	25	50
Total					**20**	120	100	**220**	280	100	**380**	**600**

For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.

DCHE 304 OPEN ELECTIVE-I
1. ENERGY CONSERVATION AND AUDIT
2. MATERIAL HANDING SYSTEM
3. INDUSTRIAL ROBOTICS AUTOMATION

DIPLOMA IN MECHANICAL ENGINEERING STUDY AND EVALUATION SCHEME

2nd Year, 4th Semester

SUBJEC CODE	SUBJECT SNAME	STUDY SCHEM E Periods /Wee k			Credits	MARKSINEVALUATION SCHEME						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMEN T			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
DME 401	STRENGTH OF MATERIALS	4	-	-	**3**	30	-	30	70	-	70	100
DME 402	INDUSTRIAL ENGINEERING & MANAGEMENT	4	-	-	**3**	30	-	30	70	-	70	100
DME 403	MANUFACTURING ENGINEERING	1	-	4	**3**	30	-	30	70	-	70	100
DME 404	MATERIAL SCIENCES & ENGINEERING	1	-	4	**3**	30	-	30	70	-	70	100
DME 405	THERMAL ENGINEERING -II	1	-	4	**3**	30	-	30	70	-	70	100
DME 406	STRENGTH OF MATERIALS LAB	-	-	**6**	**3**	-	25	25	-	25	25	50
DME 407	MANUFACTURING ENGINEERING LAB	-	-	**4**	**2**	-	25	25	-	25	25	50
DME 408	MATERIAL SCIENCES & ENGINEERING LAB	-	-	**4**	**2**	-	25	25	-	25	25	50
DME 409	THERMAL ENGINEERING-II LAB	-	-	**4**	**2**	-	25	25	-	25	25	50
Total					24	150	100	**250**	350	100	**450**	**700**

For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.

Industrial training (Summer Internship) of 4-6 weeks duration to be organized after 4th semester exam.

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DME 301

THERMAL ENGINEERING-I

RATIOANLE

Thermal Engineering is a fundamental subject for diploma holders in Mechanical, Automobile, and related engineering fields. It provides essential knowledge about thermodynamics, heat transfer, and energy systems, which form the backbone of various industrial and engineering applications. As industries increasingly focus on energy efficiency, environmental impact, and sustainable technologies, a strong understanding of thermal principles is crucial. This subject enables diploma students to analyze, operate, and maintain thermal systems such as boilers, turbines, steam generators, sources of energy.

Course Outcomes (COs)

After completion of this course, students will be able to:

CO1: Understand and explain the fundamental concepts of thermodynamics.

CO2: Analyze and solve thermodynamic problems using gas laws and the first and second laws of thermodynamics.

CO3: Determine and analyze properties of steam (wet, dry, superheated) using steam tables.

CO4: Explain the construction, working, and performance of boilers.

CO5: Analyze the working, performance, and governing of steam turbines and nozzles.

DETAILED CONTENT

UNIT-I: Fundamental Concepts:

Role of Thermodynamics in Engineering .Thermodynamic state and system, boundary, surrounding, universe, thermodynamic systems – closed, open, isolated, adiabatic, homogeneous and heterogeneous, properties of system, thermodynamic equilibrium, quasi – static process, reversible and irreversible processes, Zeroth law of thermodynamics,

Unit-II: Thermodynamic Processes on Gases and Laws of thermodynamics :

Explanation of perfect gas laws – Boyle's law, Charle's law, Gay-Lussac's law, Universal gas constant, Characteristic gas constants, simple problems on gas equation, Laws of conservation of energy, first law of thermodynamics (Joule's experiment), Application of first law of thermodynamics ,Steady flow energy equation, Application of steady flow energy equation, statement of second laws of thermodynamics: Kelvin Planck's statement, Clausius statement, Perpetual motion Machine of first kind, second kind, Carnot cycle, Carnot engine, Introduction of third law of thermodynamics.

UNIT-III: Properties of Steam:

Formation and 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, latent heat, of wet, dry and superheated steam at a given pressure using steam tables and simple direct problems on the above using table.

UNIT-IV: Steam generators. :

Introduction and classification of boilers with example, Boiler mountings and accessories, Brief explanation with line sketches of Cochran, Babcock and Wilcox Boilers Locomotive boiler ; Brief explanation with line sketches of High Pressure Boiler ,Draught systems (Natural, forced & induced).

Unit-V : Steam Turbines and Steam Nozzles:

Classification of steam turbines with examples . Difference between Impulse & Reaction turbines. Working Principle of a simple De-lavel turbine & Parson's Reaction turbine with line diagrams-Velocity diagrams; Basic concept used for calculation of work done, axial thrust, tangential thrust, blade and diagram efficiency, stage efficiency, nozzle efficiency.

Governing of steam turbines: Throttle, By-pass & Nozzle control governing Flow of steam through nozzle; Discharge of steam through nozzles; Critical pressure ratio; Effect of friction in nozzles and Super saturated flow in nozzles.

INSTRUCTIONAL STRATEGY

While imparting instructions, teacher should explain various sources of energy to the students and facilitate discussions where students evaluate pros and cons of different energy sources. It's recommended that teachers take action to grab students' interest and increase their confidence in their ability to learn. The demonstration might spark interest in the subject and encourage a scientific perspective. Every topic should have planned student activities. To make sure that learning is outcome and employability based, a theory – demonstrate practice - activity approach may be used throughout the course. If available, demonstrate small-scale models of steam boilers in the lab or use virtual labs to simulate their operation.

MEANS OF ASSEESSMENT

• Assignments and quiz/class tests.

• Sessional test.

• Model making, Mini-Projects.

• Small projects.

REFERENCE BOOKS/ ONLINE RESOURCES

1. Engineering Thermodynamics by PK Nag; Tata McGraw Hill, Delhi.

2. Basic Engineering Thermodynamics by Roy Chaudhary; Tata McGraw Hill, Delhi.

3. Engineering Thermodynamics by CP Arora; Tata McGraw Hill, Delhi.

4. R. K. Rajput, Thermal Engineering ,Laxmi Publications Pvt Ltd , New Delhi.

5. R.S. Khurmi, J. K. Gupta, A Textbook of Thermal Engineering, S. Chand Publications.

6. E-books/e-tools/relevant software to be used as recommended by AICTE.

DME 202

FLUID MECHANICS & HYDRAULIC MACHINERY

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RATIONALE

Diploma holders in this course are required to deal with problems of fluid and use of hydraulics in power generation. For this purpose, knowledge and skills about fluid mechanics and machinery, hydraulics systems are required to be imparted for enabling them to perform above functions.

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO1: Explain and solve the basic properties of fluids and fluid pressure concepts.

CO2: Measure and analyze fluid pressure using different pressure-measuring devices

CO3: Analyze fluid flow behavior using continuity equation, Bernoulli's theorem, and flow measuring devices.

CO4: Explain the construction, working, and performance of hydraulic turbines and pumps.

CO5: Describe the working and applications of hydraulic systems and explain the fundamentals of hydro power plants and renewable hydraulic energy sources.

DETAILED CONTENT

UNIT-I:

Properties of Fluid: : Definition of fluid, Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility. Different types of fluids: Ideal fluid, Real fluid, Ideal plastic fluid, Plastic fluid, Newtonian and non Newtonian fluid. Simple numerical problems.

Fluid Pressure : Fluid pressure, Pressure head, Conversion of Pressure head, Pressure Intensity, Statement of Pascal law and its applications. Concept of vacuum and gauge pressures, atmospheric pressure, absolute pressure. Simple numerical problem.

UNIT-II:

Pressure Measurement: Barometer, Simple manometer, differential manometers and sensitive Manometers, Bourdan pressure gauge. Concept of Total pressure on immersed bodies, Center of pressure, Simple problems on Manometers.

UNIT-III

Fluid Flow: Types of fluid flows, Path line, Streamline and streak lines, Continuity equation, Bernoulli's theorem, Principle of operation of Venturi meter and Orifice meter, Principle of operation of Pitot tube and rotameter. Concept and relation of Cd, Cv and Cc. Simple numerical problem.

Flow Through Pipes: Laminar and turbulent flows; Reynold's number and its effect on pipe friction; critical velocity, siphon, Water hammer. Darcy's equation and Chezy's equation for frictional losses, Minor losses in pipes. Hydraulic gradient, Simple numerical problem.

UNIT-IV

Hydraulic Turbines: Classification of hydraulic turbines, Selection of turbine on the basis of head and discharge available, Construction and working principle of Pelton wheel, Francis and Kaplan turbines, Draft tubes – types and construction, Concept of cavitation in turbines, Cavitation causes, effects and remedies.

Centrifugal Pumps: Principle of working and applications, Types of casings and impellers, Concept of multistage, Priming and its methods.

Reciprocating Pumps: Construction, working principle and applications of single and double acting reciprocating pumps, Concept of Slip, Negative slip, Cavitation and separation.

UNIT-V

Hydraulic System: Description, operation and application of hydraulic systems – hydraulic ram, hydraulic jack, hydraulic brake, hydraulic accumulator, hydraulic door closer, hydraulic press. Hydro Powerplant: Introduction, type of hydropower plant, tidal and wave energy,

INSTRUCTIONAL STRATEGY

• Use computer-based learning aids for effective teaching-learning Expose students to real life problems

• Plan assignments so as to promote problem solving abilities and develop continued learning skills.

MEANS OF ASSEESSMENT

• Assignments and quiz/class tests

• Sessional test

• Actual Practical Performance

• Small projects

• Viva-voce

REFERENCE BOOKS/ ONLINE RESOURCES:

1. Fluid Mechanics by KL Kumar; S Chand and Co Ltd., Ram Nagar, New Delhi.

2. Hydraulics and Fluid Mechanics Machine by RS Khurmi; S. Chand& Co. Ltd., New Delhi.

3. Fluid Mechanics through Problems by RJ Garde; Wiley Eastern Ltd., New Delhi.

4. Fluid Mechanics by Dr AK Jain, Khanna Publishers, New Delhi.

5. Hydraulic and Pneumatic Control by K Shammuga Sundaram, S. Chand & Co. Ltd., New Delhi

6. Hydraulics and Hydraulic Machinery by Dr. Jagadish Lal; Metropolitan Book Company Ltd., Delhi.

7. Hydraulic and Pneumatic Power and Control Design, Performance and Application by Yeaple, McGraw Hill, New York..

FLUID MECHANICS & HYDRAULIC MACHINERY LAB

LIST OF PRACTICALS

1. Measurement of pressure head by employing.

i) Piezometer tube ii) Single and double column manometer.

2. To verify Archimedes' Principle.

3. To find out the value of coefficient of discharge for a venturi meter. Measurement of flow by using venturi meter.

4. To find out the value of coefficient of discharge for a orifice meter. Measurement of flow by using orifice meter.

5. To find out the value of coefficient of discharge for V- notch.

6. Verification of Bernoulli’s theorem.

7. To find coefficient of friction for a pipe (Darcy’s friction).

8. To study hydraulic circuit of an automobile brake.

9. To study hydraulic circuit of a hydraulic ram.

10. To study the working of a Pelton wheel Turbine.

11. To study the working of a Francis turbine.

12. To study a single stage centrifugal pump for constructional details and its operation to find out its normal head and discharge.

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DME 303

MEASUREMENTS & METROLOGY

RATIONALE

The progress in metrology and measurements is highly necessary and has led to improvements in product quality, enhanced scientific research capabilities, and increased efficiency in diverse industries including manufacturing, automobile, aerospace, and quality control. It encompasses various disciplines and techniques used to ensure the accuracy, precision, and reliability of measurements. Therefore, the study of metrology and measurements is essential for maintaining uniformity and excellence across various fields, including manufacturing and scientific research.

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO1: Explain the fundamentals of metrology, measurement systems.

CO2: Use linear measuring instruments and comparators to perform precise measurements and analyze measurement errors.

CO3: Apply angular measurement techniques and measure screw threads and gears using appropriate instruments.

CO4: Operate advanced metrology equipment such as CMM, optical instruments, and laser-based measuring systems.

CO5: Perform practical measurement experiments, analyze results, compare conventional and digital instruments, and prepare technical reports.

Content

UNIT-I: Introduction to measurements:

Definition of measurement; Significance of measurement; Methods of measurements: Direct & Indirect; Generalized measuring system; Standards of mea- surements: Primary & Secondary; Factors influencing selection of measuring instruments; Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration; Errors in Measurements: Classification of errors, Systematic and Random error.

Measuring instruments: Introduction; Thread measurements: Thread gauge micrometre; Angle measurements: Bevel protractor, Sine Bar; Gauges: plain plug gauge, ring Gauge, snap gauge, limit gauge; Comparators: Characteristics of comparators, Types of comparators; Surface finish: Definition, Terminology of surface finish, Talysurf surface roughness tester; Co-ordinating measuring ma- chine.

Unit-II: Transducers and Strain gauges:

Introduction; Transducers: Characteristics, classification of transducers, two coil self-inductance transducer, Piezoelectric transducer; Strain Measurements: Strain gauge, Classification, mounting of strain gauges, Strain gauge rosettes-two and three elements.

Measurement of force, torque, and pressure: Introduction; Force measurement: Spring Balance, Proving ring, Load cell; Torque measurement: Prony brake, Eddy current, Hydraulic dynamometer; Pressure measurement: McLeod gauge.

Unit-III: Applied mechanical measurements: Speed measurement: Classification of tachometers, Revolution counters, Eddy current tachometers; Displacement measurement: Linear variable Differential transformers (LVDT); Flow measurement: Rotometers, Turbine meter; Temperature measurement: Resistance thermometers, Optical Pyrometer.

Miscellaneous measurements: Humidity measurement: hair hygrometer; Density measurement: hydrometer; Liquid level measurement: sight glass, Float gauge; Biomedical measurement: Sphygmo monometer.

Unit-IV: Limits, Fits & Tolerances: Concept of Limits, Fits, and Tolerances; Selective Assembly; Inter changeability; Hole And Shaft Basis System; Taylor's Principle; Design of Plug; Ring Gauges; IS 919-1993 (Limits, Fits & Tolerances, Gauges} IS 3477-1973; concept of multi gauging and inspection.

Angular Measurement: Concept; Instruments For Angular Measurements; Working and Use of Universal Bevel Protractor, Sine Bar, Spirit Level; Principle of Working of Clinometers; Angle Gauges (With Numerical on Setting of Angle Gauges).

Screw thread Measurements: ISO grade and fits of thread; Errors in threads; Pitch errors; Mea surement of different elements such as major diameter, minor diameter, effective diameter, pitch; Two wire method; Thread gauge micrometer; Working principle of floating carriage dial micrometer.

Unit-V: Gear Measurement and Testing: Analytical and functional inspection; Rolling test; Measurement of tooth thickness (constant chord method); Gear tooth vernier; Errors in gears such as backlash, runout, composite.

Machine tool testing: Parallelism; Straightness; Squareness; Coaxiallity; roundness; run out; alignment testing of machine tools as per IS standard procedure.

Suggested List of Student Activity

1. Each student writes and submits the assignment on the topic of Methods of measurements, Precautions to avoid inaccuracy in measurements, Selection and Calibration of measuring instruments.

2. Four students can be grouped as a batch to measure the various dimensions of taper shank drill bit and spur gear and submit the activity report. The activity report should have the diagram and various dimensions of the taper shank drill bit and spur gear.

3. Visit Industry to study the working of the CMM. Prepare a report.

4. Visit Industry to study the working of the Profile Projector. Prepare a report.

5. Study the various types of Comparator. Prepare a report.

Text and Reference books:

1. R. K. Jain, Engineering Metrology, 22 nd Edition, Khanna Publishers, 2022.

2. N. V. Raghavendra and L. Krishnamurthy, Engineering Metrology and Measurements, Oxford University Press India, 2013.

3. R. K. Rajput, Engineering Metrology and Instrumentation, S.K. Kataria & Sons, 2nd Edition, 2013.

4. Samir Mekid, Metrology and Instrumentation: Practical Applications for Engineering and Manufacturing, John Wiley & Sons, Inc., 2021.

5. Anand K. Bewoor & Vinay A. Kulkarni, Metrology & measurement, Tata McGraw-Hill, 2009.

6. Rega Rajendra, Principles of Engineering Metrology, Jaico Publishing House, 2008.

MEASUREMENTS & METROLOGY LAB

List of the Experiment

1 VERNIER CALIPER

i) Measure the dimensions of ground MS flat/Cylindrical bush using Vernier Caliper.

ii) Compare the results with Digital Vernier Caliper.

2 OUTSIDE MICROMETER

i) Measure the diameter of a wire using micrometer

ii) Compare the results with a digital Outside micrometer.

3 INSIDE MICROMETER

i) Measure the inside diameter of the bore of a bush cylindrical component using Inside micrometer

ii) Compare the results with digital inside micrometer.

4 SLIP GAUGES

Measure the thickness of ground MS plates using slip gauges.

5 VERNIER HEIGHT GAUGE

Measure the height of gauge blocks or parallel bars using vernier height gauge.

6 MECHANICAL COMPARATOR

Find out the measurement of a given component and Compare with a standard component using a mechanical comparator and slip gauge.

7 UNIVERSAL BEVEL PROTRACTOR

Measure the angle of a V-block/Taper Shank of Drill/ Dovetail using universal bevel protractor.

8 SINE BAR

Measure the angle of the machined surface using sine bar with slip gauges.

9 SCREW THREAD MICROMETER

Measure the geometrical dimensions of V-Thread using screw thread micrometer.

10 GEAR TOOTH VERNIER CALIPER

Measure the geometrical dimensions of spur gear using gear tooth vernier caliper.

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DME 304 Open Elective-I

Energy Conservation & Audit

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO1: Explain the energy scenario & consumption also provisions of the Energy Conservation(EC)Act.

CO2: Apply energy conservation methods in industrial systems such as HVAC, compressors, pumps, furnaces, and boilers.

CO3: Analyze and evaluate energy conservation projects using economic methods.

CO4: Explain performance improvement measures for power plants and electrical systems.

CO5: Conduct and document an energy audit, interpret energy flow diagrams, and use electrical measuring instruments for energy analysis.

UNIT-I: Introduction:

General energy problem, Sector wise Engy consumption, demand supply gap, Scope for energy conservation and its benefits; Energy Efficiency Principle – Maximum energy efficiency, Maximum cost effectiveness; Mandatory provisions of EC act; Features of EC act-Standards and labeling, designated consumers, Energy Conservation Building Codes (ECBC);

Unit-II:

Energy Conservation Approaches In Industries: Methods and techniques of energy conservation in ventilation and air conditioners- compressors pumps, fans and blowers - Area Sealing, Insulating the Heating / cooling fluid pipes, automatic door closing- Air curtain, Thermostat / Control; Energy conservation in electric furnaces, ovens and boilers.

Unit-III: Energy Conservation Option:

New equipment, technology, staffing, training; Calculation and costing of energy conservation project; Depreciation cost, sinking fund method. Cost evaluation by Return On Investment(ROI) and pay back method etc.

Unit-IV: Performance improvement of existing power plant:

cogeneration, small hydro, DG Set; Demand side management; Load response programmes; Types of tariff and restructuring of electric tariff Technical measures to optimize T and D losses.

Unit-V: Energy Audit:

Energy audit and its benefits; Energy flow diagram; Preliminary, Detailed energy audit; Methodology of -preliminary energy audit and Detailed energy audit – Phase I, Pre audit, Phase II- Audit and Phase III- Post audit; Energy audit report; Electrical Measuring Instruments - Power Analyzer.

Reference Books:

1. Electric Energy Generation, Utilisation and Conservation Sivaganaraju, S Pearson, New Delhi, 2012

2. Project Management, Prasanna Chandra, Tata Mcgraw Hill, New Delhi

3. O.P. Jakhar, Energy Conservations in Buildings, Khanna Publishing House, New Delhi

4. Financial Management, Prasanna Chandra Tata Mcgraw Hill, New Delhi.

5. Energy management Handbook, Prasanna Chandra, Tata Mcgraw Hill, New Delhi.

6. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi (ed. 2018)

Open Elective-I

(Material Handing System)

RATIONALE

In the field of engineering and technology, the term materials handling system is used with reference to industrial activity. In any industry, be it big or small, involving manufacturing or construction type work, materials must be handled as raw materials, intermediate goods or finished products form the point of receipt and storage of raw materials, through production processes and up to finished good storage and dispatch point. Lot of development has taken place in the field of materials handling system. So, it is necessary to teach them various types of material handling system and their different parts and selection process.

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO1: Explain the fundamentals of material handling systems.

CO2: Describe the construction, working, and maintenance of hoisting, elevating equipment, and cranes used in material handling.

CO3: Explain the construction, working, and maintenance of conveying and surface transportation equipment used in industries.

CO4: Identify and explain components and attachments of material handling systems.

CO5: Analyze mechanisms and motion in material handling equipment.

DETAILED CONTENT

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.

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.

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. 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.

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, Eyebolts, 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.

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.

INSTRUCTIONAL STRATEGY

1. Use computer-based learning aids for effective teaching-learning

2. Outdoor Visit:

a) Coal handling plant

b) Power plant

c) Automobile assembly plant

3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

MEANS OF ASSESSMENT

• Assignments and quiz

• class tests

• Sessional test

• Group discussion

• Semester Examination

REFERENCE BOOKS/ ONLINE RESOURCES

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.

Industrial Robotics & Automation

(Open ELECTIVE-I)

RATIONALE

Industrial Robotics & Automation is essential for mechanical engineering diploma students as it prepares them for the automation-driven industries of today. It equips them with practical skills to operate and maintain robotic systems, improving their employability in sectors like manufacturing and automotive. By understanding automation, students can contribute to optimizing production processes, enhancing efficiency and precision. Additionally, the subject provides a foundation for future studies in advanced fields like robotics and mechatronics, ensuring they stay competitive in a rapidly evolving technological landscape.

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO1: Explain the fundamentals of robotics, including robot anatomy and robot classification.

CO2: Describe robotic drive systems, actuators, feedback devices, and controllers.

CO3: Identify and apply various sensors, including position, range, proximity, force/torque sensors.

CO4: Perform forward and inverse kinematics of robotic manipulators, write simple robot programs using VAL or equivalent languages, and control robot motion and end-effectors.

CO5: Analyze and design automated systems, understand levels of automation, and apply robotics for industrial applications.

DETAILED CONTENT

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.

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; Robot path control: Point to point, Continuous path control and Sensor based path control;

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); Vidicon camera (Working principle & construction); Applications of Robot vision system: Inspection, Identification, Navigation & serving.

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); Robot programming Languages; VAL Programming; Motion Commands; Sensor Commands; End effector commands; and Simple programs

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.

INSTRUCTIONAL STRATEGY

To effectively teach Industrial Robotics & Automation, start with lectures that cover key concepts, using visual aids like diagrams and videos. Incorporate hands-on virtual lab sessions where students can program robots and operate various actuators and sensors. Use problem-based learning (PBL) to present real-world scenarios, encouraging collaborative projects to design automation systems.

MEANS OF ASSEESSMENT

• Assignments and quiz/class tests

• Sessional test

• Small projects

• Viva-voce

REFERENCE BOOKS/ ONLINE RESOURCES

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, McGraw 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.

DME 307 WORKSHOP PRACTICES LAB

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RATIONALE

The course aims to provide hands-on experience and practical skills in various essential workshops including Smithy Shop, Advance Welding Shop, Advance Fitting Shop and this curriculum is primarily divided into three parts. This practical knowledge will equip students with the necessary skills to handle real-world tasks efficiently, fostering a deeper understanding of the techniques and safety measures required in each shop.

Course Outcomes (COs)

After completion of this course, students will be able to:

CO1: Apply industrial safety practices in smithy, welding, and fitting workshops to prevent accidents and ensure safe operations.

CO2: Demonstrate hand forging skills including cutting, upsetting, drawing, bending, and heat treatment to prepare practical jobs.

CO3: Identify, select, and operate advanced welding equipment.

CO4: Execute precision fitting operations using appropriate tools and techniques.

CO5: Prepare and complete workshop jobs individually or in groups with proper documentation, quality checks, and compliance to tolerances.

Content

1 SMITHY SHOP

1. General Shop Talk

1.1 Purpose of Smithy shop

1.2 Different types of Hearths used in Smithy shop

1.3 Purpose, specifications, uses, care and maintenance of various tools and equipments used in hand forging by segregating as cutting tools, supporting tools, holding tools, measuring tools etc.

1.4 Types of fuel used and maximum temperature obtained

1.5 Types of raw materials used in Smithy shop

1.6 Uses of Fire Bricks & Clays in Forging workshop.

2. Practice

2.1 Practice of firing of hearth/Furnace, Cleaning of Clinkers and Temperature Control of Fire.

2.2 Practice on different basic Smithy/Forging operations such as Cutting, Upsetting.

Drawing down, Setting down, Necking, Bending, Fullering, Swaging, Punching and Drifting.

a) Demonstration - Making cube, hexagonal cube, hexagonal bar from round bar

2.3 Practice of Simple Heat treatment processes like Tempering, Normalizing, Hardening etc

3. Job Practice : Job Preparation

3.1 Job I - Making a cold/hot, hexagonal/octagonal flat chisel including tempering of edges.

3.2 Job II - Production of utility goods e.g. hexagonal bolt/square shank boring tool, fan hook (long S-type) [Two jobs are to be done by the students]

3.3 Job III - To prepare a cube from a M.S. round by forging method.

2 ADVANCE WELDING SHOP

1. General Shop Talk

1.1 Basic introduction of all types of Welding Techniques and Equipment Familiarization Overview of advanced welding equipments.

1.2 Overview of Advanced Welding Processes Brief review of foundational welding processes (e.g., SMAW, GMAW, GTAW, TIG, Plasma Arc, Submerged Arc) with explanation of their applications in industries like aerospace, automotive, oil and gas or manufacturing.

1.3 Safety Protocols and Hazard Awareness Personal Protective Equipment (PPE)- Importance of welding helmets with appropriate shade levels, gloves, flame resistant jackets, safety boots and respiratory protection.

1.4 iscuss about proper storage of gas cylinders and handling of welding consumables and awareness of fire and explosion risks from flammable materials or gases.

1.5 Weld Imperfections and Quality Standards Common weld imperfections (e.g. porosity, cracks, lack of fusion) and their causes.

2. Practice

2.1 Preparation of key components (e.g., power sources, torches, wire feeders, shielding gas regulators)

2.2 Maintenance tips to prevent equipment malfunctions (e.g., cleaning nozzles, checking cables).

2.3 Complete awareness of workstation setup, calibration and shutdown procedures.

2.4 Importance of selecting appropriate filler metals, shielding gases and welding parameters for specific materials.

2.5 Practicing flame generation is an essential step in gas welding and cutting, especially using oxy- acetylene equipment. Discuss the classification of all types of flames.

3. Job Practice : Job Preparation

Job 1. Preparing gas welding joint in vertical/Horizontal position joining M.S. Plates

Job 2. Exercise on gas cutting of mild steel plate with oxy-acetylene gas torch.

Job 3. Exercise on gas welding of cast iron and brass part or component.

Job 4. Exercise on preparation of T Joint by arc welding

Job 5. Exercise on spot welding/seam welding

Job 6. Exercise on MIG and TIG welding

Job 7. Exercise on arc welding pipe joint MS.

3 ADVANCE FITTING SHOP

General Shop Talk

1.0 Introduction of application of all types of tools used in fitting shop.

1.1 Basic knowledge of limits, fits and tolerances which is necessary for precision fitting work.

1.2 Familiarization with Interchangeable parts fitting.

1.3 Introduction to jigs and fixtures that improve efficiency and accuracy.

1.4 Understanding of Advanced shop safety, proper handling of tools and materials.

2. Practice

2.1 Precision use of tools like scrapers, micrometers, Venier calipers and gauges, Hack sawing, drilling, reaming, and tapping with precision.

2.2 Use of taps and dies for internal and external threading.

2.3 Accurate chisel and file work to meet tight tolerances.

3. Job Practice : Job Preparation

Job 1. Exercise on drilling, reaming, counter boring, counter sinking and taping.

Job 2. Dovetail fitting in mild steel.

Job 3. Radius fitting in mild steel.

Job 4. Pipe threading with die.

Text and Reference books:

1. Elements of workshop Technology Volume I & II– Hajra Chowdry & Bhattacharaya- IIth Edition- Media Promoters & Publishers Pvt. Ltd.,

2. A Textbook of workshop Technology- R.S.Khurmi & J.K.Gupta- 2nd Edition, S.Chand & Co., Ram Nagar, New Delhi– 2018.

3. Manufacturing process– Begeman- 5th Edition-McGraw Hill, New Delhi 2011.

4. Workshop Technology- WAJ Chapman- Volume I, II, & III– Vima Books Pvt. Ltd., 4262/3, Ansari Road, Daryaganj, New Delhi 110 002.

5. Production Technology– HMT- Edn. 18- published by Tata McGraw Hill publishing Co. Ltd., 7 West Patel nagar, New Delhi 110 008.– 20181.

DME 308 COMPUTER AIDED MACHINE DRAWING PRACTICE LAB

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Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO1: Explain the principles of sectional views and apply standard conventions for representing machine components.

CO2: Interpret and apply Geometric Dimensioning and Tolerancing (GD&T) symbols, datums, and material condition modifiers.

CO3: Prepare accurate manual assembly drawings of machine components with dimensions and bill of materials.

CO4: Create 2D CAD drawings of assembled machine components with appropriate dimensions.

CO5: Develop 3D solid models and assemblies of machine components using CAD software and generate drawing outputs.

Syllabus contents

Theory Portion
SECTIONAL VIEWS Sectioning - sectional views – representation of sectional plane – hatching – inclination – spacing – hatching large areas – hatching adjacent parts - full section – half section – types of half sections – conventional representation of materials in section. **GEOMETRIC DIMENSIONING AND TOLERANCES.** Importance of GD&T - Tolerance specification and interpretation - Tolerance symbols - Features - Datum plane and Axis - Shaft basis and hole basis system. Material Condition Modifiers. Maximum Material Condition (MMC) - Least Material Condition (LMC) - Feature Control Frames
Manual Drawing Practice
Detailed drawings of the following machine components will be given to students to draw the assembled views. Only the assembled Front view (Without section / Full Section / Half Section) and Top view or Side view (Without section / Full Section / Half Section) with dimensions and Bill of materials in the Drawing Sheet. Note: All the exercises drawing sheet should be submitted for the model and end semester examination as a record of work done.
COMPUTER AIDED DRAFTING (CAD) PRACTICES
PART A - Drafting Practices: 2D Drafting Practices - Draw the front view of the assembled drawing of the

components with dimensions.
PART B - Solid modelling Practices: Detailed drawings of the machine components will be given to students to create the solid modelling and assemble using any CAD software in the computer and take the printout. Machine Components for the Practical Exercises
1. Sleeve and Cotter Joint. 2. Plummer Block. 3. Flange Coupling. 4. Bushed Bearing.
Practice + Test + Revision

Suggested List of Students Activity:

● Students should practice production drawing with the GD&T representation.

● Modelling competitions can be arranged.

Text and Reference Books:

1. A beginner's guide to 3D modeling by Cameron Coward

2. Solidworks 2022 step by step guide by Amit Bhatt and Mark Wiley

Web-based/Online Resources:

● https://www.autodesk.in/campaigns/autocad-tytorials

● https://www.mycadsite.com/tutorials.html

● NPTEL Lecturers

Equipment / Facilities required to conduct the Practical Course.

1. Personal computer – 30 Nos.

2. Printer – 1 No.

3. Required Software: CAD Package/ Parametric Software packages– Sufficient to the strength.

DME 401

STRENGTH OF MATERIALS

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RATIONALE

This subject provides a crucial foundation for designing safe and efficient mechanical components. It equips students with the ability to analyses material be haviour under various loads, ensuring proper material selection and failure prevention. SOM also enhances problem-solving skills, helping students calculate stress, deformation, and stability in structures. Additionally, it prepares students for advanced courses and real-world applications in industries ensuring career readiness in technical roles.

Learning Outcomes:

After successful completion of this course, students will be able to:

 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.

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

 Define resilience, proof – resilience and modulus of resilience and obtain expressions for instantaneous stress developed in bodies subjected to different loads.

 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.

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

 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.

DETAILED CONTENT

UNIT-I: Stresses and Strains:

Stress, Strain and their nature; Mechanical properties of common engineering materials; Significance of various points on stress – strain diagram for M.S. and C.I. specimens; Significance of factor of safety; Relation between elastic constants; Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces; Thermal stresses in bodies of uniform section and composite sections; Related numerical problems on the above topics.

Unit-II: Strain Energy:

Strain energy or resilience, proof resilience and modulus of resilience; Derivation of strain energy for the following cases: i) Gradually applied load, ii) Suddenly applied load, iii) Impact/ shock load; Related numerical problems. Principal stresses Concept of principal stresses, Principal Planes and maximum shear stresses for the bodies subjected to direct and shear stresses, determination by mohr's circle method. Thin Cylindrical Shells: Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell.

Unit-III: Shear Force & Bending Moment in beams:

Introduction of Beams, Types of Beams, Types of Loads – Point load, UDL and UVL; Definition, explanation and relation of shear force and bending moment; Calculation of shear force and bending

moment and drawing the S.F and B.M. diagrams by the analytical method only for the following cases: a) Cantilever with point loads, b) Cantilever with uniformly distributed load, c) Simply supported beam with point loads, d) Simply supported beam with UDL, e) Combination of point and UDL for the above; Related numerical problems.

Unit-IV: Theory of Simple Bending and Deflection of Beams:

Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of Resistance, Bending stress, Radius of curvature; Assumptions in theory of simple bending; Bending Equation $M/I = \sigma/Y = E/R$ with derivation; Problems involving calculations of bending stress, modulus of section and moment of resistance; Calculation of safe loads and safe span and dimensions of crosssection; Definition and explanation of deflection as applied to beams; Deflection formulae without proof for cantilever and simply supported beams with point load and UDL only (Standard cases only); Related numerical problems.

Unit-V: Torsion in Shafts and Springs:

Definition and function of shaft; Calculation of polar M.I. for solid and hollow shafts; Assumptions in simple torsion; Derivation of the equation $T/J=fs /R=G\theta/L$; Problems on design of shaft based on strength and rigidity; Numerical Problems related to comparison of strength and weight of solid and hollow shafts; Classification of springs; Nomenclature of closed coil helical spring; Deflection formula for closed coil helical spring (without derivation); stiffness of spring; Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils.

INSTRUCTIONAL STRATEGY

 Use lectures to introduce fundamental concepts (stress, strain, elasticity, material properties). Visual aids such as diagrams, charts, and animations can help students understand key principles.

 Provide real-life engineering problems where students need to calculate stresses, bending moments, and deflections in beams, rods, or structures. This encourages analytical thinking and application of theoretical knowledge

MEANS OF ASSESSMENT

 Assignments and quiz/class tests

 Sessional test

 Actual Practical Performance

 Small projects

 Viva-voice

REFERENCE BOOKS/ ONLINE RESOURCES

1. Strength of Materials – D.S. Bedi, Khanna Book Publishing Co. (P) Ltd., Delhi, 2017.
2. Strength of Materials – B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi, 2013
3. Strength of Materials – S. Ramamrutham, Dhanpat Rai & Publication New Delhi
4. Strength of Materials – R.S. Khurmi, S.Chand Company Ltd. Delhi
5. A Text Book strength of Material– R.K. Bansal, Laxmi Publication New Delhi.

STRENGTH OF MATERIALS LAB

LIST OF PRACTICAL TO BE PERFORMED:

LIST OF PRACTICALS

1. Study and understand the use and components of universal Testing Machine (UTM).

2. Perform tension test on mild steel specimen using UTM.

3. Conduct compression test on sample test piece using compression testing machine.

4. Conduct Izod impact test on any metal e.g. mild steel/ brass/ aluminum/ copper/ cast iron.

5. Conduct charpy impact test on any metal e.g. mild steel/ brass/ aluminum/ copper/ cast iron.

6. Determination of Rockwell's Hardness number for various materials like mild steel, high carbon steel, brass, copper, aluminum.

7. Determination of Brinell's Hardness number for various materials like mild steel, high carbon steel, brass, copper, aluminum.

8. To find the value of 'E' for a steel beam by method of deflection for different loads.

9. Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method. (Open and closed coil spring)

10. Plot shear force diagram for cantilever, simply support beams subjected to point load only.

11. Plot bending moment diagram for cantilever, simply support beams subjected to point load only.

DME 402

INDUSTRIAL ENGINEERING MANAGEMENT

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RATIONALE

The rationale for teaching Industrial Engineering and Management to diploma students lies in its comprehensive approach to optimizing complex systems and processes. These subject combines engineering principles with management practices to improve efficiency, productivity, and quality in manufacturing and service industries. By studying this subject, students gain skills in areas such as operations research, production planning, quality control, and supply chain management. This knowledge equips them to design, analyze, and manage industrial systems effectively.

Learning Outcomes:

After successful completion of this course, students will be able-

- To understand the different types of layouts and plant maintenance with safety.
- Explain the production facilitating techniques of work and method studies.
- To understand production planning and controls for desired product quality.
- Define the principles of personal management and organizational behavior.
- List and explain the various financial and material managements.

DETAILED CONTENT

UNIT-I:

Plant Engineering:

Plant; Selection of site of industry; Plant layout; Principles of a good layout; Types; Process; Product and Fixed position; Techniques to improve Layout; Principles of Material handling equipment; Plant maintenance; Importance; Break down maintenance; Preventive maintenance and Scheduled maintenance.

Plant Safety:

Importance; Accident: Causes and Cost of an Accident, Accident Proneness, Prevention of Accidents; Industrial disputes; Settlement of Industrial disputes; Collective bargaining; Conciliation; Mediation; Arbitration; Indian Factories Act 1948 and its provisions related to health, welfare and safety.

UNIT-II:

Work Study:

Productivity; Standard of living; Method of improving Productivity; Objectives; Importance of good working conditions.

Method Study:

Definition; Objectives; Selection of a job for method study; Basic procedure for conduct of Method study; Tools used; Operation process chart; Flow process chart; Two handed process chart; Man Machine chart; String diagram and flow diagram.

Work Measurement:

Definition; Basic procedure in making a time study; Employees rating factor; Basic concept of production study; Techniques of Work Measurement; Ratio delay study; Synthesis from standard data; Analytical estimating and Pre determined Motion Time System (PMTS).

UNIT-III:

Production Planning and Control:

Introduction; Major functions of Production Planning and Control; Routing and Scheduling;

Dispatching and Controlling; Concept of Critical Path Method (CPM); Types of Production: Mass

Production, Batch Production and Job Order Production; Characteristics; Economic Batch Quantity

(EBQ); Principles of Product and Process Planning;

Quality Control:

Definition; Objectives; Types of Inspection: First piece, Floor and Centralized Inspection; Advantages

and Disadvantages; Statistical Quality Control; Types of Measurements; Method of Variables; Method

of Attributes; Uses of X, R, p and c charts; Operating Characteristics curve(O.C curve); Sampling

Inspection; Single and Double Sampling plan; Concept of ISO 9001:2008 Quality Management System

Registration/Certification procedure; Benefits of ISO to the organization.

UNIT-IV:

Principles of Management:

Definition of Management; Administration; Organization; F.W. Taylor's and Henry Fayol's Principles of Management; Functions of Manager; Types of Organization: Line, Staff, Taylor's Pure functional types; Line and staff and committee type; Directing; Leadership; Styles of Leadership; Qualities of a good leader; Motivation; Positive and Negative Motivation; Modern Management Techniques; Just In Time; Total Quality Management (TQM); Quality circle; Zero defect concept; 5S Concept; Management Information Systems.

Personnel Management:

Responsibility of Human Resource Management; Selection Procedure; Training of Workers; Apprentice Training; On the Job training and Vestibule School Training; Job Evaluation and Merit Rating; Objectives and Importance; Wages and Salary Administration; Components of Wages; Wage Fixation; Type of Wage Payment: Halsey's 50% Plan, Rowan's Plan and Emerson' sufficiency plan; Numerical Problems.

UNIT-V:

Financial Management:

Fixed and Working Capital; Resources of Capital; Shares Preference and Equity Shares; Debentures; Type of debentures; Public Deposits; Factory Costing: Direct Cost; Indirect Cost; Factory Overhead; Selling Price of a product; Profit; Numerical Problems; Depreciation; Causes; Methods: Straight line, sinking fund and percentage on Diminishing Value Method; Numerical Problems.

Material Management:

Objectives of good stock control system; ABC analysis of Inventory; Procurement and Consumption cycle; Minimum Stock, Lead Time, Reorder Level-Economic Order Quantity problems; Supply Chain.

INSTRUCTIONAL STRATEGY

To teach Industrial Engineering and Management to diploma students effectively, integrate a variety of instructional strategies. Utilize active learning through group projects, hands-on activities, and case studies to engauge students practically. Blend traditional teaching with online resources, including multimedia content and discussion forums, to enhance understanding.

MEANS OF ASSESSMENT

 Assignments and quiz/class tests

 Sessional test

 Viva-voice

REFERENCE BOOKS/ ONLINE RESOURCES

1. Industrial Engineering & Management, S.C. Sharma, Khanan Book Publishing Co (P) Ltd., New Delhi

2. Industrial Engineering and Management, O.P. Khanna, Revised Edition, Dhanpat Rai Publications (P) Ltd., New Delhi – 110002.

3. Management, A global perspective, Heinz Weihrich, Harold Koontz, 10th Edition, McGraw Hill International Edition 1994.

4. Essentials of Management, 4th Edition, Joseph L.Massie, Prentice-Hall of India, New Delhi 2004.

5. Principles and Practices of Management, Premvir Kapoor, Khanna Publishing House, N. Delhi

DME- 403
MANUFACTURING ENGINEERING

RATIONALE :

Manufacturing engineering is a crucial subject for diploma students as it provides a comprehensive understanding of the processes, tools, and technologies used in the production of goods. It lays the groundwork for understanding how products are designed, developed, and manufactured, which is essential for any career in engineering and production.

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COURSE OUTCOME:

Learning Outcomes:

After successful completion of this course, students will be able to-

- Explain the functions of Jigs and Fixtures.
- Describe the advancements in the area of manufacturing and production processes.
- Familiarized with working principles and operations performed on non-traditional machines, machining center, SPM, and maintenance of machine tools.

COURSE CONTENT

UNIT-I :

Cutting Fluids & Lubricants: Introduction -Types of cutting Fluids, Fluids and coolants required in turning, drilling, shaping, sawing & broaching; Selection of cutting fluids, methods of application of cutting fluid; Classification of lubricants (solid, liquid, gaseous) Properties and applications of lubricants. Lathe Operations: Types of lathes, CNC lathe, Specifications, Basic parts and their functions, Operations and tools – Turning, parting off, Knurling, facing, Boring, drilling, threading, step turning, taper turning. Shaping and Planning -Working principle of shaper and planer, Type of shapers, Type of planers, Quick return mechanism applied to shaper and planer machine, Work holding devices used on shaper and planer, Specification of shaper and planer, Speeds and feeds in above processes. Milling: Introduction; Types of milling machines: plain, Universal, vertical; constructional details – specifications; Milling operations: simple, compound and differential indexing; Milling cutters – types; Nomenclature of teeth; Teeth materials; Tool signature of milling cutter; Tool & work holding devices.

UNIT -II :

Drilling and Broaching: Classification of drilling machines; Basic parts and their functions; Radial drilling machine; Types of operations, Specifications of drilling machine, Types of drills and reamers. Introduction to broaching; Types of broaching machines –Elements of broach tool, broach teeth details, Nomenclature, Tool materials. Grinding and finishing processes: Principles of metal Grinding, Abrasives-Bonds and binding processes, Factors affecting the selection of grind wheels, Grinding wheel specification. Grinding wheel wear - attritions wear, fracture wear, Dressing and Truing, Grinding machines classification: Cylindrical, Surface, Tool & Cutter grinding machines, Construction details, Principle of centerless grinding, Advantages & limitations of center less grinding; Super finishing Processes: Basic principles of Honing, Lapping, Buffing, Polishing, Burnishing etc.

UNIT -III:

Rolling and Forging: Definition and complete classification of Rolling and Forging process. Extrusion and Drawing: Type of Extrusion- Hot & Cold and Direct & Indirect, Pipe Drawing, Tube Drawing; Wire Drawing. Brazing and soldering: Types, Principles and Applications. Jig and Fixture : Definition , Application and Basic Difference between a Jig and a Fixture Press working: Types of Presses and

Specifications, Press working operations - Cutting, bending, drawing, punching, blanking, notching, lancing.

UNIT -IV:

Pattern Making : Definition and Application of Patterns in casting, Classification of Patterns types (Single piece, Split pattern, match plate etc.) Materials used for patterns (wood, metal, plastic, etc.) Pattern Allowances (shrinkage, machining, draft, and distortion) and Purpose and importance of Different types of Measuring and Marking using tools, Cutting, shaping and assembling wooden or metallic patterns, Pattern layout and planning, Surface finishing and polishing of patterns. Casting and Moulding: Properties and various types of moulding sand, Types of moulds, All important steps of mould making, moulding boxes, hand tools used for mould making, Moulding processes, Casting processes – Charging of furnace, melting, pouring, Cleaning of castings, Principle, Working and application of Die casting, Investment casting, Centrifugal casting, Gating andRiser System, Casting defects and Testing of casting defects.

MANUFACTURING ENGINEERING LAB

Practical Course Content

Pattern Making Shop :

Job 1. Preparation of solid/single piece pattern.

Job 2. Preparation of two piece/split pattern.

Job 3. Preparation of a pattern on wooden lathe

Job 4. Preparation of a self cored pattern

Job 5. Preparation of a core box.

Moulding/Foundry Shop:

Job 1. Preparation of mould with solid pattern on floor.

Job 2. Preparation of floor mould of solid pattern using cope.

Job 3. Preparation of floor mould of split pattern in cope and drag of moulding box.

Job 4. Moulding and casting of a solid pattern of aluminum

Job 5. A visit to cast iron foundry should be arranged to have firsthand knowledge of cast irc melting pouring and casting.

Machine Shop : (Two Practicals are given in each group, any one is to be performed)

Job 1- Prepare a V-Block up to 0.5 mm accuracy on shaper machine.

Or

Exercise on key way cutting and spline cutting on shaper machine.

Job 2- Produce a rectangular block by facing on a slotting machine.

Or

Produce a rectangular slot on one face with a slotting cutter.

Job 3- Produce a rectangular block using a milling machine with a side and face cutter.

Or

Prepare a slot on one face using milling machine.

Job 4- Exercises on internal turning on lathe machine.

Or

Exercises on extemal turning on lathe machine.

Job 5- Exercises on internal threading on lathe machine.

Or

Resharpening of single point cutting tool with given geometry.

Job 6- Job on grinding machine using a surface grinder.

Or

Exercise of boring with the help of boring bar.

MEANS OF ASSESSMENT

 Assignments and quiz/class tests

 Sessional test

 Viva-voice

Text and Reference books:

1. Elements of workshop Technology Volume I & II– Hajra Chowdry & Bhattacharaya- IIth EditionMedia Promoters & Publishers Pvt. Ltd.,

2. A Textbook of workshop Technology- R.S.Khurmi & J.K.Gupta- 2nd Edition, S.Chand & Co., Ram Nagar, New Delhi– 2018.

3. Manufacturing process– Begeman- 5th Edition-McGraw Hill, New Delhi 2011.

4. Workshop Technology- WAJ Chapman- Volume I, II, & III– Vima Books Pvt. Ltd., 4262/3, Ansari Road, Daryaganj, New Delhi 110 002

5. Production Technology– HMT- Edn. 18- published by Tata McGraw Hill publishing Co. Ltd., 7 West

Patel nagar, New Delhi 110 008.– 20181

DME- 404 MATERIAL SCIENCES & ENGINEERING

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RATIONALE

Lot of development has taken place in the field of materials. New materials are being developed, and it has become possible to change the properties of materials to suit the requirements. Diploma holders on this course are required to make use of different materials for various applications. For this purpose, it is necessary to teach them the basics of metal structure, properties, usage and testing of various ferrous and non-ferrous materials and various heat treatment processes. This subject aims to develop knowledge about the characteristics, testing and usage of various types of materials used in industries.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

1. Distinguish between metals and non-metals and ferrous and non-ferrous materials.
2. Explain the arrangement of atoms in various crystals.
3. Carryout various heat treatment processes.
4. Analyze microstructure and changes in microstructure due to heat treatment.
5. Explain properties and applications of composites, ceramics and smart materials, plastics and rubber.
6. Perform destructive and non-destructive testing of materials.

COURSE CONTENT

UNIT-I: Crystal structures and Bonds:

Unit cell and space lattice: Crystal system: The seven basic crystal systems; Crystal structure for metallic elements: BCC, FCC and HCP; Coordination number for Simple Cubic, BCC and FCC; Atomic radius: definition, atomic radius for Simple Cubic, BCC and FCC; Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP; Simple problems on finding number of atoms for a unit cell. Bonds in solids: Classification - primary or chemical bond, secondary or molecular bond; Types of primary bonds: Ionic, Covalent and Metallic Bonds; Types of secondary bonds: Dispersion bond, Dipole bond and Hydrogen bond.

Unit-II: Phase diagrams, Ferrous metals and its Alloys:

Isomorphs, eutectic and eutectoid systems ; Iron-Carbon binary diagram; Iron and Carbon Steels; flow sheet for production of iron and steel; Iron ores – Pig iron: classification, composition and effects of impurities on iron; Cast Iron: classification, composition, properties and uses; Wrought Iron: properties, uses/applications of wrought Iron; comparison of cast iron, wrought iron and mild steel and high carbon steel; standard commercial grades of steel as per BIS and AISI; Alloy Steels – purpose of alloying; effects of alloying elements – Important alloy steels: Silicon steel, High Speed Steel (HSS), heat resisting steel, spring steel, Stainless Steel (SS): types of SS, applications of SS – magnet steel – composition, properties and uses

Unit–III: Non-Ferrous Materials

Properties and uses of aluminum, copper, tin, lead, zinc, magnesium and nickel; Copper alloys: Brasses, bronzes – composition, properties and uses; Aluminum alloys: Duralumin, hindlimb, magnalium – composition, properties and uses; Nickel alloys: Inconel, Monel, nucleome – composition, properties and uses. Anti-friction/Bearing alloys: Various types of bearing bronzes - Standard commercial grades as per BIS/ASME.

Unit-IV: Failure analysis & Testing of Materials:

Introduction to failure analysis; Fracture: ductile fracture, brittle fracture; cleavage; notch sensitivity; fatigue; endurance limit; characteristics of fa-tigue fracture; variables affecting fatigue life; creep; creep curve; creep fracture; Destructive testing: Tensile testing; compression testing; Hardness testing: Brinell, Rockwell; bend test; torsion test; fa-tigue test; creep test. Non-destructive testing: Visual Inspection; magnetic particle inspection; liquid penetrant test; ultrasonic inspection; radiography.

Unit-V: Corrosion & Surface Engineering:

Nature of corrosion and its causes; Electrochemical re- actions; Electrolytes; Factors affecting corrosion: Environment, Material properties and physical con ditions; Types of corrosion; Corrosion control: Material selection, environment control and design; Surface engineering processes: Coatings and surface treatments; Cleaning and mechanical finishing of surfaces; Organic coatings; Electroplating and Special metallic plating; Electro polishing and photo-etching ;– Conversion coatings: Oxide, phosphate and chromate coatings; Thin film coatings: PVD and CVD; Surface analysis; Hard-facing, thermal spraying and high-energy processes; Process/material selection. Pollution norms for treating effluents as per standards.

Reference Books:

1. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpath Rai and Sons, New Delhi.
2. Material Science & Engineering – R.K. Rajput, S.K. Kataria & Sons, New Delhi, 2004.
3. Material Science – R.S. Khurmi, S. Chand & Co. Ltd., New Delhi, 2005.

MATERIAL SCIENCES & ENGINEERING LAB

LIST OF PRACTICALS

1 Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.
2 Prepare a specimen and examine the microstructure of the Ferrous and Non- ferrous metals using the Metallurgical Microscope.
3 Study and sketches of Blast furnace, Cupola Furnace
4 To detect defects and Deformation in any metals
5 Torsion test on mild steel – relation between torque and angle of twist determination of shear modulus and shear stress.
6 Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open & Closed coil spring)
7 Identification of metal by giving mini projects.
8 Detect the cracks in the specimen using (i) Visual inspection and ring test (ii) Die penetration test (iii) Magnetic particle test.
9 Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and Aluminum.
10. Single or double Shear test on M.S. bar to finding the resistance of material to shear load
11 Finding the resistance of materials to impact loads by Izod test and Charpy test.

DME 405
THERMAL ENGINEERING-II

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COURSE OBJECTIVES

Introduction

The purpose of this subject is to give conceptual and principles involving thermal science, especially focusing on Internal combustion engine, Refrigerator, and compressors. Through experiments and simulations conducted in the lab, students can validate theoretical concepts, optimize system performance, testing of various oil properties for using as a fuel and lubricant in thermal systems and develop innovative solutions for real-world applications. This practical knowledge enhances their problem-solving skills and prepares them for the challenges they will face in their careers.

Learning Outcomes:

After successful completion of this course, students will be able-

 To understand the fundamental concepts involved in thermal systems.

 To analyses the various performance parameters of internal combustion (IC) engines.

 To analyses the performance of refrigeration cycle/ components.

 To analyses the performance of the compressor and its volumetric efficiency.

 To study the properties, complete combustion of fuels and its products.

COURSE CONTENT

Unit I : AIR CYCLES, IC ENGINES AND FUEL

Air-standard Brayton cycle; Description with p-v and T-S diagrams; Gas turbines Classification: open cycle gas turbines and closed cycle gas turbines; IC Engines : Introduction, Working principle of two stroke and four stroke cycle, SI engines and CI engines, Otto cycle, diesel cycle and dual cycle, Testing of IC Engines: Engine power - indicated and brake power, Efficiency - mechanical, thermal. relative and volumetric, Methods of finding indicated and brake power, Morse test for petrol engine, Heat balance sheet. Classifications of fuels: Requirements of a good fuel – stoichiometric air required for complete combustion of fuels –products of combustion – analysis of exhaust gases - calorific value of fuels – higher and lower calorific values ,Specific fuel consumption.

Unit II AIR COMPRESSOR ,REFRIGERATION AND POWER PLANTS

Air Compressor and its functions, Single stage & Multi stage reciprocating air Compressor. Introduction to Refrigeration, Refrigeration Effects . COP, TON of Refrigeration. Reversed Carnot cycle, Air-standard Brayton cycle, Functions and classification of Refrigerants, selection of Refrigerant. Component and Line diagram of thermal power plant , nuclear power plant and hydro-power plant .

Unit–III: Properties of Steam

Formation of steam Wet, dry and superheated steam Dryness fraction Steam tables Mollier (h-s) chart Numerical problems on steam properties

Unit–IV: Steam Boilers

Classification of boilers Fire tube and water tube boilers Boiler mountings and accessories Boiler efficiency Boiler draught

Unit–V: Steam Nozzles and Steam Turbines

Flow of steam through nozzles Types of nozzles Impulse and reaction turbines Velocity diagrams Turbine efficiency

Textbook for reference

1. R. K. Rajput, Thermal Engineering, 11th Edition, Laxmi publications Pvt Ltd , New Delhi, 2020.

2. R.S. Khurmi, J. K. Gupta, A Textbook of Thermal Engineering, S. Chand Publishing, 2019.

3. R. K. Rajput , A Text Book of Automobile Engineering, Laxmi publications Pvt Ltd, New Delhi, 2012.

4. P. K. Nag, Basic And Applied Thermodynamics 2/E, McGraw-Hill Education (India) Pvt Limited, 2010.

THERMAL ENGINEERING-II LAB

Practical Exercises:

1 Determine the flash and fire point of the lubricating oil by using Open cup apparatus and Closed cup apparatus and compare the value for the given sample.

2 Draw the valve timing diagram of single cylinder four stroke petrol and diesel engines.

3 Draw the port timing diagram of a single cylinder two stroke
Petrol Engine.

4 Load test (Performance test) on Four Stroke Diesel Engine or Four
Stroke Petrol Engine.

5 Morse test on multi-cylinder petrol engine.

6 Heat balance test on Four Stroke Diesel or Petrol Engine.

7 Find the Percentage of CO, CO2, O2, and amount of HC, NOx using
Exhaust gas analyzer.

8 Volumetric efficiency of Air Compressor.

9 Demonstration of various refrigeration tools and equipment.

10 Study of various parts of power plants.

11 Study and sketch of various mountings and accessories of boilers.