

DIPLOMA (MECHANICAL) – PART SIX

Optional Early Certificate :- N/A

Syllabus:-

Sr. No.	Module Code	Name of Module	Credits	Total Marks
1	MC22-26	Hydraulics & Hydraulic Machines	5	100
2	MC22-27	Machine Design & Drawing – II	5	100
3	MC22-28	Industrial Engineering	5	100
4	MC22-29	Project	4	100

Module Name: Hydraulics and Hydraulic Machines

- 1. Introduction:** Fluid: Real Fluid, Ideal Fluid, Fluid Mechanics, Hydraulics, Hydrostatics, Hydrokinematics and Hydrodynamics.
- 2. Properties of Fluids:** Mass Density, Specific Weight, Specific Gravity, Cohesion, Adhesion, Viscosity, Surface Tension, Capillary, Vapour Pressure and Compressibility, Units of Measurement.
- 3. Hydrostatic Pressure:** Pressure, Intensity of Pressure, Pressure Head, Pascal's Law and its Applications, Total Pressure, Resultant Pressure, and Center of Pressure, Total Pressure and Center of Pressure on Vertical and Inclined Plane Surfaces: Rectangular, Triangular, Trapezoidal, Circular, Total Pressure on Dams and Lock Gates.
- 4. Measurement of Pressure:** Atmospheric Pressure, Gauge Pressure, Vacuum Pressure and Absolute Pressure, Piezometers, Simple Manometer, Different Manometer and Mechanical Gauges, Measurement of Pressure by Manometers and Pressure Gauges.
- 5. Fundamentals of Fluid Flow:** Types of Flow: Steady and Unsteady Flow, Laminar and Turbulent Flow, Uniform and Non Uniform Flow, Discharge and Continuity Equation (Flow Equation), Types of Hydraulic Energy: Potential Energy, Kinetic Energy, Pressure Energy, Bernoulli's Theorem: Statement and Description (without Proof of Theorem).
- 6. Orifice:** Definition of Orifice, and Types of Orifice, Hydraulic Coefficients, Large Vertical Orifices and Small Orifices, Free Drowned and Partially Drowned Orifice, Time of Emptying a Rectangular/Circular Tanks with Flat Bottom.
- 7. Flow Through Pipes:** Definition, Laminar and Turbulent Flow, Explain Through Reynolds Experiment, Reynolds Number, Critical Velocity and Velocity Distribution, Head Lose in Pipelines Due to Friction, Sudden Expansion and Sudden Contraction, Entrance, Exit, Obstruction and Change of Direction (No Derivation of Formulae), Flow From One Reservoir to Another Through Long Pipe of Uniform and Composite Section, Water Hammer Phenomenon and its Effects (Only Elementary Treatment), Pipes in Series and Parallel, Siphon.

8. **Flow Through Open Channels:** Definition of a Channel, Uniform Flow and Open Channel Flow, Discharge Through Channels Using: (a) Chezy's Formulae (No Derivation), (b) Manning's Formulae, Most Economical Sections: (a) Rectangular, (b) Trapezoidal, (c) Circular.
9. **Flow Measurements:** Measurement of Velocity by Pitot-Tube, Current Meter, Surface Float, Velocity Rods, Measurement of Discharge by a Notch: (a) Difference between Notches and Orifices, (b) Discharge Formulae for Rectangular Notch, Triangular Notch, Trapezoidal Notch and Conditions for their use (No Derivation), Measurement of Discharge by Weirs: (a) Difference between Notch and Weir, (b) Discharge Formulae for Free Drowned and Broad Crested Weir With and Without end Contraction, Velocity of Approach and Condition of Their Use, (c) Venturi Fumes to Measure Flow, Measurement of Discharge by Velocity Area- Method.
10. **Hydraulic Machines:** Reciprocating Pumps, Centrifugal Pumps, Impulse Turbines, Reaction Turbines, Sketching and Description of Principles of Working of Above Mentioned Machines.

Module Name: Machine Design and Drawing-II

1. **Linkages:** Introduction, Basic Linkage Concepts, Mobility Criterion, Establishing Precision Positions, Plane Four- Bar Linkage, Plane Offset Slider- Crank Linkage, Kinematic Analysis of the Planar Four- Bar Linkage, Dimensional Synthesis of the Planer Four- Bar Linkage: Crank- Angle Coordination, Pole- Force Method.
2. **Springs:** Selection of Spring Materials, Heat Treatment of Springs, Helical Compression Springs, Helical Extension Springs, Helical Torsion Springs, Belleville Spring Washer, Special Spring Washers, Flat Springs, Constant- Force Springs, Torsion Bars, Power Springs, Hot- Wound Springs.
3. **Gearing: Gear Trains:** General Gear Trains, Gear Type Selection, Planetary Gear Trains, Differential Trains, Spur Gears, Force Analysis, Helical Gears, Types, Advantages, Geometry, Bevel and Hypoid Gears, Gear Manufacturing, Worm Gearing, Kinematics, Force Analysis, Strength and Power Rating, Heat Dissipation, Design Standards.
4. **Flywheels and Power Screws:** Flywheel Usage, Sizing the Flywheel, Stress, Flywheels for Energy Storage, Strength and Safety, Power Screws.
5. **Clutches and Brakes:** Types, Uses, Advantages and Characteristics, Torque and Energy, Temperature Considerations, Friction Materials, Torque and Force Analysis of Rim, Band and Cone Brakes and Clutches.
6. **Belt Drives:** Basic Concept of Belt Drives, Flat Belts, V-Belts, Synchronous-Belt Drive.

Module Name: Industrial Engineering

1. **Industrial Engineering and Scientific Management:** Application of Industrial Engineering, Nature of Industrial Engineering, Scientific Management Techniques.
2. **Production, Productivity and the Standard of Living:** The Standard of Living, Requirements for a Minimum Satisfactory Standard Living, Production, Productivity, Factors Influencing Productivity, Work Contents.
3. **Work Study and Human Factors:** Techniques of Work Study, Basic Steps of Work Study, Work Study and Top Management, Work Study and Middle Management, Work Study and the Workers.
4. **Working Environment and Safety:** Occupational Accidents, Industrial Accidents, Good Housekeeping, Lighting and Noise, Environment, Ergonomics, Fatigue in Industry.
5. **Plant Layout and Materials Handling:** The Plant Layout, Types of Layout, Product Layout, Process Layout, Mixed or Grouped Layout, Group Technology Layout, Materials Handling.
6. **Work Simplification:** Selection of Work to be Studied, Recording the Facts, Process Charts, Operation Process Chart, Flow Process Chart, Procedure for Examine Critically.
7. **Movement of Workers in the Plant:** The String Diagram, Procedure of Constructing String Diagram, The Travel Chart, Weighted Travel Chart, Multiple Activity Chart, Man and Machine Process Chart, Multiple Activity Chart, (Gang Process Chart).

- 8. Movement at the Work Place:** The Principles of Motion Economy, Summary on Work Place Layout and Simplification of Movements, The Two Handed Process Chart, Example of a Two Handed Process Chart, Micro Motion Study, Simultaneous Motion Chart.
- 9. Work Measurement:** Objectives and Uses of Time Study, Techniques of Work Measurement, Basic Procedure of Time Study, Techniques of Work Measurement, Time Study Equipment, Breaking an Operation Into Elements, Types of Elements, Rules for Breaking a Job into Elements, Sample Size (Statistical Method), Performance Rating, Scales of Rating, Allowances.
- 10. Time Study Techniques:** Production Study, Work Sampling, Determination of Sample Size, Procedure for Making a Work Sampling Study, Estimation of Standard Time, Synthesis Techniques of Work Measurement, Predetermined Time Standards (PTS), Work Factor System, Methods Time Measurement (MTM) System, Basic Motion Time Study (BMT), Advantages of PTS System.
- 11. Incentives:** Need of Incentive Plans, Day Work Incentive Scheme, Piece Rate Incentive Scheme, Premium Bonus Incentive Scheme, Group Incentives, Special Forms of Incentive Plans.
- 12. Statistical Quality Control:** Statistical Tools is Quality Control, Statistical Concept and Variability, Mean and Spreads, Normal Distribution, Control Charts for Variables (X and R-Charts), Control Limits, Control Charts for Range, Control Charts for Attributes, Number Defective (NP Chart) Chart, Control Chart for Defects, Acceptance Sampling, Operating Characteristic Curve, Design of an Acceptance Plan.