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**SYLLABUS
DIPLOMA IN MECHANICAL ENGINEERING
SEMESTER – IV**

THERMODYNAMICS

Sub. Code: DME 401

Credits: 02

Total Marks: 100

Minimum Pass Marks: 40%

Internal Assessment: 40 Marks

University Examination: 60 Marks

BLOCK I

Unit 1: Basic Concepts and Gas Laws

Thermodynamics; Property: Intensive and Extensive; System: Open, Closed and Isolated; Energy: Internal Energy, Potential Energy, Kinetic Energy; Heat; Work; Specific Heat; Enthalpy; Boyle's Law; Charle's Law; Joule's Law; Characteristics of Gas Equation; Gas Constant; Mol; Universal Gas Constant and Molar Specific Heats.

Unit 2: Laws of Thermodynamics and Processes

Zerth Law of Thermodynamics; First Law of Thermodynamics; Second Law of Thermodynamics; Concept of Entropy; Constant Volume; Constant Pressure; Isothermal, Adiabatic, Polytrophic Processes; Throttling and Free Expansion; Work done during these Processes; Available and Unavailable Energy Effectiveness; Irreversibility in Flow and Non-flow Process.

Unit 3: Formation of Steam and its Properties

Generation of Steam at Constant Pressure; Various Stage of Steam: Wet Steam, Dry Steam, Saturated Steam, Dryness Fraction, Super Heated Steam, Degree of Super Heat; Critical Point, Triple Point; Thermodynamic Properties of Steam: Specific Volume, Specific Enthalpy, Specific Internal Energy, Specific Entropy; Steam Property Diagram: Temperature, Entropy Diagram, Enthalpy- Entropy Diagram; Pressure: Enthalpy Diagram; Heating and Expansion of Steam during Thermodynamic Processes; Change of Internal Energy and Entropy of Steam during Processes; Simple Numerical Problems; Use of Steam Tables and Mollier Charts.

BLOCK II

Unit 4: Steam Generators

Definition of Boiler according to I.B.R; Classification of Boilers; Description and Working of Lancashire, Cochran and Babcock and Wilcox boilers; Comparison of Water Tube and Fire Tube Boilers; Brief Description and Working of Boiler; Mountings and Accessories used in Common Boilers; Special Characteristics of High Pressure Boilers; Structural Details and Working of Lamont, Benson and Schmidt Hartmann Boilers; Introduction to Indian Boiler Act.

Unit 5: Boiler Performance

Actual Evaporation; Equivalent Evaporation; Factor of Evaporation; Boiler Efficiency; Heat Losses in Boiler Plants; Boiler Power; Energy Balance Sheet of Boiler; Simple Numerical Problems.

Unit 6: Vapour Power Cycle

Rankine Cycle; Modified Rankine Cycle; Representation on P-V; T-S and H-S Charts and Efficiency; Simple Numerical Problems.

Suggested Readings:

1. Thermal Engineering, Verma & Gulecha, Khanna Publishers.
2. Thermal Engineering Vol.1, Mathur & Mehta, Tata McGraw-Hill.
3. Thermal Engineering, R.K.Purohit, Laxmi Publishing.
4. Thermal Engineering, R.S. Khurmi, Eurasia Publishing House.
5. Elements of Heat Engines, Vol.1, Patel & Karam Chandani, Khanna Publishers.

Note:

1. Eight questions are to be set. Students will have to attempt five questions in all.
2. Use of non-programmable scientific calculator is allowed in Examination Hall.

**SYLLABUS
DIPLOMA IN MECHANICAL ENGINEERING
SEMESTER – IV**

WORKSHOP TECHNOLOGY

Sub. Code: DME 402

Credits: 02

Total Marks: 100

Minimum Pass Marks: 40%

Internal Assessment: 40 Marks

University Examination: 60 Marks

BLOCK I

Unit 1: Welding

Principle; Classification; Processes; Advantages and Limitations; Industrial Applications; Welding Positions and Techniques; Symbols.

Gas Welding: Principle, Types, Flames and their Applications, Gas Welding Equipment: Gas Welding Torch, Oxy Acetylene Cutting Torch, Blow Pipe, Pressure Regulators, Filler Rods and Fluxes.

Arc Welding: Principle of Operation, Arc Welding Machines and Equipment, A.C. and D.C. Arc Welding, Effect of Polarity, Current Regulation and Voltage Regulation, Electrodes: Classification, B.I.S. Specification and Selection, Flux for Arc Welding.

Other Welding Processes: Resistance Welding: Principle, Advantages, Limitations, Working and Applications of Spot Welding, Seam Welding, Projection Welding and Percussion Welding, Atomic Hydrogen Welding, Shielded Metal Arc Welding, Submerged Arc Welding, Welding Distortion, Welding Defects, Methods of Controlling Welding Defects and Inspection of Welded Joints.

Modern Welding: Methods, Principle of Operation, Advantages, Disadvantages and Applications of, Tungsten Inert Gas (TIG) Welding, Metal Inert Gas (MIG) Welding, Thermit Welding, Electro Slag Welding, Electron Beam Welding, Ultrasonic Welding, Laser Beam Welding, Robotic Welding.

Unit 2: Pattern Making

Types of Pattern, Pattern Material, Pattern Allowances, Pattern Codes as per B.I.S., Introduction to Cores, Core Boxes and Core Materials, Core Making Procedure, Core Prints, Positioning of Cores

Unit 3: Moulding and Casting

Moulding Sand: Properties of Moulding Sand, their Impact and Control of Properties Viz. Permeability, Refractoriness, Adhesiveness, Cohesiveness, Strength, Flow Ability, Collapsibility, Various Types of Moulding, Sand Testing of Moulding Sand.

Mould Making: Types of Moulds, Step Involved in Making a Mould, Molding Boxes, Hand Tools used for Mould Making, Molding Processes: Bench Molding, Floor Molding, Pit Molding

and Machine Molding, Molding Machines Squeeze Machine, Jolt Squeeze Machine and Sand Slinger.

Casting Processes: Charging a Furnace, Melting and Pouring Both Ferrous and Non Ferrous Metals, Cleaning of Castings, Principle, Working and Applications of Die Casting: Hot Chamber and Cold Chamber, Investment and Lost Wax Process,

Centrifugal Casting: Gating and Riser System, Elements of Gating System, Pouring Basin, Sprue, Runner, Gates, Types of Risers, Location of Risers, Directional Solidification

Melting Furnaces: Construction and Working of Pit Furnace, Cupola Furnace, Crucible Furnace: Tilting Type, Electric Furnace.

Casting Defects: Different Types of Casting Defects, Testing of Defects: Radiography, Magnetic Particle Inspection and Ultrasonic Inspection.

Unit 4: Metal Forming Processes

Press Working: Types of Presses, Type of Dies, Selection of Press Die, Die Material Press Operations: Shearing, Piercing, Trimming, Punching, Notching, Shaving, Gearing, Embossing and Stamping.

Forging: Open Die Forging, Closed Die Forging, Press Forging, Upset Forging, Swaging, Up Setters, Roll Forging, Cold and Hot Forging.

Rolling: Elementary Theory of Rolling, Types of Rolling Mills, Thread Rolling, Roll Passes, Rolling Defects and Remedies.

Extrusion and Drawing: Type of Extrusion: Hot and Cold, Direct and Indirect, Pipe Drawing, Tube Drawing and Wire Drawing.

Unit 5: Plastic Processing

Industrial Use of Plastics, Situation where used; Injection Moulding: Principle, Working of Injection Moulding Machine; Compression Moulding: Principle, and Working of Compression Moulding Machine; Potential and Limitations in the Use of Plastics.

Suggested Readings:

1. Workshop Technology, BS Raghuvanshi, Dhanpat Rai and Sons.
2. Elements of Workshop Technology, SK Choudhry and Hajra, Asia Publishing House
3. Manufacturing Technology, M Adithan and A.B. Gupta, Wiley Eastern India Ltd.
4. Welding Engineering, RL Aggarwal and T Manghnani, Khanna Publishers.
5. A Text Book of Production Engineering, PC Sharma, S Chand and Company Ltd.
6. Foundry Technology, KP Sinha and DB Goel, Roorkee Publishing House.
7. A Text Book of Manufacturing Science and Technology, A Manna, Prentice Hall of India.

Note:

1. Eight questions are to be set, at least one question from each unit. Students will have to attempt five questions in all.
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**SYLLABUS
DIPLOMA IN MECHANICAL ENGINEERING
SEMESTER – IV**

INSTRUMENTATION TECHNIQUES

Sub. Code: DME 403

Credits: 02

Total Marks: 100

Minimum Pass Marks: 40%

Internal Assessment: 40 Marks

University Examination: 60 Marks

BLOCK I

Unit 1: Introduction

Definition of Metrology; Standard of Measurement; Types of Errors: Controllable and Random Errors; Precision, Accuracy, Sensitivity, Hysteresis, Response Time, Repeatability and Calibration; Uncertainty of Measurement; Interchangeability; Standardization and Standardizing Organizations.

Unit 2: Linear Measurement

Construction Features and Use of Instruments for Non Precision Linear Measurement: Steel Rule, Calipers, Surface Plate, Angle Plate and V-Block; Construction Features and Use of Instruments for Precision Measurements: Vernier Calipers, Vernier Height and Depth Gauges, Micrometers, Slip Gauges, Indian Standards of Slip Gauges, Sets of Slip Gauges, Use of Slip Gauges, Cylinder Bore Gauges, Feeler and Wire Gauges; Comparators: Characteristics, Uses, Working Principles of Different Types of Comparators: Mechanical, Electrical, Electronics and Pneumatic Comparator.

Unit 3: Angular Measurement

Construction and Use of Instruments for Angular Measurements: Bevel Protector, Sine Bar, Angle Gauges, Clinometers and Angle Decker; Optical Instruments for Angular Measurement, Auto Collimator.

Unit 4: Measurement of Surface Finish

Terminology of Surface Roughness; Concept of Primary **BLOCK I**
Texture and Secondary Texture; Factors Affecting Surface Finish; CLA, RMS and RA Value; Principle and Operation of Stylus Probe Instruments. Tomlinson Surface Meter and Taylor Surface Talysurf; Measurements of Screw threads and Gears.

BLOCK II

Unit 5: Measurement of Screw Threads

Introduction; Measurements of External and Core Diameters, Checking of Pitch and Angle of Threads with Gauges; Effective Diameter Measurement by Three Wire Method; Measurements of Gears (Spur): Measurement of Tooth Thickness, Pitch, Testing of Alignment of Teeth; Profile Projector, Coordinate Measuring Machine (CMM) and Tool Maker's Microscope.

Unit 6: Testing Techniques

Flatness Testing by Optical Flat; NPL Flatness Interferometer and Its Working Principle; Squareness and Circularity Testing using Dial Indicator.

Machine Tool Testing: Alignment Test on Lathe, Drilling Machine and Milling Machine.

Unit 7: Limits, Fits and Tolerances

Definition and Terminology of Limits, Fits and Tolerances; Hole Basis and Shaft Basis Systems; Type of Fits; Limit Gauges; Selection of Fits.

Unit 8: Instrumentation

Various Types of Instruments used for Mechanical Quantities such as Displacement, Velocity, Acceleration, Speed and Torque; Use of Transducers and Electronic Counters, Stroboscope, Vibrating Reeds and Tachometers.

Strain Gauge: Use of Strain Gauge and Load Cells

Suggested Readings:

1. Engineering Metrology, RK Jain; Khanna Publishers.
2. A Text Book of Production Engineering, RC Sharma; S Chand and Company.
3. Metrology Laboratory Manual, M Adithan and R Bahl; NITTTR, Chandigarh.
4. Engineering Metrology, RK Rajput, SK Kataria and Sons.

Note:

1. Eight questions are to be set.. Students will have to attempt five questions in all.
2. Use of non-programmable scientific calculator is allowed in Examination Hall.

**SYLLABUS
DIPLOMA IN MECHANICAL ENGINEERING
SEMESTER – IV**

STRENGTH OF MATERIALS

Sub. Code: DME 404

Credits: 02

Total Marks: 100

Minimum Pass Marks: 40%

Internal Assessment: 40 Marks

University Examination: 60 Marks

BLOCK I

Unit 1: Stresses and Strains

Concept of Load; Stresses and Strain; Tensile Compressive & Shear Stresses and Strains; Concept of Elasticity; Elastic Limit and Limit of Proportionality; Hook's Law; Young Modulus of Elasticity; Nominal Stress; Yield Point; Plastic Stage; Strain Hardening; Ultimate Strength and Breaking Stress; Percentage Elongation; Proof Stress and Working Stress; Factor of Safety; Shear Modulus; Strain Energy due to Direct Stresses; Proof Resilience and Modulus of Resilience; Stresses due to Gradual, Sudden and Failing Load; Longitudinal and Circumferential Stresses in Seamless Thin Walled Cylindrical Shells. (Derivation of these Formulae not required).

Unit 2: Moment of Inertia

Concept of Moment of Inertia and Second Moment of Area; Radius of Gyration; Second Moment of Area of Common Geometrical Sections: Rectangle, Triangle, Circle (without Derivation); Second Moment of Area for L, T and I Section; Section Modulus.

Unit 3: Beams and Bending Stress

Bending and Shearing Force: Concept of Beam and form of Loading; Concept of End Supports, Roller, Hinged and Fixed; Concept of Bending Moment and Shearing Force; B.M. and S.F. Diagram for Cantilever and Simply Supported Beams with and without Overhang Subjected to Concentrated and U.D.L.

Bending Stresses: Concept of Bending Stresses; Theory of Simple Bending; Use of the Equation $f/y = M/I + E/R$; Concept of Moment of Resistance; Bending Stress Diagram; Calculation of Maximum Bending Stress in Beams of Rectangular, Circular, I and T Section; Permissible Bending Stress; Section Modulus for Rectangular, Circular and Symmetrical I Section.

Laminated Spring (Semi Elliptical Type only): Determination of Number of Plates; Maximum Bending Stress and Deflection.

Combined Direct and Bending Stresses: Simple Cases of Short Columns of Uniform Section Subject to Eccentric Loading with Stress Diagram.

BLOCK II

Unit 4: Columns

Concept of Column; Modes of Failure; Types of Columns; Buckling Load; Crushing Load; Factors Effecting Strength of a Column; End Restraints; Strength of Column by Euler Formula without Derivation; Rankine Gourdan Formula (without Derivation).

Unit 5: Torsion

Concept of Torsion; Difference between Torque and Torsion; Use of Torque Equation for Circular Shaft; Comparison between Solid and Hollow Shaft with Regard to their Strength and Weight; Power Transmitted by Shaft; Concept of Mean and Maximum Torque.

Unit 6: Helical Springs

Closed Coil Helical Springs Subjected to Axial Load and Impact Load; Stress Deformation; Stiffness and Angle of Twist and Strain Energy; Proof Resilience.

Suggested Readings:

1. Strength of Materials & Theory of Structures, B.C.Punmia et.al, Lakshmi Publications.
2. Strength of Materials, S. Ramamurtham, Dhanpatrai & Sons.
3. Strength of Materials, Junarkar, Charator Publications.
4. Strength of Materials, R.S. Khurmi, S Chand Publications.
5. Strength of Materials, Gurcharan, Sandhu Books.

Note:

1. Eight questions are to be set, at least one question from each unit. Students will have to attempt five questions in all.
2. Use of non-programmable scientific calculator is allowed in Examination Hall.

**SYLLABUS
DIPLOMA IN MECHANICAL ENGINEERING
SEMESTER – IV**

MECHANICAL ENGINEERING DRAWING II

Sub. Code: DME 405

Credits: 02

Total Marks: 100

Minimum Pass Marks: 40%

Internal Assessment: 40 Marks

University Examination: 60 Marks

BLOCK I

Unit 1: Office Equipments

Introduction to drawing office equipments through a visit to modern drawing office of an industry.

Unit 2: Drilling Jig

Drilling Jig: Detail and Assembly.

2 sheets

Unit 3: Vices

Machine Vice: Detailed and Assembly Drawing.

3 sheets

Unit 4: I.C. Engine Parts

Piston;

Connecting Rod (Assembly Drawing);

Crankshaft and Flywheel Assembly.

3 sheets

Unit 5: Boiler Parts

Stop Valve (Assembled Drawing)

Blow Off Cock. (Assembled Drawing)

2 sheets

Unit 6: Mechanical Screw Jack

Mechanical Screw Jack: Assembled Drawing

1 sheet

Unit 7: Cams

4 sheets

Types of cams and followers (Theoretical);

Profile of cams for imparting following motions with knife edge and roller followers:

- a) Uniform motion
- b) Simple Harmonic Motion
- c) Uniformity accelerated and retarded motion.

Unit 8: Gears

4 sheets

Nomenclature of Gears and Conventional Representation;
Drawing the Actual Profile of Involute Teeth of Spur Gear by Different Methods.

Suggested Readings:

1. Machine Drawing, P.S. Gill; S.K. Kataria & Sons.
2. A Text Book of Machine Drawing, RK Dhawan, S.Chand & Co. Ltd.
3. Machine Drawing, N.D Bhatt, Charotar Book Depot, Anand.

Note:

1. 1st angle projection should be followed. 20% of the drawings may be made using 3rd angle projection.
2. SP- 46-1998 should be followed. The drawings should include dimensions with tolerance wherever necessary and material as per BIS/ISO specifications
3. Eight questions are to be set. Students will have to attempt five questions in all.
4. Use of non-programmable scientific calculator is allowed in Examination Hall.