

Faculty of Engineering & Technology

P.K .University

Shivpuri (MP)



Evaluation Scheme & Syllabus for
(Department of Mechanical Engg.)

Diploma-(Mechanical Engg.)
(IV Semester)

(Effective from Session 2025-26)

EVALUATION SCHEME

DIPLOMA MECHANICAL ENGG. (IV SEMESTER)

Study And Evaluation Scheme For Diploma Mechanical Engineering												
SEMESTER-IV												
SUBJECT CODE	SUBJECTS NAME	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME						Total Marks of internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
DMECHME401	Mechanics of Solids	4	0	0	4	30	-	30	70	-	70	100
DHYDRME402	Hydraulics and Hydraulics Machines	4	0	0	4	30	-	30	70	-	70	100
DELECME403	Electrical Technology & Electronics	4	0	0	4	30	-	30	70	-	70	100
DMECHME404	Mechanical Engg. Drawing	4	0	0	4	30	-	30	70	-	70	100
DHYDRME405	Hydraulics & Hydraulics Machines Lab	0	0	2	1	-	25	25		25	25	50
DMECHME406	Mechanics of Solids Lab	0	0	2	1	-	25	25		25	25	50
DELECME407	Electrical Technology & Electronics Lab	0	0	2	1	-	25	25		25	25	50
Total		16	0	6	19	120	75	195	280	75	355	550

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L	T	P
4	0	0

DMECHME401
MECHANICS OF SOLIDS

1. INTRODUCTION TO MATERIAL PROPERTIES: Mechanical properties of materials such as elasticity, plasticity, ductility, brittleness, toughness, hardness, tenacity, fatigue, malleability, stiffness. Elastic bodies, plastic bodies and rigid bodies, deformation.

2. STRESSES AND STRAIN: Force, its definition and types, units, different types of loads. Definition of stress and strain, axial loading, different types of stresses and strains, tensile and compressive stress and strain, elastic limit, Hooke's law, stress-strain curve for ductile and brittle material, salient features of stress-strain curve. Young's modulus of elasticity. Factor of safety, safe stress, ultimate stress. Stress and strain in straight, stepped bars and taper bar of circular cross section, determination of stress and elongation of a bolt in a bolted joint when subjected to direct external load only. Temperature stresses for single section.

Stress and strain on composite section under axial loading, stress and strain due to temperature variations in homogeneous and composite bars and metallic types. Shear load, shear stress and strain, modulus of rigidity, lateral strain, Poisson's ratio, Volumetric strain, bulk modulus relation between modulus of elasticity, modulus of rigidity and bulk modulus.

Compound stresses- Introduction, stresses due to different types of load, Principle planes and principal stresses, Mohr's stress circle, Combined bending and torsion.

3. SHEAR FORCE AND BENDING MOMENT: Shear force and bending moment for concentrated and uniformly distributed loads on simply supported beams, cantilever and overhanging beam. Shear force and bending moment diagrams. Relationship between shear force and bending moment. Point of contra flexure, calculations for finding the position of contra flexure. Condition for maximum bending moment.

4. THEORY OF SIMPLE BENDING: Simple bending, examples of components subjected to bending such as beam, axle, carriage spring etc.. Assumptions made in the theory of simple bending in the derivation of bending formula. Section Modulus Definition of neutral surface and neutral axis and calculation of bending stresses at different layers from the neutral surface for beam of different sections, Pure bending, Concept of Moment of Inertia and case study

5. STRAIN ENERGY: Meaning of strain energy and resilience. Derivation of formula for resilience of a uniform bar in tension. Proof resilience, modulus of resilience, suddenly applied load, Impact or shock load. Strain energy in a material subjected to uniaxial tension and uniform shear stress. General expression for total strain energy of simple beam subjected to simple bending.

6. TORSION: Strength of solid and hollow circular shafts. Derivation of torsion equation. Polar modulus of section. Advantages of a hollow shafts over solid shaft. Comparison of weights

of solid

and hollow shafts for same strength. Horse power transmitted. Calculation of shaft diameter for a given horse power.

7. Slopes and Deflections of Beams: Definition of slope and deflection, sign convention .Circular bending. Calculation of maximum slope and deflection for the following standard cases by double integration or moment area method.

(1) Cantilever having point load at the free end. Cantilever having point load at any point of the span. Cantilever with uniformly distributed load over the entire span Cantilever having U.D.L. over part of the span from free end Cantilever having U.D.L. over a part of span from fixed end (2) Simply supported beam with point load at centre of the span. Simply supported beam with U.D. load over entire span.

8. COLUMNS AND STRUTS: Definition of long column, short column and slenderness ratio. Equivalent length, Critical load, Collapsing load, End conditions of columns. Application of Euler's and Rankin's formula . Simple numerical problems.

9. THICK AND THIN CYLINDRICAL & SPHERICAL SHELLS: Differentiation between thick and thin shells, cylindrical and spherical shells, thin spherical and cylindrical shells subjected to internal pressure, longitudinal stresses, circumferential or hoop stresses. Longitudinal, circumferential and volumetric strains. Changes in the dimensions and volume of a thin shell subjected to internal fluid pressure.

Books and References:

1. Mechanics of Materials by Hibbeler, Pearson.
2. Mechanics of material by Gere, Cengage Learning
3. Mechanics of Materials by Beer, Jhonston, DEwolf and Mazurek, MCGRAW HILL INDIA
4. Strength of Materials by Pytel and Singer, Harper Collins
5. Strength of Materials by Ryder, Macmillan.
6. Strength of Materials by Timoshenko and Youngs, East West Press.
7. Introduction to Solid Mechanics by Shames, Pearson
8. Mechanics of material by Pytel, Cengage Learning

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DHYDRME402
HYDRAULICS & HYDRAULICS MACHINE

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DETAILED CONTENTS

1. INTRODUCTION: Fluid, Fluid Mechanics, Hydraulics, Hydro-statics, Hydro dynamics, Ideal fluid.
2. HYDROSTATICS: Properties of fluids, Pressure and depth relationship, Hydrostatic pressure, pascal's law, total pressure on flat surfaces, Centre of pressure on flat surfaces. (Simple Numerical Problems)
3. BUOYANCY : Bouyancy, Condition of equilibrium of a floating body, Meta centre and Meta centric height. (Simple Numerical Problems)
4. FLUID FLOW: Different types of flow, Reynold's number, Equation of continuity and its applications. (Simple Numerical Problems)
5. ENERGY AND MOMENTUM EQUATION: Types of energies, Energy equation and its application. Bernoulli's theorem flow measurement instruments where energy equation is used e.g. Venturimeter, Orifice meter, Flow nozzle, pitot tube, Prandtl tube. (Simple Numerical Problems)
6. ORIFICES: Flow through orifices, Co-efficient of contraction, Co-efficient of velocity, Co-efficient of discharge, Large vertical orifices, Drowned orifice, time of emptying a rectangular and circular tanks with flat bottoms. (Simple Numerical Problems)
7. NOTCHES & WEIRS: Different types of notches, Measurement of discharge over rectangular notch, V-notch, Francis and Bazin's formula for rectangular weirs. Submerged weirs, Broad crested weirs. (Simple Numerical Problems)
8. FLOW THROUGH PIPES AND CHANNELS: Losses in pipe flow due to friction, sudden enlargement, contraction and bends, Elbow & Tee. (Simple Numerical Problems)
9. CHANNELS: Characteristics of flow, Uniform flow through channels. Rectangular and Trapezoidal channels, Application of Chezy's, Manning and Kutter's formula. Most economical channel sections of rectangular and trapezoidal shapes. (Simple Numerical Problems)
10. HYDRAULIC MACHINES: Impulse and reaction turbines, Principle and working of Pelton wheel, Francis and Kaplan turbines with simple line diagrams, their classification, construction, working, operational problems. Centrifugal and reciprocating pumps, Hydraulic press and Hydraulic Jack.

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DELECME403
ELECTRICAL TECHNOLOGY & ELECTRONICS

1. ELECTRIC INDUCTION:

Faraday's Laws of electromagnetic induction. Self and mutual induction. Statically and Dynamically induced e.m.f., Lenz's law. Fleming's left hand and right hand rule.

2. A. C. THEORY:

Production of alternating e.m.f. Definition of cycle, Frequency, Amplitude, Time period, Instantaneous, Average, R.M.S. maximum values of sinusoidal wave. Form factor, peak factor. Representation of a sinusoidal quantity by a mathematical expression and phasor, phase and phase difference, Relationship of voltage and current for pure resistance, pure inductance and pure capacitive reactance, impedance. Solution and phasor diagrams of simple R.L.C. series and parallel circuits. Active and reactive power. Significance of P.F.

3. THREE PHASE CIRCUITS:

Production of Three phase voltage, advantages of three phase supply. Concept of star and delta connections. Relationship between phase and line values of currents and voltages, Power in three phase circuits, simple numerical problems.

4. MEASUREMENT & MEASURING INSTRUMENTS:

- (i) Primary and secondary instruments-Indicating, Recording and Integrated instruments.
- (ii) Working principle and construction of the following instruments.
 - (a) Ammeter & Voltmeter (Moving coil & Moving Iron). Extension of their ranges.
 - (b) Dynamometer type wattmeter.
 - (c) Single Phase A. C. Energy Meter.
- (iii) Measurement of power in a single phase and three phase circuits by wattmeter, Use of Digital multimeter for measurement of voltage, Current and testing of devices.

5. ELECTRONICS:

Basic idea of semi conductors P & N type. Semi conductor diodes, Zener diodes and their applications in rectifiers. Transistors-PNP and NPN-their characteristics and uses as an amplifier (Brief description only). Principle characteristics and application of SCR. Devices like UJT, FET, DIAC, TRIAC (Brief introduction, Introduction to operational amplifier, Introduction to basic logic gates and microprocessors.

6. D. C. MACHINES:

A. C. Generator:

Working principle, Constructional details, e.m.f. equation, Types of generators and their

applications. D. C. Motor: Working principle, Back e.m.f., Types of D. C. motor and elementary idea of their characteristics. Torque equation, Methods of speed control (Description Only).

7. TRANSFORMERS:

Working principle and constructional details of a single phase and 3phase transformers, e.m.f. equation, Losses and efficiency, Cooling of transformers, Elementary idea of auto transformers and welding transformers.

8. SYNCHRONOUS MACHINES:

(a) Alternators:

Working principle, Types of alternators, Constructional details, E.M.F. equation, Condition for parallel operation.

(b) Synchronous Motors:

Working principle, Constructional details, Vector diagram, Effect of excitation on armature current and power factor, Synchronous condenser.

9. INDUCTION MOTORS:

(a) Three Phase Induction Motors:

Working principle and constructional details-Types of induction motors-Slipring and Squirrel cage. Slip in induction motors. Speed torque characteristic, Starting and speed control. Application of induction motors in industry. General faults and their remedies.

(b) Single Phase Induction Motors:

Working principle and constructional details and application of single phase motors (Split phase, Capacitor start and Run Motor). A. C. series motors, General faults and their remedies.

10. ELECTRO HEATING:

Types of electro heating. Brief description of resistance ovens and induction furnace and core furnaces.

11. ELECTROPLATING:

Importance of electroplating, Principle of electroplating and equipment used. Processes used in electroplating, Anodising

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DMECHME404
Mechanical Engg. Drawing

1. GENERAL CONCEPT OF MACHINE DRAWING

- (a) Views and sections (Full and half), dimensioning Technique –Uni-direction and aligned practice conventions as per latest code of practice for general engineering drawing.
- (b) General concept of IS working drawing symbols for
 - (i) Welding & Riveting
 - (ii) Screws & Screw threads
 - (iii) Surface Finish Marks
 - (iv) Limits, Fits & Tolerances

2. FAMILIARIZATION WITH AUTO CAD COMMANDS: etc.

- What is CAD, Different type of CAD software available, Advantages of using CAD, AUTOCAD graphical user interface.
- Setting up drawing environment : Setting units, Drawing limits, Snap, Opening and Saving a drawing, Setting drafting properties, Different co-ordinate system used.
 - Commands and their aliases, Different methods to start a command.
 - Selecting object, removing object from selection set, Editing with grips, Editing object properties. - Use of draw commands
 - Line, Arc, Circle, Polygon, Polygon, Polline, rectangle, Ellipse, construction line, Spline. - Use of modify commands
 - Erase, offset, Move, Copy, Mirror, Fillet, Chamfer, Array, Scale, Stretch, rotate, Explode, lengthen
 - Creating 2D objects using Draw and Modify commands, Use of Hatch commands.
 - Controlling the drawings display; Zoom, PAN, view ports, Aerial view. - Drawing with precision : Adjusting snap and Grid alignment.
 - Use of Tools Menu bar for calculating distance, angle, area, ID points, Mass using inquiry command, Quick select.
 - Adding text to drawing, Creating dimension.
 - Use of UCS, Alignment of UCS, Move UCS, Orthographic UCS. - Creating 3 D objects using region, boundary, 3D Polyline, Extrude, revolve feature.
 - Use of solid 3D edit features, Shell, Imprint, Separate, Section, Boolean functions like Union, Subtract and Intersect, Extrude faces, Move faces, Delete face, Offset faces, Copy faces and colour faces commands.
 - To show the section - Use of slice, Section commands.
 - Rendering and imaging, Produce hard copies.

3. Sectioned View of

- (i) Foundation bolts (ii) Pipe Joints - Flanged, Socket, Hydraulic joint and Union joint.

4. Assembly Drawing of

- I.** Knuckle joint- Part drawing, Solid Modeling, Assembly and Sectioning.
- II.** Protective type flange coupling- Part drawing, Solid Modeling, Assembly and Sectioning.
- III.** Bench vice - Part drawing, Solid Modeling, Assembly and Sectioning.

5. A Assembly drawing from detail and vice versa.

- (i) Tail stock of Lathe machine
- (ii) Screw jack
- (iii) Drilling Jig
 - B. Assembly and Disassembly Drawings Plummer block Footstep bearings Couplings etc. ,Riveted & Welded Joints Screw and form of screw thread
- 6. Spur gear profile drawing from given data
- 7. Free hand sketching of
 - (i) Pipe fittings-Such as-Elbows-Reducers, T-Cross and Bibcock.
 - (ii) I. C. engine piston, Simple bearing, Cottor and Knuckle joint, pulleys and flywheel-Sectioned views.
 - (iii) Cutting tools of Lathe machine, shaper and common milling cutters.
 - (iv) Gear puller and C-clamp
 - (v) Sketching of ortho graphics views from isometric views are practiced.

Books and References:

- 1. Fundamentals of Machine Drawing by Sadhu Singh & Shah, PHI
- 2. Engineering Drawing by Bhat, & Panchal, Charotar Publishing House
- 3. Machine Drawing with AutoCAD by Pohit and Ghosh, Pearson
- 4. Machine Drawing-KL Narayana, P Kannaiah, KV Reddy, New Age
- 5. Machine Drawing, N. Siddeshwar, P Kannaiah, VVS Shastry, Tata McGraw Hill
- 6. Engineering Drawing, Pathak, Wiley
- 7. Textbook of Machine Drawing, K C John, PHI
- 8. AutoCAD 2014 for Engineers & Designers, Bhatt, WILEY
- 9. Engineering Graphics with AutoCAD, Bethune, PHI

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DHYDRME405
Hydraulics & Hydraulics Machines Lab

Demonstration of the following for study & sketch:

1. Piezometer tube, Mechanical flow meter, Manometers, Pressure gauge.
 2. Hydraulic ram, press and jack.
 3. Pelton wheel and Francis turbine or their model.
 4. Centrifugal and Reciprocating pumps.
- B. Performance Experiments :-**
5. Measurement of discharge over notches and its verification.
 6. To verify Bernoulli's theorem.
 7. To determine coefficient of discharge of a Venturimeter.
 9. To determine coefficient of contraction, coefficient of velocity and coefficient of discharge for a given orifice.
 9. To determine the loss of head of water due to friction in a water pipe line.
 10. To study performance
 - i. Pelton Wheel
 - ii. Francis Turbine.
 11. To study the performance of a:
 - i. Centrifugal Pump
 - ii. Reciprocating Pump.
 - iii. Gear Pump
 12. To measure the velocity of water flow in a open channel by a current meter.

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DMECHME406
Mechanics of Solids Lab

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List of Practicals:

1. To find the shear force at a given section of simply supported beam for different loading.
2. To find the value of 'E' for a steel beam by method of deflection for different loads.
3. To determine the Max-Fibre stress in X-section of simply supported beam with concentrated loads and to find the neutral axis of the section.
4. To determine the ultimate tensile strength, its modulus of Elasticity, stress at yield point, % Elongation and contraction in x-sectional area of a specimen by U.T.M. through necking phenomenon.
5. To determine the ultimate crushing strength of materials like steel and copper and compare their strength.
6. To determine Rock Well Hardness No. Brinell Hardness No. of a sample.
7. To estimate the Shock Resistance of different qualities of materials by Izod's test and charpy test.
8. To determine the bending moment at a given section of a simply supported beam for different loading.
9. To determine the various parameters of Helical coil spring.
10. To determine the angle of twist for a given torque by Torsion apparatus and to plot a graph between torque and angle of twist.
11. Study of diamond polishing apparatus.
12. Study metallurgical microscope.
13. (a) To prepare specimens for microscope examination (For Polishing and etching).
(b) To examine the microstructure of the above specimens under metallurgical microscope.
(c) To know composition of alloy steel by spectroscopic steeloscope.
(d) To know carbon in steel by carbon steel estimation apparatus.
14. Preparation of specimens and study of microstructure of eight given metals and alloys on metallurgical microscope.
 - i. Brass.
 - ii. Bronze.

iii. Grey Cast Iron.

iv. Malleable Cast Iron.

v. Low Carbon Steel.

vi. High Carbon Steel.

vii. High Speed Steel.

viii. Bearing Steel.

15. To perform heat treatment process on materials of known carbon percentage -

1. Annealing 2. Normalising 3. Case Hardening

16. Mini Project

i. Collect samples of heat insulating materials

ii. Collect samples of various steels and cast iron.

iii. Collect sample of Non-Ferrous alloys.

iv. Collect samples of Non-Metallic engineering materials

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0	0	2

***DELECME407
ELECTRICAL TECHNOLOGY & ELECTRONICS LAB***

1. To change the speed and direction of rotation of d.c. shunt motor by
 - (a) Armature control method.
 - (b) Field control method.
2. To change the speed and direction of rotation of d.c. compound motor by
 - (a) Armature control method.
 - (b) Field control method.
3. To measure the terminal voltage with variation of load current of
 - (a) D.C. shunt generator.
 - (b) D.C. compound generator.
4. To perform load test on a single phase transformer and determine its efficiency.
5. To start and run a induction motor by
 - (a) Star Delta Starter.
 - (b) Auto Transformer Starter.
6. To measure slip of an induction motor by direct loading.
7. To start and change the direction of rotation of an induction motor.
8. To measure transformation ratio of a single phase transformer.
9. To measure power and P.F. in a single phase circuit by Ammeter, Voltmeter and Wattmeter.
10. To measure power and P.F. in a 3 phase/A.C. circuit by two wattmeter method.
11. To calibrate a single phase energy meter at different P.F.'s and different loads.
12. To locate the faults in an electrical machine by a megger.
13. To connect a fluorescent tube and note its starting and running current.
14. To draw characteristics of Silicon Controlled Rectifier (SCR).
15. Testing of electrical devices - Zener, Diode, Transistor, FET, UJT, SCR.
16. Use of operational amplifier as adder, subtractor, comparator, differentiator and integrators.