Faculty of Engineering and Technology

P.K. University

Shivpuri (MP)

Evaluation Scheme & Syllabus

Diploma in Production Engineering

(IV Semester)

(Effective from session 2025-26)

EVALUATION SCHEME

DIPLOMA –PRODUCTION ENGINEERING (4th SEM)

Study And Evaluation Scheme For Diploma Production Engineering												
YEAR -2ND /SEMESTER -4TH												
SUBJECT CODE	SUBJECTS NAME	STUDY SCHEME Periods/Week			Credits	MARKSINEVALUATIONSCHEME						Total Marks of Internal & External
						INTERNAL ASSESSMET			EXTERNAL ASSESSMENT			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	Int +Ext
DMECHPE401	Mechanics of Solids	4	0	0	4	30	-	30	70	-	70	100
DHYDRPE402	Hydraulics & Hydraulic Machines	4	0	0	4	30	-	30	70	-	70	100
DINDUPE403	Industrial Engineering and Management	4	0	0	4	30	-	30	70	-	70	100
DPOWEPE404	Power Plant Engineering	4	0	0	4	30	-	30	70	-	70	100
DHYDRPE405	Hydraulics & Hydraulic Machines Lab	0	0	2	1	-	25	25	-	25	25	50
DMECHPE406	Mechanics of Solids Lab	0	0	2	1	-	25	25	-	25	25	50
	Total	16	0	6	18	120	50	170	280	50	330	500

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L	T	P
4	0	0

DMECHPE401: 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 right 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 modules 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 tyres. 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. Cantelever having point load at any point of the span. Cantitilever with uniformly distributed load over the entire span Cantilever having U.D.L. over part of the span from free end Cantelever 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, Collasping load, End conditions of columns. Application of Euler's and Rankin’s formula . Simple numerical problems.

9. **THICK AND THIN CYLINDERICAL & 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

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DHYDRPE402:HYDRAULICS & HYDRAULIC MACHINES

DETAILED CONTENTS

1. INTRODUCATION: 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. Bernoulle'stheorem flow measurement instruments where energy equation is used e.g. Venturimeter, Orifice meter, Flow nozzle, pitot tube, Prandtle 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 Brazin'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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DINDUPE403:INDUSTRIAL ENGINEERING AND MANAGEMENT

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 Quqntity (EOQ) Problems, Supply Chain.

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.

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DPOWEPE404: POWER PLANT ENGINEERING

UNIT I:

Power plants – types and classification based on energy sources. Coal based Thermal Power Plants: Basic Rankine cycle and its modifications; Layout of modern coal power plant; Super critical boilers, FBC boilers; Turbines, condensers, steam and heating rates; Subsystems of thermal power plants; Fuel and ash handling; Draught system; Feed water treatment; Binary cycles and cogeneration systems

UNIT II:

Gas Turbine and Combined Cycle Power Plants: Brayton cycle analysis and optimization; Components of gas turbine power plants; Combined cycle power plants; Integrated Gasifier based Combined Cycle (IGCC) systems.

UNIT III:

Nuclear Power Plants: Basics of nuclear energy conversion; Layout and subsystems of nuclear power plants; Boiling Water Reactor (BWR); Pressurized Water Reactor (PWR); CANDU Reactor; Pressurized Heavy Water Reactor (PHWR); Fast Breeder Reactors (FBR); Gas cooled and liquid metal cooled reactors; Safety measures for nuclear power plants.

UNIT IV: Hydroelectric Power Plants: Classification; Typical layout and components. Renewable Power Systems: Principles of wind, tidal, solar photo-voltaic, solar thermal, geothermal, biogas and fuel cell power systems.

UNIT V: Energy Economics and Environment: Economic and environmental issues; Power tariffs; Load distribution parameters; Load curve; Capital and operating cost of different power plant. Pollution Control Technologies including waste disposal options for coal and nuclear plants.

REFERENCE BOOKS/ ONLINE RESOURCES:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.

2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.

3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

4. https://onlinecourses.nptel.ac.in/noc22_me73/preview.

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DHYDRPE405: HYDRAULICS & HYDRAULIC 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. Centifugal and Reciprocating pumps.

B. Performance Experiments :-

5. Measurement of discharge over notches and its verification.
6. To verify Bernaulli'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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DMECHPE406: MECHANICS OF SOLIDS LAB

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 appratus 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 andetching).

(b) To examine the microstructure of the above specimens under metallurgical microscope.

(c) To know composition of alloy steel by spebber steeloscope.

(d) To know carbon in steel by carbon steel estimation apparatus.

14. Perparation 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-Metalic enginering materials