

Roll No:

B.TECH.

**(SEM. II) THEORY EXAMINATION 2025-26
FUNDAMENTALS OF MECHANICAL ENGINEERING**

TIME: 3 HRS

M.MARKS: 70

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt all questions in brief.

02 x 7 = 14

Q no.	Question	CO	Level
a.	Explain the following terms in the context of the stress-strain curve for mild steel: elastic limit, limit of proportionality, upper and lower yield point.	CO-1	K1
b.	Define the scavenging process. Briefly explain its importance in internal combustion engines.	CO-2	K1
c.	Define and differentiate clearly between wet bulb temperature and thermodynamic wet bulb temperature.	CO-3	K1
d.	Why is a reciprocating pump called a positive displacement pump?	CO-4	K1
e.	What is meant by 'Constant Power Speed Ratio' as applied to an electric motor? Explain.	CO-5	K1
f.	What do you mean by point of contraflexure? Is the point of contraflexure and the point of inflexion different?	CO-1	K2
g.	Mention the material used for the following components of an IC engine: cylinder block, piston, piston ring, connecting rod, crank and crankshaft, valves, and flywheel.	CO-2	K2

SECTION B

2. Attempt any three of the following:

07 x 3 = 21

Q no.	Question	CO	Level
a.	State Varignon's theorem. Discuss its applicability to three-dimensional force systems, the assumptions made regarding moment arms, and whether it can be applied to deformable bodies.	CO-1	K3
b.	Explain with suitable sketches, the working of a four-stroke CI engine.	CO-2	K3
c.	(i) Draw a neat diagram of a window air conditioner. (ii) Define 'Effective Temperature'. Explain its utility in comfort air conditioning.	CO-3	K3
d.	A hydraulic lift consists of a 25 cm diameter ram which slides in a 25.015 cm diameter, the annular space being filled with oil having a kinematic viscosity of 0.025 cm ² /sec and specific gravity of 0.85. If the rate of travel of the ram is 9.15 m/min, find the frictional resistance when 3.05 m of the ram is engaged in the cylinder.	CO-4	K3
e.	Describe the principle of operation of a piezo-electric transducer. Identify the input and output of the system. Mention some natural and synthetic materials that exhibit the piezo-electric effect.	CO-5	K3

SECTION C

3. Attempt any one part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	A bar of 24 mm in diameter and 400 mm in length is acted upon by an axial load of 38 kN. The elongation of the bar and the change in diameter are measured as 0.165 mm and 0.0031 mm, respectively. Determine: (i) the Poisson's ratio (ii) the values of the three moduli	CO-1	K3
b.	A cantilever has a distributed load with linearly varying intensity, zero at the fixed end, and w per meter at the free end. Draw the shear force and bending moment diagrams.	CO-1	K3



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4. Attempt any one part of the following:**07 x 1 = 07**

Q no.	Question	CO	Level
a.	Give a neat sketch of the theoretical and actual p-V diagrams for a four-stroke petrol engine. Describe briefly the factors which accounts for the deviations between these two plots.	CO-2	K3
b.	Why is an Energy Management Control System (EMCS) required in a Hybrid Electric Vehicle? Do you think an elaborate energy management system similar to that applied to a hybrid vehicle is required in an electric vehicle? Explain.	CO-2	K3

5. Attempt any one part of the following:**07 x 1 = 07**

Q no.	Question	CO	Level
a.	A reversed Carnot cycle is used for cooling in summer, maintained at 5°C when the ambient temperature is 40°C. The same cycle is used for heating in winter at 55°C when the ambient temperature is 15°C. Assuming a 5°C temperature difference in the heat exchanger that exchanges heat with the surroundings, find: (i) the C.O.P. for cooling and heating cycles. (ii) If water at 30°C is used as cooling medium with 3°C temperature difference for summer air conditioning, what will be Carnot COP? (iii) The power consumption per ton of refrigeration in each case.	CO-3	K3
b.	Describe in brief the principles and processes involved in the following methods of production of low temperatures: (i) Irreversible adiabatic expansion (throttling) of a real gas (ii) Thermoelectric cooling (iii) Adiabatic demagnetization	CO-3	K3

6. Attempt any one part of the following:**07 x 1 = 07**

Q no.	Question	CO	Level
a.	Sketch the Propeller/Kaplan turbine. Name the various components and state their functions in brief.	CO-4	K3
b.	(A) Define the following set of liquid properties: (i) surface tension and capillarity, (ii) dynamic viscosity and kinematic viscosity (B) A diver is working at a depth of 20 m below the surface of sea water (sp. wt. = 10 kN/m ³). Calculate the pressure intensity at this depth. What would be the absolute pressure if the barometer reads 760 mm of mercury column at sea level?	CO-4	K3

7. Attempt any one part of the following:**07 x 1 = 07**

Q no.	Question	CO	Level
a.	(i) Explain briefly bonded and unbonded strain gauges. Which of these two is finding wide industrial applications? (ii) What is the purpose of the proving ring? Draw a neat sketch of the proving ring.	CO-5	K3
b.	(A) Explain clearly the following: (i) Accuracy and Precision (ii) Repeatability and Reproducibility (B) Explain clearly the laws of thermocouples. Mention the commonly used industrial name of any two thermocouples, mentioning the temperature range.	CO-5	K3