

11N509

Roll No. _____

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B. Tech. I - Sem. (New Scheme) (Main) Exam., May - 2023

All Branch

1FY2 - 09 Elements of Mechanical Engineering
Common to all Branches

Time: 3 Hours

Maximum Marks: 70

Instructions to Candidates:

Part - A: Short answer questions (up to 25 words) 10×2 marks = 20 marks.
All ten questions are compulsory.

Part - B: Analytical/Problem solving questions 5×4 marks = 20 marks.
Candidates have to answer five questions out of seven.

Part - C: Descriptive/Analytical/Problem Solving /Design questions 3×10 marks = 30 marks. Candidates have to answer three questions out of five.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL

2. NIL

PART - A

Q.1 Give the limitations of the first law of thermodynamics.

Q.2 Differentiate between path and point functions.

Q.3 Define one ton of refrigeration.

Q.4 Classify engineering materials.

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- Q.5 Draw the P.V. diagram of a simple vapor compression refrigeration cycle.
- Q.6 What is the range of compression ratio for S.I. and diesel engines?
- Q.7 What is meant by the calorific value of a fuel?
- Q.8 What are the defects in welds?
- Q.9 Define cold working of metals.
- Q.10 State Carnot theorem.

PART – B

- Q.1 An irreversible heat engine extracts heat from a high – temperature source at a rate of 100 kW and rejects heat to a sink at a rate of 50 kW. The entire work output of the heat engine is used to drive a reversible heat pump operating between a set of independent isothermal heat reservoirs at 17°C and 75°C. What is the rate (in kW) at which the heat pump delivers heat to its high-temperature sink?
- Q.2 Differentiate between two-stroke and four-stroke I.C. engines.
- Q.3 Explain turbocharging and supercharging in S.I. engines.
- Q.4 Mention the various processes in the diesel cycle and dual cycle.
- Q.5 Why is the Brayton cycle used in gas turbines?
- Q.6 Explain the gas welding process.
- Q.7 Write short notes on ductility, annealing and toughness.

PART - C

- Q.1 (i) A heat pump operates on a Carnot heat pump cycle with a C.O.P. of 8.7. It keeps a space at 24°C by consuming 2.15 kW of power. Determine the temperature of the reservoir from which the heat is absorbed and the heating load provided by the heat pump.
- (ii) An inventor claims to have developed a refrigeration system that removes heat from the closed region at -12°C and transfers it to the surrounding air at 25°C while maintaining a C.O.P. of 6.5 . Is this claim reasonable? Explain.
- Q.2 A Carnot refrigerator system has a working temperature of -30°C and 40°C . What is the maximum C.O.P. possible? If the actual C.O.P. is 75% of maximum, calculate the actual refrigeration effect produced per kWh and the capacity of the system.
- Q.3 Estimate the loss in air standard efficiency for the diesel engine for the compression ratio 14 and the cutoff changes from 6% to 13% of the stroke.
- Q.4 Discuss the various metal forming processes in detail.
- Q.5 An engine running at 150 r.p.m. drives a line shaft by means of a belt. The engine pulley is 750 mm in diameter and the pulley on the line shaft is 450 mm . A 900 mm diameter pulley on the line shaft drives a 150 mm diameter pulley keyed to a dynamo shaft. Find the speed of the dynamo shaft when;
1. there is no slip, and
 2. there is a slip of 2% at each drive.
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