11N509

B. Tech. I - Sem. (New Scheme) Main Exam., July – 2022
1FY2 – 09 Elements of Mechanical Engineering (ME)
Common to all Branches

Time: 2 Hours

Maximum Marks: 70
Min. Passing Marks:

Instructions to Candidates:

Part – A: Short answer questions (up to 25 words) 5 ×3 marks = 15 marks. Candidates have to answer 5 questions out of 10.

Part – B: Analytical/Problem Solving questions 3 ×5 marks = 15 marks. Candidates have to answer 3 questions out of 7.

Part – C: Descriptive/Analytical/Problem Solving questions 2 ×20 marks = 40 marks. Candidates have to answer 2 questions out of 5.

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 Define internal energy and enthalpy.

Q.2 Differentiate steel and cast iron.

Q.3 Define the C.O.P. of a refrigeration system.

Q.4 Classify engineering materials.

Q.5 What is an air standard efficiency?

Q.6 Why is a re-heater necessary in a gas turbine? What are its effects?

Q.7 Differentiate forward and backward extrusion.

Q.8 Define soldering.

Q.9 When do we use worm gears?

Q.10 State the law of belting.

PART–B

Q.1 A frictionless piston-cylinder device contains a gas initially at 0.8 MPa and 0.015 m³. It expands quasi-statically at a constant temperature to a final volume of 0.030 m³. The work output (in kJ) during this process will be.

Q.2 Write the principle of the vapor compression refrigeration system.

Q.3 What is the difference between Otto and Diesel cycle?

Q.4 Define (a) Specific fuel consumption and (b) The calorific value of a fuel.

Q.5 Mention the types of failures in gear drives?

Q.6 Differentiate helical and spur gears.

Q.7 Define slip and creep in case of belt drive.

PART-C

Q.1 A piston-cylinder assembly contains one kg air at 10 bar pressure and 500 K temperature. The piston moves outwards, and the air expands to 2 bar pressure and 350K temperature. Determine the maximum work obtainable. Assume the environmental conditions to be 1 bar and 290 K. Also, make calculations for the availability in the initial and final states.

Q.2 A steam power plant uses steam as a working fluid and operates at a boiler pressure of 5 MPa, dry saturated, and a condenser pressure of 5 kPa. Determine the cycle efficiency for (i) Carnot cycle and (ii) Rankine cycle. Also, show the T-s representation for both the cycles.

Q.3 In an Otto cycle, air at 1 bar and 290K is compressed isentropically until the pressure is 15 bar. The heat is added at constant volume until the pressure rises to 40 bar. Calculate the air standard efficiency and mean effective pressure for the cycle. Take C_v=0.717 kJ/kg K and R_{univ} = 8.314 kJ/kg K.

Q.4 Discuss the various welding processes in detail.

Q.5 (a) Derive the velocity ratio of belt drive, (b) Derive the slip of belt drive

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