21N509

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21N509

B. Tech. II - Sem. (New Scheme) (Main) Exam., (Academic Session 2021- 2022)

All Branch

2FY2 – 09 Elements of Mechanical Engineering

Common to all Branches

Time: 2 Hours **Maximum Marks: 70**

Instructions to Candidates:

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

Part – B: *Analytical/Problem solving questions 3 × 5 marks = 15 marks. Candidates have to answer **three** questions out of **seven.***

Part – C: *Descriptive/Analytical/Problem Solving questions 2 ×20 marks = 40 marks. Candidates have to answer **two** 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 Explain briefly Zeroth Law of Thermodynamics.

Q.2 What is a PMM1? Why is it impossible?

Q.3 Why is Carnot cycle not practicable for a steam power plant?

Q.4 How are the maximum temperature and maximum pressure in the Rankine cycle fixed?

Q.5 What do you mean by latent heating and latent cooling?

Q.6 Define thermal efficiency and mechanical efficiency of I.C. engine.

Q.7 Give advantages of two-stroke engine over four-stroke engine.

Q.8 Define the following mechanical properties:

(i) Strength (ii) Hardness (iii) Ductility (iv) Toughness

Q.9 What are the required properties of molding sands? Classify the molding sand.

Q.10 State the Law of Gearing.

PART – B

Q.1 A heat pump working on a Carnot cycle takes in heat from a reservoir at 8°C and delivers heat to the reservoir at 50°C. The heat pump is driven by a reversible heat engine taking heat from a reservoir at 850°C and rejecting heat to a reservoir at 50°C .The reversible heat engine also drives a machine of input required of 25 kW. If the heat pump extracts 15 kJ/sec from the 8°C reservoir, determine (a) the rate of heat supply from the 850°C source and (b) the rate of heat rejection to 50°C sink.

Q.2 What is a reversible process? A reversible process should not leave any evidence to show that the process had ever occurred. Explain.

Q.3 Explain with a neat sketch the working of a vapor compression refrigerator. Also draw p-h and T-s diagram for the same.

Q.4 Derive an expression for the air standard efficiency of a Brayton cycle in terms of pressure ratio.

Q.5 Define composite material. How are composite classified? Discuss its applications in aerospace industry and automobile industry.

Q.6 What is forging? Explain different forging process.

Q.7 List different types of gears and explain any one with advantages.

PART – C

Q.1 (a) State and explain Carnot theorem.

(b) A fluid is confined in a cylinder by a spring-loaded, frictionless piston so that the pressure in the fluid is a linear function of the volume (p = a + b V).The internal energy of the fluid is given by the following equation:

U=34+3.15pV

Where U is in kJ, p in kPa, and V in cubic meter. If the fluid changes from an initial state of 170 kPa, 0.03 m^3 to a final state of 400 kPa, 0.06 m^3, with no work other than that done on the piston, find the direction and magnitude of the work and heat transfer.

Q.2 (a) With a neat sketch of a room air-conditioner, explain its working principle.

(b) Carnot refrigeration cycle absorbs heat at 250 K and rejects heat at 300 K.

(a)Calculate the coefficient of performance of this refrigeration cycle.

(b)If the cycle is absorbing 1,050 kJ/min at 250 k, how many kJ of work is required per second?

(c)If the Carnot heat pump operates between the same temperatures as the above refrigeration cycle, what is the coefficient of performance?

(d) How many kJ/min will the heat pump deliver at 300 K if it absorbs 1,050 kJ/min at 250 K?

Q.3 (a) What is scavenging? Explain with the neat sketch, working of the two-stoke petrol engine.

(b) In an engine working on Diesel cycle inlet temperature and pressure are 1 bar and 290 K respectively. Pressure at the end of adiabatic compression is 40 bar. The ratio of expansion i.e., after constant pressure heat addition is 5.2. Calculate the heat addition, heat rejection and thermal efficiency of the cycle.

Assume γ=1.4, C_p=1.004 kJ/kg.K and C_v=0.717 kJ/kg.K.

Q.4 (a) Define ferrous and non-ferrous metals and discuss its applications.

(b) Explain the principle of arc welding with neat sketch.

Q.5 (a) Explain chain drives and rope drives and their applications?

(b) Derive an expression for length of the belt in open belt drive.
