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(2064)

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B. Tech 2nd Semester Examination

Basic Mechanical Engineering (O.S.)

ME-1003

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION - A

1. (a) Draw the P-V charts and also calculate the work done for the following processes: polytropic process, adiabatic process, isochoric process, isobaric process and isothermal process. (5×3=15)

   (b) State the first law of thermodynamics with its limitations. (5)

OR

2. (a) In a steady flow apparatus, 135 kJ of work is done by each kg of fluid. The specific volume of the fluid, pressure, and velocity at the inlet are 0.37 m^3/kg, 600 kPa, and 16 m/s. The inlet is 32 m above the floor, and the discharge pipe is at floor level. The discharge conditions are 0.62 m^3/kg, 100 kPa, and 270 m/s. The total heat loss between the inlet and discharge is 9 kJ/kg of fluid. In flowing through this apparatus, does the specific internal energy increase or decrease, and by how much? (10)

(b) Give two examples to illustrate the applications of steady flow energy equation (S.F.E.E.) in engineering system. (10)

SECTION - B

3. (a) What is a Carnot cycle? What are the four processes which constitute the cycle. Also explain the limitations of the Carnot cycle. (15)

(b) A cyclic heat engine operates between a source temperature of 800°C and a sink temperature of 30°C. What is the least rate of heat rejection per kW net output of the engine. (5)

OR

4. (a) State and explain the concept of entropy and Classius inequality. (5)

(b) Draw the schematic diagram for heat engine, heat pump and refrigerator. Also calculate the COP for each. (15)

SECTION - C

5. (a) A cantilever 12 m long is loaded with uniformly distributed load of 1 kN/m in addition to 3 kN load at its free end. It is supported from the bottom with 12 kN load at the middle of the cantilever. Draw Shear Force and Bending Moment diagrams and find Bending Moment at significant points. (15)

(b) Give a detailed classification of beams. (5)

OR

6. (a) A steel bar is 4 m long and its both ends are firmly fixed to two walls. The original temperature of the bar is 40°C. The bar is cooled to 25°C. Determine the thermal strain and stress in the bar. Assume E_s=200 kN/mm^2 and α = 12 x 10^{-6} per °C. State the nature of stress set up. (12)

(b) What do you mean by (i) Modulus of elasticity (ii) Modulus of rigidity (iii) Bulk Modulus. Give their units. Also give a mathematical relation between them. (8)

SECTION - D

7. (a) Define the following terms

(i) Major Principal stress

(ii) Minor Principal stress

(iii) Maximum shear stress

(iv) Principal planes

(v) Polar moment of inertia (10)

(b) A solid shaft of 10 cm diameter transmits 161.81 kW at 100 r.p.m. Calculate the maximum intensity of shear stress and the angle of twist in degrees for a length of 20 times the diameter of the shaft. Take G = 8 x10^6N/cm^2. (10)

OR

8. (a) Prove that the torque transmitted by a solid shaft when subjected to torsion is given by

$$T = \frac{\pi}{16}\tau D^3$$

Where D = diameter of solid shaft and τ = maximum shear stress. (12)

(b) What is pure bending? List at least five assumptions made in the theory of simple bending. (8)

SECTION - E

9. (a) Define system, boundary and surroundings.

(b) Define ton of refrigeration.

(c) Differentiate between open system, closed system and isolated system.

(d) What is a thermometer?

(e) Define the COP of a refrigerator.

(f) State expression for power transmitted by a shaft giving meaning of each term used.

(g) Define moment of resistance.

(h) Define shear stress.

(i) What are different types of loads acting on a beam?

(j) What do you mean by point of contraflexture. Is the point of contraflexure and point of inflexion different?

(10×2=20)