14607

B. Tech 2nd Semester Examination

Basic Mechanical Engineering (N.S.)

BE-102

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. Use of steam table, graphical plots are 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)   Classify the following into Extensive and Intensive properties:

          Pressure, Enthalpy, Energy, Weight, Volume   (5×1=5)

OR

2. (a)   Derive steady flow energy equation (SFEE). Also give applications of steady flow energy equation.   (12)

(b) In a steady flow apparatus, 185 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 m³/kg, 600 kPa, and 16 m/s. The inlet is 40 m above the floor, and the discharge pipe is at floor level. The discharge conditions are 0.62 m³/kg, 100 kPa, and 270 m/s. The total heat loss between the inlet and discharge is 10 kJ/kg of fluid. In flowing through this apparatus, does the specific internal energy increase or decrease, and by how much? (8)

SECTION - B

3. (a) A domestic food freezer maintains a temperature of –10°C. The ambient air temperature is 20ºC, if heat leaks into the freezer at the continuous rate of 1.75 kJ/s. What is the least power necessary to pump this heat out continuously. (8)

(b) Differentiate between heat pump and refrigerator. Also prove that (COP) Heat Pump - (COP) Refrigerator = 1 (6)

(c) Explain the principle and concept of increase of entropy. (6)

OR

4. (a) Draw the schematic diagram for heat engine, heat pump and refrigerator. Also calculate the COP for each. (3×5=15)

(b) Find out the saturation temperature, the changes in specific volume, entropy during evaporation and the latent heat of vaporization of steam at 1 MPa. (5)

SECTION - C

5. (a) Explain Carnot cycle and derive the expressions for its efficiency. Discuss the reasons, why Carnot cycle could not be practiced. (15)

(b) Explain the mixed or dual cycle. (5)

OR

6. (a) What is spark ignition engine? What is air standard cycle of such an engine ? What are its four processes? (12)

(b) A cyclic heat engine operates between a source temperature of 1200°C and a sink temperature of 50°C. What is the least rate of heat rejection per kW net output of the engine. (8)

SECTION - D

7. (a) Explain how the psychometry chart is prepared? (10)

(b) What is Stefan-Boltzman law and also derive its expression. (5)

(c) Explain the concept of Newton's law of viscosity. (5)

OR

8. (a) Explain the terms Daltons law of partial pressure, specific humidity, dry bulb temperature, wet bulb temperature, dew point temperature and their relations. (5×2=10)

(b) What is insulator? Why they are needed? State name of insulators. (5)

(c) Why the fins are necessary in evaporator and condenser of a refrigeration plant. (5)

SECTION - E

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

(b) Define Newton's law of viscosity.

(c) What is a thermometer?

(d) What is zeroth law of thermodynamics?

(e) Define conduction and convection..

(f) Define ton of refrigeration.

(g) Define superheated steam.

(h) Differentiate between laminar and turbulent flow.

(8×2.5=20)