00424

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

June, 2011

BME - 019 : ENGINEERING THERMODYNAMICS

Time : 3 hours | *Maximum Marks : 70*

Note : *Answer **any five** questions. All questions carry **equal** marks. Use of calculator, steam table, and motion chart are permitted.*

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1. (a) Define system, surroundings and boundary. Also describe how pressure difference between two points is measured using manometer. 7

   (b) To a closed system 150 kJ of work is supplied. If the initial volume is 0.6 m^3 and pressure of the system changes as $P = 8 - 4V$, where P is in bar and V is in m^3, determine the final volume and pressure of the system. 7

2. (a) As shown in the figure 1.1, when a system is taken from A to B along ACB, 100 kJ of heat is transfered to the system which performs 30 kJ of work. 9

(i) What is heat transfer to the system along the path ADB if the work done is 10 kJ.

(ii) When the system is returned from B to A along the curved path, 20 kJ of work is done on the system. Determine the magnitude and sign of the corresponding heat transfer.

(iii) If $E_A = 0$ and $E_D = 40$ kJ, determine the heat transfers during the processes AD and DB.

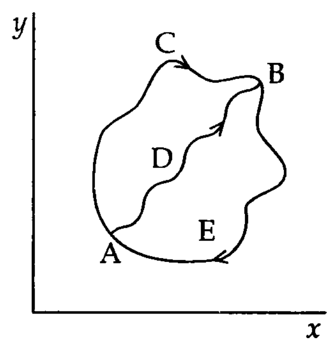

Figure : 1.1

(b) In an air motor cylinder the compressed air has an internal energy of 450 kJ/kg at the beginning of expansion and an internal energy of 220 kJ/kg after expansion. If the work done by the air during the expansion is 120 kJ/kg, calculate the heat flow to and from the cylinder. 5

3. (a) In a steam power plant the work output of the turbine is 100 kJ while heat supplied at the boiler is 300 kJ. Given that during the same period work input to the pump is 0.5 kJ, find the heat rejected at the condenser and thermal efficiency of the plant. 7

(b) A refrigerator with a COP of 4.0 transfers heat at a rate of 0.5 kJ/s at the condenser. Find the rate of heat transfer at the evaporator and the power input to the compressor. Also calculate the COP if the refrigerator were to operate as a heat pump with same heat and work interactions. 7

4. (a) A domestic food refrigerator maintains a temperature of $-12°C$. The ambient temperature is 35°C. If heat leaks in to the freezer at the continuous rate of 2 kJ/s determine the least power necessary to pump this heat out continuously. 7

(b) A carnot cycle operates between source and sink temperatures of 250°C and $-15°C$. If the system receives 90 kJ from the source, find : 7

(i) Efficiency of the system

(ii) The net work transfer

(iii) Heat rejected to the sink

5. (a) Define entropy. Explain the principle of increase of entropy. 7

(b) A piston-cylinder arrangement contains 0.05 m^3 of nitrogen at 1 bar and 280 K. The piston moves inwords and the gas is compressed isothermally and reversibly until the pressure becomes 5 bar. Determine : 7

(i) change in entropy

(ii) work done

Assume nitrogen to be a perfect gas.

6. (a) Describe the working of vapour absorption refrigeration system with neat diagram. 7

(b) A refrigerating system operates on the reversed Carnot cycle. The higher temperature of the refrigerant in the system is 35°C and the lower temperature is -15°C. The capacity is to be 12 tonnes. Neglect all losses. Determine : 7

(i) COP

(ii) Heat rejected from the system per hr

(iii) Power required.

7. (a) Describe the working of Ideal reheat Rankine cycle. Also explain the advantages of reheat Rankine cycle. 7

(b) What are the various types of feed water heaters used in the regenerative Rankine cycle ? Explain its properties. 7
