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BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING) BTMEVI

Term-End Examination

June, 2013

BME-019 : ENGINEERING THERMODYNAMICS

Time : 3 hours *Maximum Marks : 70*

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

1. (a) Define and explain the terms system, surroundings, boundary, heat and energy. 5+5

   (b) A U-tube manometer is connected to a gas pipe. The level of the liquid in the manometer arm open to the atmosphere is 170 mm lower than the level of the liquid in the arm connected to the gas pipe. The liquid in the manometer has specific gravity of 0.8. Find the absolute pressure of the gas if the manometer reads 760 mm Hg.

2. (a) Define and explain Heat, Conduction, Convection and Radiation. 5+5

   (b) The heat transferred in to a closed system during a process is 4400 kJ. If the work done by the system is 2400 kJ, determine the change in total energy of the system.

3. (a) Draw the schematic of Steam Power Plant and derive the equation for thermal efficiency of the plant. **5+5**

(b) Draw the schematic of Refrigerator and explain the working of refrigerator, also derive the equation for C.O.P of refrigerator.

4. A cyclic heat engine operates between a source temp. of 1000°C and a sink temp. of 40°C. Find the least rate of heat rejection per kW net output of the engine. **10**

5. Two carnot engines (as shown in fig. 1) work in series between the source and sink have temperatures of 550K and 350K. If both engines develop equal power, determine the intermediate temperature. **10**

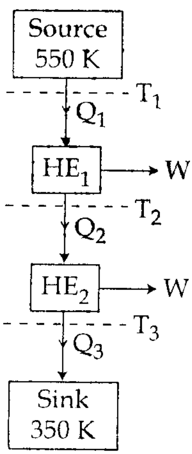

Figure - 1

6. Consider three hypothetical heat engines A, B, and C, each operating between 1200 K and 400 K. When each engine involves itself with a heat interaction of 1200 kJ with the high temp. reservoir, it is claimed that while engine A develops a work of 700 kJ, engine B and C develops 800 kJ and 900 kJ respectively. Use the carnot statement and identify the engines A, B and C as reversible, irreversible or impossible. 10

7. As shown in figure 2, a reversible engine is operating having heat interactions with three reservoirs at temperatures of $T_1 = 700$ K, $T_2 = 500$ K and $T_3 = 300$ K. When Q_1, the heat transfer to the heat engine from T_1 is 700 kJ the work output of the engine is reported to be 225 kJ. Find the magnitudes and directions of Q_2 and Q_3. 10

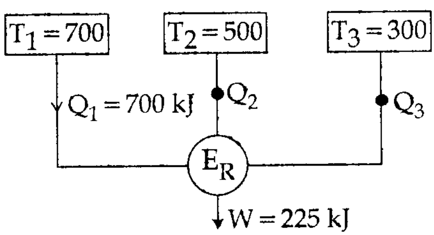

Fig. 2

8. 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. 10

9. In an Ideal air cycle refrigeration system air centres the compressor at 1 bar 5°C and then expanded in a turbine to 1 bar. The cooling capacity of the system is 10kW. Assume air behaves as a perfect gas with Cp = 1.005 kJ/kg.K. and Cp = 0.718 kJ/kg. K. Find COP, mass flow rate of air and the power required by the system. **10**

10. (a) Briefly describe the working of ideal reheat rankine cycle. **5+5**

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