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BME - 019

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BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

December, 2010

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 Mollion chart is permitted.*

1. (a) Define a thermodynamic system. Differentiate between open system, closed system and an isolated system. 7

   (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 of Hg. 7

2. (a) Define heat. Describe the various modes of the heat transfer. Also explain the differences between work and heat. 7

(b) 1 kg of gaseous CO_2 contained in a closed system undergoes a reversible process at constant pressure. During this process 42 KJ of internal energy is decreased. Determine the work done during the process. Take C_P = 840 J/kg°C and C_v = 600 J/kg°C. 7

3. (a) Define heat engine, refrigerator and heat pump. Derive an expression for the efficiency of the reversible heat engine. 7

(b) A cyclic heat engine operates between a source temperature of 1000°C and a sink temperature of 40°C. Find the least rate of heat rejection per kW net output of the engine. 7

4. (a) Describe the concept of reversible heat engine. Also explain the importance of reversible heat engine. 7

(b) A direct heat engine A and a reversed heat engine B are operating between 177°C and 27°C. The COP of B as a heat pump is 2.5. A drives B. The magnitude of heat interaction of A and B with the reservoir at 27°C are 200 kJ and 50 kJ respectively. The combined work output of A and B is 20 kJ. Identify whether the heat engine A is reversible or irreversible. 7

5. (a) Describe the working of vapour compression refrigeration system with neat diagram. 7

(b) An ideal wet compression refrigeration cycle, with R-12 as the refrigerant, operates between an evaporator temperature of $-10°C$ and a condenser temperature of $40°C$. Calculate the following: 7

(i) refrigerating effect.

(ii) compressor work, and

(iii) COP

6. A single - stage reciprocating compressor takes 1 m^3 of air per minute at 1.013 bar and 15°C and delivers it at 7 bar. Assuming that the law of compression is $PV^{1.35}$ = constant, and the clearance is negligible, calculate the indicated power. 14

7. (a) What is a heat exchanger ? Explain the working of a heat exchanger. List the various applications of heat exchangers. 7

(b) Describe the major functions and duties of energy manager. 7