BACHELOR OF ENGINEERING (CIVIL ENGINEERING) SECOND YEAR FIRST SEMESTER EXAM 2019 (OLD)

Thermodynamics and Heat Power

Time:-Three Hours Full Marks:-100

Answer any five questions

All parts of the same question must be answered together

Data, consistent with the problem may be assumed if necessary

1. Answer the following questions (***any four***):
   a) Define and classify thermodynamic system.
   b) Show that enthalpy of an ideal gas depends only on temperature.
   c) Define the following thermodynamic terms: Phase, heat, work.
   d) Define boiler mountings and accessories.
   e) What is PMM1? Why it is impossible? 20

2 a) State the assumptions of air-standard cycle. 8

b) In an air standard Diesel cycle, the compression ratio is 17. Compression begins at 0.1 MPa, 40^0C. The heat added is 1675 kJ/kg. Calculate (i) the maximum pressure and temperature of the cycle, (ii) work done per kg of air, (iii) the cycle efficiency and (iv) the cut-off ratio. 14

3 a) Find out an expression of displacement work for the pv^n=*constant* process. 6

b) A gas of mass 1.5kg undergoes a reversible expansion which follows a relationship $p = a + bV$, where a and b are constants. The initial and final pressures are 1000 kPa and 200 kPa respectively and the corresponding volumes are 0.20 m^3 and 1.20 m^3. The specific internal energy of the gas is given by the relation $u = (1.5pv - 85)$ kJ/kg, where p is in kPa and v is in m^3/kg. Calculate the net heat transfer and the maximum internal energy of the gas attained during expansion. 14

4 a) State and explain the 2nd law of thermodynamics. 6

b) Two reversible heat engines A and B are arranged in series. A rejecting heat directly to B. Engine A receives 200 kJ at a temperature of 421^0C from a hot source, while engine B is in communication with a cold sink at a temperature of 4.4^0C. If the work output of A is twice that of B, find (i) the intermediate temperature between A and B, (ii) the efficiency of each engine, and (iii) the heat rejected to the cold sink. 10

5 a) The enthalpy and the velocity of the fluid passing at the inlet to a certain nozzle are 3000 kJ/kg and 60 m/s respectively. At the discharge end, the enthalpy is 2762 kJ/kg. The nozzle is horizontal and there is negligible heat loss from it. (i) Find the velocity at exit from the nozzle. (ii) If the inlet area is 0.1 m^2 and the specific volume at inlet is 0.187m^3/kg, find the mass flow rate. (iii) If the specific volume at the nozzle exit is 0.498m^3/kg, find the exit area of the nozzle. 12

b) Derive an expression of work done for a fed pump. 8

6. a) What do you mean by feed check valve and fusible plug? 6
   c) Discuss with neat sketch the working principle of a water tube boiler. 14

7. Write short notes on the following (***any four***):
   a) PMM2, b) Reversible process, c) Refrigerator, d) Reheater, e) Entropy, f) Intensive property. 20