BACHELOR OF ENGINEERING (CIVIL ENGINEERING) SECOND YEAR FIRST SEMESTER SUPPLEMENTARY EXAM 2018 (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) What do you mean by thermodynamic system?
   b) Define specific heat at constant volume and constant pressure.
   c) Define the following thermodynamic terms: State, path.
   d) Define boiler mountings and accessories.
   e) State and explain Zeroth law of thermodynamics.   20

2. a) The air standard thermal efficiency of Otto cycle is greater than that of diesel cycle for the same compression ratio". Justify the statement.   8

   b) An engine working on the Otto cycle has an air standard cycle efficiency of 56% and rejects 544 kJ/kg of air. The pressure and temperature of air at the beginning of compression are 0.1 MPa and 60^0C respectively. Compute (a) the compression ratio of the engine, (b) the work done per kg of air, (c) the pressure and temperature at the end of compression, and (d) the maximum pressure of the cycle.   12

3. a) Find out an expression of displacement work in an isothermal process.   8

   b) Determine the total work done by a gas system following an expansion process as shown in the figure below.   12
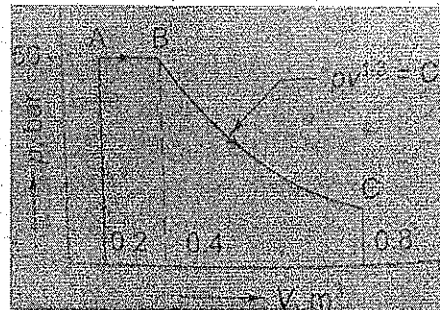
4. a) Show that internal energy is a property of a system.   10

   b) A heat engine receives reversibly 420 KJ/cycle of heat from a source at 327°C, and rejects heat reversibly to a sink at 27°C. There are no other heat transfers. For each of the three hypothetical amounts of heat rejected, in (i), (ii) and (iii) below, compute the cyclic integral of dQ/T. From these results show which case is reversible, which irreversible and which impossible: (i) 210KJ/cycle rejected, (ii) 105KJ/cycle rejected, (iii) 315 KJ/cycle rejected.   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 m² and the specific volume at inlet is 0.187m³/kg, find the mass flow rate. (iii) If the specific volume at the nozzle exit is 0.498m³/kg, find the exit area of the nozzle.

12

b) Derive an expression of exit velocity for flow through a nozzle.   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) Phase, c) Refrigerator, d) Reheater, e) Entropy, f) Intensive property.   20