

B.E. CIVIL ENGINEERING (PART TIME) 2nd YEAR 1st SEMESTER EXAMINATION, 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 heat engine? 20
 - b) Define and explain reversible process.
 - c) Define the terms: Phase, Cycle.
 - d) Differentiate between fire tube and water tube boilers.
 - e) State and explain 1st law of thermodynamics. 8

- 2 a) Derive an expression of cycle efficiency for the Otto cycle with relevant parameters. 8
 - b) In an air standard Diesel cycle, the compression ratio is 15, and at the beginning of the isentropic compression, the temperature is 20⁰C and the pressure is 0.1 Mpa. Heat is added until the temperature at the end of the constant pressure process is 1500⁰C. Calculate (i) the cut-off ratio, (ii) the heat supplied per kg of air, and (iii) the cycle efficiency. 12

- 3 a) Find out an expression of displacement work in an isobaric process ($p=constant$). 6
 - b) A mass of 8 kg gas expands within a flexible container so that the $p-v$ relationship is of the form $pv^{1.2}=const$. The initial pressure is 1000kPa and the initial volume is 1 m³. The final pressure is 5 kPa. If specific internal energy of the gas increases by 40kJ/kg, find the heat transfer in magnitude and direction. 14

- 4 a) What is PMM2? Why is it impossible? 5
 - b) Prove that $COP_{HP}=1+COP_{refrigerator}$ 5
 - c) A cyclic heat engine operates between a source temperature of 1000⁰C and a sink temperature of 400⁰C. Find the least rate of heat rejection per kW net output of the engine? 10

- 5 a) In a steady flow apparatus 135 kJ of work is done by each kg of fluid. The specific volume of the fluid, pressure and velocity at the inlet are 0.37 m³/kg, 600 kPa and 16 m/s. The inlet is 32 m above the floor and the discharge pipe is at floor level. The discharge conditions are 0.62 m³/kg, 100 kPa and 270 m/s. The total heat loss between the inlet and discharge is 9 kJ/kg of fluid. In flowing through this apparatus, does the specific internal energy increase or decrease and by how much? 12
 - b) Write a short note on 'Energy reservoir'. 8

6. a) What is the function of blow off cock? 2
b) Define and Classify boiler. 6
c) Discuss with neat sketch the working principle of a fire tube boiler. 12
7. Write short notes on the following (*any four*):
a) PMM1, b) Safety valve, c) Heat pump, d) Economiser, e) Enthalpy, f) Property. 20