Code No. : 6163

FACULTY OF ENGINEERING
B.E. II/IV (Mech./Prod. Engg.) II Semester (Main) Examination, June 2010
THERMODYNAMICS

Time : 3 Hours] [Max. Marks : 75

Note : *i) Answer **all** questions from **Part A** and **any five** questions from Part **B**.*
*ii) **Missing** data, if any, may suitably be **assumed**.*

PART – A **(Marks : 25)**

1. Define quasi static process. **3**
2. List three major differences between Microscopic and Macroscopic approaches. **2**
3. What methods are used to solve thermodynamic problems of open and closed systems ? **3**
4. Explain how Work Transfer differs from Heat Transfer ? **2**
5. State Carnot's first theorem. **3**
6. Define Helmholtz function. **2**
7. State one example where Clausius Clapyron equation is used. **3**
8. What is triple point ? List the values of triple point for water. **2**
9. State the advantages of solid fuels over liquid fuels. **3**
10. Sketch Dual cycle on P-V diagram. **2**

PART – B **(Marks : 50)**

11. Explain the working principle of Ideal Gas thermometer (Constant volume type) with a neat sketch.

12. For analysis of flow through a device involving one inlet flow and one exit flow, it is found that for mass flow rate of 5 kg/sec, the inlet and exit section flow parameters are 20 m/sec velocity, 2 m altitude, 300 kJ/kg enthalpy and 30 m/sec velocity, 6 m altitude, 400 kJ/kg enthalpy respectively. There is heat flow of 500 kW out of the device and Work transfer of 300 kW into the device. Determine whether the flow is Steady or Unsteady. What is the rate of energy change for the device ? If changes in K.E. and P.E. were to be neglected, what would be the percent error in the calculation of Energy transfer ?

13. a) A Carnot heat engine draws heat from two reservoirs at temperatures 900°C and 600°C simultaneously and rejects 3600 kJ/min heat to a single reservoir at 300°C while developing a work output of 100 kW. Determine heat supplied by each source/min to the engine and calculate efficiency of the engine. 5

    b) Discuss the concept of available energy for steady flows. What happens to the available energy when a system is heated to higher temperature ? 5

14. Explain the Phase equilibrium diagram for Water as pure substance with neat sketches of P-V-T Plots giving definitions for critical point, triple point and triple line.

15. Discuss the working principle of Junker's Gas Calorimeter.

16. The water has a pressure 20 bar and temperature 400°C (state 1). It is isentropically expanded to a pressure of 1.0 bar (state 2). Then it is heated at constant pressure to a temperature 200°C (state 3) . Find fundamental properties (P, T and v) at all the three states and mention the condition of water in these states. From state 1 to state 3, calculate net changes in

    i) specific enthalpy

    ii) specific entropy and

    iii) specific internal energy.

17. a) Obtain various relations for entropy changes of a System from first law and second law applications. 5

    b) In the turbine of a gas turbine unit the gases flow through the turbine is 17 kg/s and the power developed by the turbine is 14000 kW. The enthalpies of the gases at inlet and outlet are 1200 kJ/kg and 360 kJ/kg respectively, and the velocities of the gases at inlet and outlet are 60 m/s and 150 m/s respectively, calculate the rate at which the heat is rejected from the turbine. Find also the area of the inlet pipe given that the specific volume of the gases at inlet is $0.5\ m^3/kg$. 5
