Model Question Paper – 1 (CBCS) with effect from 2015-16

USN | | | | | | | | | | | **15ME33**

Third Semester B.E. Degree (CBCS) Examination, Dec.2016/Jan.2017

Basic Thermodynamics

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing one full question from each module.
2. Use of Thermodynamic data handbook and steam table is permitted.

MODULE- 1

1 a. Define the following with examples.
i) Open system ii) Closed system iii) Isolated system **(08Marks)**

b. State Zeroth law of thermodynamics. The readings t_A and t_B of two Celsius thermometers A and B agree at ice & steam point, but elsewhere are related by the equation $t_A=L+Mt_B+Nt_B^2$ where L,M,N are constants, when both thermometers are immersed in a system of fluid , A registers 11°C while B registers10°C.Determine the reading on A when B registers 37.4°C **(08 Marks)**

OR

2. a. Define thermodynamic work. Write similarities & dissimilarities between Heat and Work. **(08Marks)**

b. A gas initially at 100KPa and 6000cm^3. The final volume is 2000cm^3. Determine the moving boundary work for each of the following processes.
(i) P is inversely proportional to V (ii) PV^2= constant iii) P is inversely proportional to V **(08Marks)**

MODULE- 2

3. a. Describe the classic paddle wheel experiment performed by Joule. What conclusion was drawn based on the experimental observations (Joule experiment). **(08Marks)**

b. A turbine operates under steady flow conditions, receives steam at the following state: Pressure 1.2MPa, temperature 188oC, enthalpy 2785KJ/Kg, velocity 34 m/s & elevation 3m. The steam leaves the turbine at the following state: pressure 20Mpa, enthalpy 2512KJ/kg, velocity 100m/s and elevation 0 m. Heat loss to the surrounding at a rate of 0.29KJ/s. If the steam rate is0.42kg/s.Determine power output from the turbine. **(08Marks)**

OR

4. a. State and Prove that Kelvin- Planck and Clausis statements of second law of thermodynamics **(08Marks)**

b. Using a heat engine of thermal efficiency of 30% to drive a refrigerator having a COP of 5, what is the heat received by the heat engine for each MJ of heat removed from the cold body of the refrigerator? **(08Marks)**

Important Note: 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written e.g, 38+2 = 40, will be treated as malpractice.

MODULE- 3

5. a. Define reversible heat engine with temperature reservoirs diagrams. **(02Marks)**
   b. Explain the factors such as friction, heat transfer through a finite temperature difference, unresisted expansion that renders the process irreversible. **(06Marks)**

OR

6. a. Define Entropy and explain Principle of increase of entropy. **(02Marks)**
   b. Two copper blocks weighing 10kg each are initially at temperatures of 227^{o}C and 27^{o}C respectively. What is the change in entropy when these two blocks are brought in contact with each other? Assume specific heat of copper as 0.4KJ/kg k **(06Marks)**

MODULE -4

7. a. Define availability and irreversibility **(02Marks)**
   b. Explain availability function for closed system (Non flow Process) and open system (Steady Flow process). **(06Marks)**

OR

8. a. Define dryness fraction of the steam? What are methods used to measure dryness fraction? with neat sketch explain any one method. **(08Marks)**
   b. Calculate the internal energy per kg of superheated steam at pressure of 10 bar and a temperature of 3000 C. Also find the change in internal energy if this steam is expanded to 1.4 bar and dryness fraction 0.8. **(08Marks)**

MODULE -5

9. a. Distinguish between Ideal and Real gas. Starting from the relation Tds = du + Pdv show that for an ideal gas undergoing a reversible adiabatic process, the law for the process is given by TV^{n-1}= constant. **(08Marks)**

10. a. A balloon of sphere shape 6m in diameter is filled with hydrogen gas at a pressure of 1 bar abs and 20^{0}C. At a later time, the pressure of the gas is 94% of its original pressure at the same temperature. i) What mass of the original gas must have escaped If the dimensions of the balloon is not changed.
    ii) Find the amount of heat removed to cause the dame drop in pressure at constant volume. Take Cv for hydrogen as 10400J/kg K