

Total No. of Questions : 8]

[Total No. of Printed Pages : 2

Roll No

MMTP-102**M.E./M.Tech., I Semester**

Examination, December 2017

Thermodynamics and Combustion**Time : Three Hours****Maximum Marks : 70**

- Note:** i) Attempt any five questions out of eight questions.
 ii) All questions carry equal marks.
 iii) Draw suitable diagram and suitable data wherever required.
 iv) Use of steam table is permitted.

- Write the different statements for Third Law of Thermodynamics. Also prove the Equivalence of those statements.
 - An insulated steam turbine receives 30 kg of steam per second at 3 MPa, 350°C. At the point in the turbine where pressure is 0.5 MPa, steam is bled off for processing equipment at the rate of 5 kg/s. The temperature of this steam is 200°C. The balance of the steam leaves the turbine at 15 kPa, 90% quality. Determine the availability per kg of the steam entering and at both points at which steam leaves the turbine, the isentropic efficiency and second-law efficiency for this process.
- Write short notes on Joule-Kelvin Effect.
 - In the boiler, heat transferred from the products of combustion to the steam. The temperature of the products of combustion decreases from 1100°C to 550°C while the pressure remains constant at 0.1 MPa. The average constant-pressure specific heat of the products of combustion is 1.09 kJ/kgK. The water enters at 0.8 MPa, 150°C and leaves at 0.8 MPa, 250°C. Determine the second law efficiency for this process and irreversibility per kg of water evaporated.

[2]

- Explain the Gibbs Theorem and Derive the formula for Entropy and Gibbs function of a mixture of inert ideal gases.
- Using the principle of First order transition derive the Clapeyron's Equation.
 - Explain the Generalized Compressibility Chart.
- How does the flame propagate? Discuss the theory of flame propagation.
 - Discuss the combustion phenomenon of gaseous fuel.
- At 35°C and 1 atm the degree of dissociation of N_2O_4 at equilibrium is 0.27. (a) Calculate the degree of reaction at the same temperature when the pressure is 100 mm Hg. (b) Calculate K (c) the equilibrium constant for the dissociation of N_2O_4 has the values 0.664 and 0.141 at temperature 318 and 298 K respectively. Calculate the average heat of reaction within this temperature range.
- Write short notes on following :
 - Combustion of fuel droplets and sprays
 - Triple point
- Describe the phenomenon of Entropy flow and Entropy Production.
 - Draw the phase equilibrium diagram for water on T-S plot and show the following: liquid, two phase and superheated region, critical point, water line, saturated vapour line and dryness fraction lines.

161 *****