B. Tech. 3rd Semester (M.E.) F- Scheme
Examination, December – 2016
THERMODYNAMICS
Paper–ME-201-F

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt **five** questions. All question carry equal marks. The students have to attempt **first common question, which is compulsory**, and **one** question from each of the four sections. Use steam Table.*

1. (a) Define intensive and Extensive properties. Give examples. 2×10

(b) What is Zeroth law of Thermodynamics ? Give its applications.

(c) Differentiate between Throttling Process and Free Expansion Process.

(d) Explain second law of thermodynamics and also define Entropy,

(e) Describe Steady flow Energy Equation.

(f) Differentiate between Heat Pump and Refrigeration.

(g) Describe Gibson Dalton's law.

(h) Differentiate between Otto cycle and Diesel cycle.

(i) Explain Availability and Irreversibility.

(j) Describe van-der-Waal's equation of state.

Section–1

2. What is point and path functions ? Give examples. A 1m^3 rigid tank initially contains air whose density is 1.18kg/m^3. The tank is connected to a high-pressure supply line through a valve. The valve is opened and air is allowed to enter the tank until the density in the tank rises to 7.20 kg/m^3. Determine the mass of air that has entered the tank. 20

3. In the gas turbine unit the gases flow through the turbine is 17 kg/s and the power developed by the turbine is 1000KW. The enthalpies of the gases at inlet and outlet are 1200kj/kg and 360kj/kg respectively and velocities of the gases at inlet and outlet are 60m/s and 150m/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 sprcific volume of the gases at inlet is 0.5m^3/kg. 20

Section–2

4. Explain Causes of Irreversibility. Give the expression for change in entropy during isothermal processes and polytropic processes. 20

5. What is the difference between adiabatic and isentropic process ? A block of copper with a mass of 1.5 kg is initially at 700 K. It is allowed to cool by means of heat transfer to the surrounding air at 300K. Determine the change in entropy of the copper and change in entropy of the universe after copper reaches

thermal equilibrium. Assume specific heat of copper is 0.39kJ/kgK. 20

Section–3

6. Describe P-V-T surface. A steam plant operates on a simple ideal Rankine cycle between the pressure limits of 3MPa and 50 kPa. The temperature of the steam at the turbine inlet is 300°C, and the mass flow rate of steam through the cycle is 35kg/s. Show the cycle on a *T-s* diagram with respect to saturation lines, and determine (a) the thermal efficiency of the cycle and (b) the net power output of the power plant. 20

7. Express Dalton's law of additive pressures. Consider a gas mixture that consists of 3kg of O_2, 5 kg of N_2, and 12 kg of CH_4. Determine (a) the mass fraction of each component, (b) the mole fraction of each component and (c) the average molar mass and gas constant of the mixture. 20

Section–4

8. Describe Joule-Thomson coefficient. Using the Maxwell relations, $(\frac{\partial s}{\partial P})_T$ determine a relation for a gas whose eqaution of state is $P(v-b) = RT$. 20

9. Describe the Clapeyron equation. Derive the expression $Cp - Cv = R$ for an ideal gas. 20