**REG.NO:**

**SEMBODAI RUKMANI VARATHARAJAN ENGINEERING COLLEGE**

**ACADEMIC YEAR 2013-2014/ODD SEMESTER**

**MODEL EXAM**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**SUBJECT CODE/TITLE:** ENGINEERING THERMODYNAMICS

**YEAR/SEM:** II/III **DATE:**

**DURATION:** 1 ½ HOURS **MAX.MARKS:** 50

**Answer ALL the Questions**

**PART A (10X2=20)**

1. Explain the following terms process and cycle.
2. Define internal energy.
3. What do you mean by the term ‘entropy’?
4. What is Quasi – Static process?
5. Draw a p-T (pressure-temperature) diagram for a pure substance.
6. Explain comparison between Rankine cycle and Carnot cycle.
7. Explain compressibility factor.
8. Write the Maxwell’s equation.
9. Define dry bulb temperature.
10. Explain adiabatic mixing of two substances.

**PART B (80 MARKS)**

1. A system contains 0.2 m3 of a gas at a pressure of 4 bar and 150°C. It is expanded adiabatically till the pressure falls to 1 bar. The gas is then heated at a constant pressure till its enthalpy increases by 100 kJ. Determine the total work done. Take Cp = 1 kJ/kgK and Cv = 0.714 kJ/kg K. (16)

(or)

1. i) In a gas turbine the gas enters at the rate of 5 kg/s with a velocity of 50 m/s and enthalpy of 900 kJ/kg and levels the turbine with a velocity of 150 m/s and enthalpy of 400 kJ/kg. The loss of heat from the gases to the surroundings is 25 kJ/kg. Assume for gas R=0.285 kJ/kg K and cp = 1.004 kJ/kg K and the inlet conditions to be at 100 kPa and 27oC. Determine the power output of the turbine and the diameter of the inlet pipe. (10)

ii) Differentiate Intensive and Extensive properties. (4)

iii) What do you understand by equilibrium of a system? (2)

1. A reversible heat pump is used to maintain a temperature of 0°C in a refrigerator when it rejects the heat to the surroundings at 27°C. If the heat removal rate from the refrigerator is 1500 kJ/min. determine the C.O.P of the machine and work input required. If the required input to run the pump is developed by a reversible engine which receives heat at 400°C and rejects heat to atmosphere, then determine the over all C.O.P of the system. (16)

(or)

1. i) A reversible heat engine operating between reservoirs at 900k and 300k drives a reversible refrigerator between reservoirs at 300k and 250k. The heat engine receives 1800kJ heat from 900k reservoir. The net output from the combined engine refrigerator is 360kJ. Find the heat transfer to the refrigerator and the net heat rejected to the reservoir at 300k. (8)

ii) Write short notes on availability and entropy. (8)

1. One kg of steam at 10 bar exists at the following conditions (i) wet and 0.8 dry (ii) dry and saturated and (iii) at a temperature of 199.9°C. Determine the enthalpy, specific volume, density, internal energy and entropy in each case. Take ps c = 2.25 kJ/kg. (16)

(or)

1. A steam turbine receive is 600 kg/h of steam at 25 bar, 350oC. At a certain stage of the turbine, steam at the rate of 150 kg/h is extracted at 3 bar, 200oC. The remaining steam leaves the turbine at 0.2 bar, 0.92 dry. During the expansion process there is heat transfer from the turbine to the surroundings at the rate of 10 kJ/s. Evaluate per kg of steam entering the turbine

(a) The availability of steam entering and leaving the turbine

(b) The maximum work and

(c) The irreversibility. The atmosphere is at 30oC.

1. A container of 3m3 capacity contains 10 kg of CO2 at 27°C. Estimate the pressure exerted by CO2 by using.  
   (i) Perfect gas equation.  
   (ii) Vander Waal’s equation.  
   (iii) Beattie Bridgeman equation. (16)

(or)

1. i) Derive Vander Waal’s equation in terms of reduce parameters. (8)

ii) Derive Tds equations taking temperature, volume and pressure as independent properties. (8)

1. Atmospheric air at 1.0132 bar has 20oC DBT and 65% RH. Find the humidity ratio, wet bulb temperature, dew point temperature, degree of saturation, enthalpy of the mixture, density of air and density of vapour in the mixture. (16)

(or)

1. i) With the aim of model psychometric chart explain the adiabatic mixing and evaporative processes. (10)

ii) Derive the sensible heat factor for cooling and dehumidification process. Also explain the process. (6)