ANNA UNIVERSITY OF TECHNOLOGY, COIMBATORE

B.E. / B.TECH DEGREE EXAMINATIONS: NOV / DEC 2010

REGULATIONS : 2008

THIRD SEMESTER

080190005 - ENGINEERING THERMODYNAMICS

(COMMON TO AUTOMOBILE / MECHANICAL ENGG.)

TIME: 3 Hours **Max.Marks: 100**

PART – A

(20 x 2 = 40 MARKS)

ANSWER ALL QUESTIONS

1. What is meant by internal energy?
2. Define '*Available energy*'
3. What do you understand by a reversible process?
4. What are the two major conclusions deduced from the Carnot principles?
5. Define triple point and identify the triple point of water.
6. Steam in a pipeline with a pressure of 1000 kPa flows through a throttling calorimeter where pressure is 100 kPa and temperature is 120°C. What is the initial quality of steam if enthalpy remains constant during throttling?
7. What is equation of state? Write the same for an ideal gas.
8. What is compressibility factor?
9. What is specific humidity?
10. What is meant by adiabatic saturation temperature?
11. What is the convention of positive and negative work?
12. What are the corollaries of the first law of Thermodynamics?
13. Given Kelvin-Planck statement of the second Law of Thermodynamics.
14. What are the processes involved in a Carnot cycle.Sketch the same in P-V diagram.
15. Define saturation pressure and temperature.
16. Sketch the Rankine cycle on a P-V and T-S plane.

17. What is pure substance?
18. Define Dalton's law.
19. What is a PMMI? Why is it impossible?
20. Define the term "Adiabatic mixing".

PART – B

(5 x 12 = 60 MARKS)

ANSWER ANY FIVE QUESTIONS

21. (a) Describe in brief the steady flow energy equation with the assumptions made. (8)
    (b) Deduce suitable expression for water turbine with suitable assumptions. (4)

22. A reversible heat engine operates between two reservoirs at temperatures 700°C and 50°C. The engine drives a reversible refrigerator which operates between reservoirs at temperatures of 50°C and – 25°C. The heat transfer to the engine is 2500 kJ and the network output of the combined engine refrigerator plant is 400 kJ. Determine the heat transferred to the refrigerant and the net heat transferred to the reservoir at 50°C

23. In an air compressor ,air flows steadily at the rate of 0.5 kg/s through an air compressor. It enters the compressor at 6 m/s with a pressure of 1 bar and a specific volume of 0.85 m^3/kg and leaves at 5 m/s with a pressure of 7 bar and a specific volume of 0.16 m^3/kg. The internal energy of the air leaving is 90 kJ/kg greater than that of the air entering. Cooling water in a jacket surrounding the cylinder absorbs heat from the air at the rate of 60 kJ/s. Calculate :
    (i) The power required to drive the compressor ;
    (ii) The cross-sectional areas of inlet and output pipes.

24. In a steam turbine, steam at 20 bar, 360°C is expanded to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assuming ideal processes, determine per kg of steam the net work and the cycle efficiency.

25. A steam turbine is fed with steam having an enthalpy of 3100 kJ/kg. It moves out of the turbine with an enthalpy of 2100 kJ/kg. Feed heating is done at a pressure of 3.2 bar with steam enthalpy of 2500 kJ/kg. The condensate from a condenser with an enthalpy of 125 kJ/kg enters into the feed heater. The quantity of bled steam is 11200 kg/h. Find the power developed by the turbine. Assume that the water leaving the feed heater is saturated liquid at 3.2 bar and the heater is direct mixing type. Neglect pump work.

26. The sling psychrometer in a laboratory test recorded the following readings :
Dry bulb temperature = 35°C
Wet bulb temperature = 25°C.
Calculate the following : (i) Specific humidity (ii) Relative humidity (iii) Vapour density in air (iv) Dew point temperature
Take atmospheric pressure = 1.0132 bar

27. (a) A vessel of 6 m^3 capacity contains two gases A and B in proportion of 45 per cent and 55 per cent respectively at 30°C. If the value of R for the gases is 0.288 kJ/kg K and 0.295 kJ/kg K and if the total weight of the mixture is 2 kg, calculate : (i) The partial pressure ; (ii) The total pressure ; (iii) The mean value of R for the mixture. (8)

(b) What is PMM2? Explain with neat sketch. (4)

28. (a). A system at 500 K receives 7200 kJ/min from a source at 1000 K. The temperature of atmosphere is 300 K. Assuming that the temperatures of system and source remain constant during heat transfer find out : (i) The entropy produced during heat transfer ; (ii) The decrease in available energy after heat transfer. (8)

(b). Deduce the expression for the displacement work in an isothermal process. (4)

*******THE END*******