Code: 13A03302 **R13**

B.Tech II Year I Semester (R13) Supplementary Examinations November/December 2016

THERMODYNAMICS

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What is thermodynamic equilibrium?
(b) Distinguish between path and point properties.
(c) State first law of thermodynamics.
(d) Differentiate between internal energy and enthalpy.
(e) State Carnot's theorem.
(f) What is Clausius inequality?
(g) What is a Mollier diagram?
(h) What is Joule-Kelvin effect?
(i) Distinguish between C_P and C_V.
(j) Differentiate between Sterling and Ericson Cycles.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) What are Microscopic and Macroscopic approaches?

(b) A Gas of volume 6000CC at a pressure of 100 kPa is compressed quasi statically according to PV^2 = a constant until the volume becomes 2000CC. Determine the final pressures and work transfer.

OR

3 (a) Briefly discuss about the work and heat transfer.

(b) A cylinder containing the air comprises the system. The cycle is completed as follows:

(i) 82000 N-m of work is done by the piston on the air during compression stroke and 45 kJ heat is rejected to the surroundings.

(ii) During expansion stroke 100000 N-m of work is done by the air piston.

(iii) Calculate the quantity of heat added to the system.

UNIT – II

4 (a) Apply first law to a process and a cycle.

(b) A cyclic heat engine operates between a source temperature of 800^{o}C and a sink temperature of 30^{o}C. What is the least rate of the heat rejection per kW net output of the engine?

OR

5 A nozzle is a device for increasing the velocity of a steadily flowing stream. At the inlet to a certain nozzle, then the enthalpy of fluid passing is 3000 kJ/kg and velocity is 60 m/s. at the discharge end, the enthalpy is 2762 kJ/kg. the nozzle is horizontal and there is negligible heat loss from it.

(i) Find the velocity at the exit from the nozzle.
(ii) If the inlet area is 0.1 m^2 and the specific volume at inlet is 0.187 m^3/kg, find the mass flow rate.
(iii) If the specific volume at nozzle exit is 0.498 m^3/kg, find the exit area of the nozzle.

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UNIT – III

6 (a) Briefly discuss about reversibility and irreversibility concepts.

(b) 2 kg of water at 80^{o}C is mixed adiabatically with 3 kg of water at 30^{o}C ion a constant pressure process of 1 atmosphere. Find the increase in entropy at the total mass of water due to the mixing process. Take specific heat of water has 4.187 kJ/kgK.

OR

7 (a) Explain the vapour compression cycle with the help of flow, T-S and p – h diagrams.

(b) A domestic freezer maintains a temperature of -50^{o}C. The ambient air temperature is 30^{o}C. If heat leaks in to the freezer at a continuous rate of 1.75 kJ/s, what is the least power necessary to pump the heat out continuously?

UNIT – IV

8 (a) Draw a P – T diagram for a pure substance and mark various regions.

(b) Stream initially at 0.3 MPa, 250^{o}C is cooled at constant volume?

(i) At what temperature will the stream become saturated vapour?

(ii) What is the quantity at 80^{o}C?

(iii) What is the heat transferred per Kg of stream in cooling from 250^{o}C to 80^{o}C?

OR

9 (a) Derive any two Maxwell's relations.

(b) The vapour pressure, in mm Hg, of solid ammonia is given by:

ln P = 23.03 – 3754/T and the of liquid ammonia by

ln P = 19.49 - 3063/T

(i) What is the temperature of the triple point?

(ii) What is the pressure?

UNIT – V

10 (a) Draw P – V and T – S Diagrams of Otto cycle and mark all the processes in it.

(b) An engine equipped with a cylinder having a bore of 15 cm and a stroke of 45 cm operates on Otto cycle if the clearance volume is 2000CC, complete the air standard efficiency of the cycle.

OR

11 (a) Explain briefly about Avogadro's law and Dalton's law of partial pressures.

(b) A certain gas has C_P = 1.968 and C_V = 1.507 kJ/kgK, find its molecular weight and its gas constant. A constant volume chamber of 0.3 m^3 capacity contains 2 kg of this gas at 5^{o}C. Heat is transferred to the gas until the temperature is 100^{o}C. Find the work done, the heat transferred and the changes in internal energy, enthalpy and entropy**.**

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