Code: 15A03303 **R15**

B.Tech II Year I Semester (R15) Supplementary Examinations June 2017

THERMODYNAMICS

(Mechanical Engineering)

(Use of steam tables & mollier diagrams should be supplied)

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 do you mean by reversible work?
(b) State zeroth law of thermodynamics.
(c) Compare steady and unsteady flow process.
(d) Define internal energy and enthalpy.
(e) Write some examples of irreversible process.
(f) What is a temperature entropy diagram?
(g) What is Joule Kelvin effect?
(h) Sketch the H-S and P-T diagram of a pure substance.
(i) State Dalton's law of partial pressures.
(j) Write the characteristic equation for gas mixture.

PART – B

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

UNIT – I

2 (a) What is a quasi-static process?
(b) The properties of a closed system will change following the relation between pressure and volume as PV = 3.0 where P is in bar, V is in m^3. Calculate the work done when the pressure increases from 1.5 bar to 7.5 bar.

OR

3 (a) Compare open, closed and semi closed systems.
(b) Determine the work done by the air which enters into an evacuated vessel from atmosphere when the valve is opened. The atmospheric pressure is 1.013 bar and 1.5 m^3 of air at atmospheric condition enters into the vessel.

UNIT – II

4 (a) State the first law of thermodynamics and prove that for a non-flow process, it leads to the energy equation $Q = \Delta U + W$.
(b) The work and heat transfer per degree temperature change for a system executing a steady non-flow process are given by $\frac{dw}{dt} = \frac{1}{8}\ kJ/℃$ and $\frac{dQ}{dT} = 0.4\ kJ/℃$. Determine the change in internal energy of the system when the temperature increases from 100℃ to 260℃.

OR

5 (a) Define internal energy and prove that it is a property of the system.
(b) A system executes a cyclic process during which there are four transfers of heat as given below: Q_{12} = 880 kJ; Q_{23} = 100 kJ; Q_{34} = -720 kJ; Q_{41} = 200 kJ. The work transfers during the processes are given as: W_{12} = 60 kJ; W_{23} = -40 kJ; W_{34} = 80 kJ. Find W_{41}.

UNIT – III

6 (a) Given an expression for entropy changes for an open system.
(b) 1.2 m^3 of air is heated reversibly at constant pressure from 300 K to 600 K and is then cooled reversibly at constant volume back to initial temperature. If the initial pressure is 1 bar, calculate the net heat flow and overall change in entropy. Take Cp = 1.005 kJ/kgK and R = 0.287 kJ/kgK.

OR

7 An ice plant working on a reversed Carnot cycle heat pump produces 15 ton of ice per day. The ice is formed from water at 0℃ and the formed ice is maintained at 0℃. The heat is rejected to the atmosphere at 25℃. The heat pump used to run the ice plant is coupled to a Carnot engine which absorbs heat from a source which is maintained at 220℃ by buring liquid fuel of 44500 kJ/kg calorific value and rejects the heat to the atmosphere. Determine (i) Power consumed by the engine. (ii) Fuel consumed per hour. Take enthalpy of fusion of ice = 334.5 kJ/kg.

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UNIT – IV

8 Describe with a neat sketch, separating throttling calorimeter for measuring the degree fraction of steam.

OR

9 Derive the Maxwell relations and explain their importance in thermodynamics.

UNIT – V

10 State and explain the importance of internal energy and enthalpy of gas mixtures.

OR

11 Derive an expression for efficiency of Otto cycle. Draw p-V and T-s diagrams.

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