Code: 15A03303 **R15**

B.Tech II Year I Semester (R15) Regular Examinations November/December 2016

THERMODYNAMICS

(Mechanical Engineering)

(Steam tables & mollier diagrams should be supplied)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

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

(a) What is a thermodynamic cycle?
(b) What is the energy of an isolated system?
(c) State the zeroth law of thermodynamics.
(d) Write the differential form of the steady flow energy equation.
(e) Define thermal efficiency of a heat engine cycle.
(f) State the Kelvin Plank Statement of second law.
(g) What do you mean by quality of steam?
(h) State Avagadro's law.
(i) What do you mean by 'Tripple point' with respect to pure substance?
(j) What is Universal Gas Constant?

PART – B

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

UNIT – I

2 What is a thermodynamic system? Explain different classes of systems with suitable examples.

OR

3 (a) Show that work is a path function and not a property.

(b) A gas under goes two processes: Process 1-2 expansion from pressure P_1 = 340 kPa and volume V_1 = 0.0425 m^3 to pressure P_2 = 136 kPa, during which the P-V relation is given by PV^2 = constant. Process 2-3 constant pressure compression to volume $V_3 = V_1$. Sketch the processes on a P-V diagram and determine the work done.

UNIT – II

4 A fluid system, contained in a piston and cylinder machine, passes through a complete cycle of four processes. The sum of all heat transferred during a cycle is -170 kJ. The system completes 100 cycles per minute. Complete the following table showing the method for each item and compute the net rate of work output in kW.

Process	Q (kJ/min)	W (kJ/min)	ΔE (kJ/min)
1-2	0	2170	--
2-3	21000	0	--
3-4	-2100	--	-36600
4-1	--	--	--

OR

5 An ideal gas of volume 0.15 m^3 at a pressure of 15 bar and 550 °K expanded isothermally to 4 times the initial volume. It is then cooled to 290 °K at constant volume and then compressed back polytropically to its initial state. Calculate the net work done and heat transferred during the cycle.

UNIT – III

6 Define Carnot efficiency and which is the more effective way to increase the efficiency of a Carnot cycle: to increase T_1 keeping T_2 constant; or to decrease T_2, keeping T_1 constant? Where T_1 is upper temperature and T_2 is lower temperature.

OR

7 Derive an expression for entropy changes for a closed system of polytropic process.

Contd. in page 2

UNIT – IV

8 A large insulated vessel is divided into two chambers one containing 5 kg of dry saturated steam at 0.2 MPa and the other 10 kg of steam, 0.8 quality at 0.5 MPa. If the partition between the chambers is removed and the steam is mixed thoroughly and allowed to settle, find the final pressure, steam quality and entropy change in the process.

OR

9 By using first and second Tds equations, derive an expression for the difference in heat capacities, C_P and C_V. What does the expression signify?

UNIT – V

10 0.5 kg of air is compressed reversibly and adiabatically from 80 kPa, 60℃ to 0.4 MPa and is then expanded at a constant pressure to the original volume. Sketch these processes on the p-v and T-s planes. Compute the heat transfer and work transfer for the whole path.

OR

11 Prove that for the same compression ratio, the efficiency of the diesel cycle is less than that of Otto cycle.

*****