Code: 15A03303 **R15**

B.Tech II Year I Semester (R15) Regular & Supplementary Examinations November/December 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 are intensive and extensive properties?
(b) Define heat transfer.
(c) List out the applications of steady flow processes.
(d) What do you mean by perpetual motion machine of first kind-PMM1?
(e) Define available energy.
(f) Compare refrigerator and heat pump.
(g) What is a pure substance?
(h) Define dryness fraction.
(i) Write the relation for specific heats of a gas mixture.
(j) Draw the dual cycle.

PART – B

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

UNIT – I

2 Write short notes on work and heat properties of a system? Discuss with examples the following statements:

(a) Heat is not always present when temperatures rise occurs.
(b) Heat does not inevitably cause temperature rise.

OR

3 Explain the difference between point and path functions. Define thermodynamic work and prove that it is a path function.

UNIT – II

4 (a) What is mechanical equivalent of heat? Write down its value when heat is expressed in kJ and work is expressed in Nm.

(b) A closed system of constant volume experiences a temperature rise of 25℃ when a certain process occurs. The heat transferred in the process is 30 kJ. The specific heat at constant volume for the pure substance comprising the system is 1.2 kJ/kg℃ and the system contains 2.5 kg of this substance. Determine: (i) Change in internal energy. (ii) Work done.

OR

5 (a) Why only in constant pressure non-flow process the enthalpy change is equal to heat transfer?

(b) 5 m^3 of air at 2 bar, 27℃ is compressed up to 6 bar pressure following $PV^{1.3}$ = constant. It is subsequently expanded adiabatically to 2 bar. Considering the two processes to be reversible, determine the network.

UNIT – III

6 (a) What do you mean by "Calusius inequality"?

(b) Determine the entropy change of 4 kg of a perfect gas whose temperature varies from 127℃ to 227℃ during a constant volume process. The specific heat varies linearly with absolute temperature and is represented by the relation: $C_V = (0.48 + 0.0096T)$ kJ/kgK.

OR

7 Two Carnot engines work in series between the sources and sink temperatures of 550 K and 350 K. If both engines develop equal power, determine the intermediate temperature.

UNIT – IV

8 Draw a neat sketch of throttling calorimeter and explain how dryness fraction of steam is determined, clearly explain its limitations.

OR

9 For a perfect gas, show that the difference in specific heats is $C_P - C_V = \frac{R}{T}$.

UNIT – V

10 Explain briefly Dalton's law and Gibbs-Dalton law.

OR

11 Derive an expression for efficiency of Diesel cycle. Draw the P-V and T-S diagrams.

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