Code: 15A03303 **R15**

B.Tech II Year I Semester (R15) Regular & Supplementary Examinations November/December 2018

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 meant by thermodynamics system? How do you classify it?
(b) Difference between path and point functions.
(c) State the first law of thermodynamics.
(d) What is the requirement of thermal equilibrium? Which law governs it?
(e) State Carnot's theorem.
(f) State Clausius statement of second law of thermodynamics.
(g) Draw the T-S diagram for reheat cycle.
(h) What is the value of the Clapeyron equation in thermodynamics?
(i) State Dolton's law of partial pressure.
(j) Write about Dual combustion cycles.

PART – B

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

UNIT – I

2 (a) Differentiate between microscopic and macroscopic approaches in thermodynamics.
(b) Explain the working principle of constant pressure ideal gas thermometer.

OR

3 The following data referred to a 12 cylinder, single acting, two stroke marine diesel engine.

Speed = 150 r.p.m
Cylinder diameter = 0.8 m
Stroke of piston = 1.2 m
Area of indicator diagram = 5.5×10^{-4} m^2
Length of the indicator diagram = 0.06 m
Spring value = 147 MPa/m

Find the net rate of work transfer from the gas to piston in kW.

UNIT – II

4 A cylinder contains 0.45 m^3 of gas at 1×10^5 N/m^2 and 80°C. The gas is compressed to a volume of 0.13 m^3, the final pressure being 5×10^5 N/m^2. Determine: (i) The mass of gas. (ii) The value of index "n" for compression the increase in internal energy of the gas. (iii) The heat received or rejected by the gas during compression. Take γ = 1.4, R = 294.2 J/kgK.

OR

5 For analysis of flow through a device involving one inlet flow and one exit flow, it is found that for mass flow rate of 5 kg/see, the inlet and exit section flow parameters are 20 m/sec velocity, 2 m altitude, 300 kJ/kg enthalpy and 30 m/sec velocity, 6 m altitude, 400 kJ/kg enthalpy respectively. There is heat flow of 500 kW out of the device and Work transfer of 300 kW into the device. Determine whether the flow is steady or unsteady. What is the rate of energy change for the device? If changes in K.E and P.E were to be neglected, what would be the percent error in the calculation of energy transfer?

Contd. in page 2

Code: 15A03303

R15

UNIT – III

6 Derive the efficiency of Carnot cycle and explain with neat p-v and t-s diagrams.

OR

7 A reversible engine is supplied with heat from two constant temperature sources at 900 K and 600 K and rejects heat to a constant temperature sink at 300 K. The engine develops work equivalent to 90 kJ/s and rejects heat at the rate of 56 kJ/s. Estimate: (i) Heat supplied by each source. (ii) Thermal efficiency of the engine.

UNIT – IV

8 Derive Dalton's law of partial pressure. Define Amagat's law of partial volume.

OR

9 Derive Maxwell's equation.

UNIT – V

10 An Ericsson cycle operating with an ideal regenerator works between 1100 K and 288 K. the pressure at the beginning of isothermal compression is 1.013 bar. Determine: (i) The compressor and turbine work per kg of air. (ii) The cycle efficiency.

OR

11 Explain the processes of Otto cycle using T-s and P-v plots. Derive equation for cycle efficiency.

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