25/11/14

F 3110 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Mechanical Engineering/Automobile Engineering

THERMODYNAMICS (M,U)

(Prior to 2010 Admissions—Old Scheme)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. Differentiate between closed system and isolated system.
2. Explain (i) chemical and (ii) thermal equilibrium.
3. How does the resistance thermometer measure temperature ?
4. What is meant by effective pressure ? How is it measured ?
5. How is entropy related to molecular disorder in a system ?
6. Why is the second law called a directional law of nature ?
7. What is meant by availability ?
8. Why is the Joule-Thomson coefficient zero for an ideal gas ?
9. What do you understand by triple point ?
10. Why cannot a throtting calorimeter measure the quality if the steam is very wet ?

(10 × 4 = 40 marks)

SAINTGITS COLLEGE OF ENGINEERING LIBRARY KOTTAYAM

Part B

Answer **all** *questions.*
Each question carries 12 *marks.*

11. Distinguish between the terms 'change of state' 'path' and 'process'. What is a thermodynamic cycle ?

Or

12. (a) Discuss the different types of pressure transducers. (5 marks)

Turn over

(b) A turbine is supplied with steam at a gauge pressure of 1.4 MPa. After expansion in the turbine the steam flows into a condenser which is maintained at a vacuum of 710 mm Hg. The barometric pressure is 772 mm Hg. Express the inlet and exhaus steam pressures in Pascals (absolute). Take density of mercury as 13.6×10^3 kg/m^3.

(7 marks)

13. Account for the existence of two values for specific heat of a gas, and derive the relation between them and the characteristic gas constant.

Or

14. (a) Define enthalpy. How is it related to internal energy ? (6 marks)

(b) State and explain Joule's law of internal energy for an ideal gas. (6 marks)

15. Derive the Clausius inequality and explain its significance.

Or

16. A reversible heat engine receives equal quantity of heat from two thermal reservoirs at temperature T_1 and T_2, and rejects heat to a heat sink at T_3. Presuming that efficiency of this engine is 'α' times the efficiency of a reversible engine, absorbing the same amount of heat only from reservoir at T_1, and rejecting heat to sink at T_3, show that

$$\alpha = \frac{1}{2}\left[\frac{T_2 - T_3}{T_1 - T_3} + \frac{T_2}{T_3}\right] \times \frac{T_1}{T_2}$$

SAINTGITS COLLEGE OF ENGINEERING LIBRARY KOTTAYAM

17. Air enters a compressor in steady flow at 140 KPa, 17°C and 70 m/s and leaves it at 350 KPa, 127°C and 110 m/s. The environment is at 100 KPa, 7°C. Calculate per kg of air (a) the actual amount of work required, (b) the minimum work required, and (c) the irreversibility of the process.

Or

18. Over a certain range of pressures and temperature the equation of a certain substance is given by the relation $V = \frac{RT}{P} - \frac{C}{T^3}$, where C is a constant. Derive an expression for (a) the change of enthalpy and (b) the change of entropy of this substance in an isothermal process.

19. Steam initially at 1.5 MPa, 300°C expands reversibility and adiabatically in a steam turbine to 40°C. Determine the ideal work output of the turbine per kg of steam.

Or

20. (a) Derive the expression for properties of mixture of gases based at Dalton's law. (6 marks)

(b) Show that for an ideal gas, the slope of the constant volume line on the T-s diagram is more than that of the constant pressure line.

(6 marks)

($5 \times 12 = 60$ marks)