Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐   Total No. of Pages : 02

Total No. of Questions : 18

B.Tech. (Food Technology)   (Sem.–3)
THERMODYNAMICS
Subject Code : BTFT-217-19
M.Code : 78734

Time : 3 Hrs.   Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :
1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Define a thermodynamic system.

2. Draw a p-T (pressure-temperature) diagram for a pure substance.

3. Does wet steam obey laws of perfect gases ?

4. Explain clearly the difference between a non-flow and a steady flow process.

5. Why only in constant pressure non-flow process, the enthalpy change is equal to heat transfer?

6. What do you mean by 'Thermodynamic temperature'?

7. What are the characteristics of entropy?

8. What is the difference between an ideal and a perfect gas?

9. What is Joule-Thomson coefficient?

10. Explain the importance of Maxwell relations in thermodynamics.

SECTION-B

11. Derive the following relations :

   i) $u = a - T\left(\dfrac{\partial a}{\partial T}\right)_v$ ii) $h = g - T\left(\dfrac{\partial g}{\partial T}\right)_p$

   Where a = Helmholtz function (per unit mass), and

   g = Gibbs function (per unit mass).

12. Derive the relationship between the two principal specific heats and characteristic gas constant for a perfect gas.

13. Prove that all reversible engines operating between the same heat reservoirs have the same efficiency.

14. Determine the entropy change of 4kg of a perfect gas whose temperature varies from 127ºC to 227ºC during a constant volume process. The specific heat varies linearly with absolute temperature and is represented by the relation :

   $c_\upsilon = (0.48 + 0.0096\ T)\ kJ\ /\ kg\ K$.

15. Describe the process of formation of steam and give its graphical representation also.

SECTION-C

16. 0.45 kg of carbon monoxide (28) and 1 kg of air at 15ºC are contained in a vessel of volume 0.4 m^3. Calculate the partial pressure of each constituent and the total pressure in the vessel. The gravimetric analysis of air is to be taken as 23.3% oxygen (32) and 76.7% nitrogen (28).

17. a) Prove that the rate of change of hat interchange per unit change of volume when gas is compressed or expanded is given by $\dfrac{\gamma - n}{\gamma - 1} \times \dfrac{pd\upsilon}{J}$

   b) For isothermal flow and non-flow steady processes, prove that

   $$\int_1^2 pd\upsilon = - \int_1^2 \upsilon.dp$$

   Also state the assumptions made.

18. Write short notes on the following :

   i) Perpetual motion machine of second kind.

   ii) Claperyon equation and its applications.

   iii) Helmholtz and Gibbs function.

   iv) Measurement of dryness fraction.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.