Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B. TECH DEGREE EXAMINATION (Regular), JULY 2022

FOOD TECHNOLOGY

(2020 SCHEME)

Course Code: **20FTT206**

Course Name: **Food Engineering Thermodynamics and Reaction Kinetics**

Max. Marks : **100** **Duration: 3 Hours**

Data Book is necessary

PART A

(Answer all questions. Each question carries 3 marks)

1. State Zeroth law of thermodynamics.
2. Define enthalpy.
3. List the limitations of first law of thermodynamics.
4. Discuss the entropy concept.
5. Write the equation for Clapeyron.
6. Reproduce fugacity
7. State collision theory.
8. State transition theory.
9. Differentiate space time and space velocity.
10. Write down the Michaeli's-Menten equation for the enzyme substrate reaction.

$$E + A \rightarrow X \leftarrow E + P.$$

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Derive the first law of Thermodynamics for non-flow process (10)
    b) Recall system and discuss closed system, open system and isolated system with examples. (4)

OR

12. a) A mass of air is initially at 200°c and 450kPa, and occupies 0.016 m^3. the air is expanded at constant pressure to 0.077 m^3. A polytrophic process with n=1 is then carried out followed by a constant temperature process which completes a cycle. All the processes are reversible. (10)
        i). Sketch the cycle in T-S and P-V planes
        ii). Find the heat received and heat rejected in the cycle
    b) Discuss the significance of joule Thompson coefficient. (4)

MODULE II

13. a) Elaborate Carnot cycle and reverse Carnot cycle in detail. (10)
    b) Recall the Clausius inequality. (4)

OR

14. a) Write the Kelvin–Planck statement and the Clausius statement of the second law of thermodynamics and justify that they are equivalent. (10)
    b) Recall Carnot theorem. (4)

MODULE III

15. A 30 per cent by mole methanol-water solution is to be prepared. How many cubic meters of pure methanol (molar volume, 40.727 x 10^{-6} m^3/mol) and pure water (molar volume, 18.068 x 10^{-6} m^3/mol) are to be mixed to prepare 2m^3 of the desired solution? The partial molar volumes of methanol and water in a 30 per cent solution are 38.632 x 10^{-6} m^3/mol and 17.765 x 10^{-6} m^3/mol, respectively. (14)

OR

16. a) Derive Maxwell's thermodynamics relation from Gibbs free energy and Helmholtz free energy. (10)
    b) Discuss on fundamental thermodynamic property relations. (4)

MODULE IV

17. Explain the effect of temperature on reaction rate according to the transition state theory and compare with other theories. (14)

OR

18. Explain the Integral and Differential method of analysis for finding the rate of reaction. (14)

MODULE V

19. Derive the space time and space velocity equations for the steady state MFR and PFR and also give the graphical representations of the design equations. (14)

OR

20. Explain Michaelis Menten kinetics in explaining the fundamentals of enzymatic reactions. (14)

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