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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (R), MAY 2023
FOOD TECHNOLOGY
(2020 SCHEME)

Course Code : 20FTT206

Course Name: Food Engineering Thermodynamics and Reaction Kinetics

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

PART A

(Answer all questions. Each question carries 3 marks)

1. Define closed system, open system and isolated system with examples.
2. What are intensive and extensive thermodynamic properties? Give examples.
3. Write short notes on P-V and T-s diagrams.
4. Summarize the concept of entropy with an illustration.
5. Recall the fundamental thermodynamic property relations.
6. Define fugacity and summarize the effect of temperature on activity.
7. Draw a flowchart to classify chemical reactions.
8. Compare first order and second order chemical reactions.
9. Define space time and space velocity.
10. Explain the concept of ideality in chemical reactors.

PART B

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

MODULE I

11. Prove that for reversible non-flow process dH=dQ at constant pressure and dU=dQ at constant volume. (14)

OR

12. Explain Joule Thompson porous plus experiment with neat sketch and state the significance of joule Thompson coefficient. (14)

MODULE II

13. a) Elaborate on Carnot cycle with necessary state diagrams and discuss about the efficiency of the reversed Carnot cycle. (10)
    b) Write short notes on entropy change in ideal gases. (4)

OR

14. a) Show that the Kelvin–Planck statement and the Clausius statement of the second law of thermodynamics are equivalent. (10)

b) Summarize the concept of Clausius Inequality. (4)

MODULE III

15. a) Derive Maxwell's thermodynamics relation from Gibbs free energy and Helmholtz free energy. (10)

b) Discuss the effect of temperature and pressure on fugacity. (4)

OR

16. a) A 30 per cent by mole methanol-water solution is to be prepared. How many cubic metres 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. (7)

b) Derive Gibbs Duhem equation. (7)

MODULE IV

17. a) Explain the Integral and Differential method of analysis for finding the rate of reaction. (10)

b) State Collision theory and Transition state theory with illustrations. (4)

OR

18. a) Describe the effect of temperature on reaction rate according to the transition state theory and compare with other theories. (10)

b) Discuss the effect of pressure and temperature on activity of fluids. (4)

MODULE V

19. a) Derive the design equation for ideal batch reactor and continuous stirred tank reactor. (10)

b) Summarize the Michaelis Menten kinetics of enzymatic reactions. (4)

OR

20. 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)

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