Register No.: …… Name: ……..

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B. TECH DEGREE EXAMINATION (S), SEPT 2022
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 thermodynamic system and surroundings with examples.
2. Compare intensive and extensive thermodynamic properties.
3. Recall the Kelvin–Planck statement and the Clausius statement of the second law of thermodynamics.
4. Summarize the concept of entropy with an illustration.
5. Express Joule Thompson coefficient for different processes.
6. Define activity 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. A mass of air is initially at 206°C and 700kPa, and occupies 0.03m^3. the air is expanded at constant pressure to 0.09m^3. A polytrophic process with n=1.5 is then carried out followed by a constant temperature process which completes a cycle. All the processes are reversible. All the process is reversible.Sketch the cycle on pressure-volume diagram and find the heat received and heat rejected in the cycle. Take R=0.287 KJ/KgK, Cr = 0.713 KJ/KgK. (14)

OR

12. Describe the Joule Thompson porous plug experiment with neat sketch and state the significance of Joule Thompson coefficient. (14)

MODULE II

13. a) Explain the Carnot cycle and discuss about the P-V and T-s diagram and also the efficiency of the reversed Carnot cycle. (10)
    b) Write short notes on Clausius Inequality. (4)

OR

14. a) Show that the Kelvin–Planck statement and the Clausius statement of the second law of thermodynamics are equivalent. (10)
    b) Recall the entropy change calculation for ideal gases. (4)

MODULE III

15. a) Define Gibbs free energy and from the concept of free energy derive Gibbs Helmholtz equation. (10)
    b) Summarize the fundamental thermodynamic property relations. (4)

OR

16. a) Using the concept of equilibrium, derive Clausius Clapeyron equation (10)
    b) Discuss the effect of temperature and pressure on fugacity. (4)

MODULE IV

17. a) Explain the Integral and Differential method of analysis for finding the rate of reaction. (10)
    b) Discuss the uniqueness of zero order reaction other order reactions. (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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