

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 : 20FTT202****Course Name: Fundamentals of Heat and Mass Transfer****Max. Marks : 100****Duration: 3 Hours****PART A*****(Answer all questions. Each question carries 3 marks)***

1. What is Fourier's Law of heat conduction?
2. What is coefficient of Thermal conductivity?
3. What is meant by free or natural convection & forced convection?
4. State Buckingham's pi' theorem.
5. Define Wien's distribution law.
6. Distinguish between Absorptivity & Transmittivity of radiation.
7. Explain Fick's law of diffusion.
8. What is the governing equation for transient diffusion?
9. Define distillation with neat flow diagram.
10. List the types of absorption columns.

PART B***(Answer one full question from each module, each question carries 14 marks)*****MODULE I**

11. a) Derive the equation for conduction of heat through a hollow cylinder. (10)
- b) Explain the difference between individual and overall heat transfer coefficient. (4)

OR

12. a) A composite wall is formed of a 2.5 cm copper plate ($k = 355 \text{ W/m.K}$), a 3.2 mm layer of asbestos ($k = 0.110 \text{ W/m.K}$) and a 5 cm layer of fiber plate ($k = 0.049 \text{ W/m.K}$). The wall is subjected to an overall temperature difference of 560°C (560°C on the Cu plate side and 0°C on the fiber plate side). Estimate the heat flux through this composite wall and the interface temperature between asbestos and fiber plate. (10)

- b) What is meant lumped capacity? What are the physical assumptions necessary for an unsteady state analysis of a lumped capacity model? (4)

MODULE II

13. a) Sketch the boundary layer development of a flow over a flat plate and explain the significance of the boundary layer. (7)
b) Derive an expression for critical thickness of insulation for a cylinder. (7)

OR

14. a) Explain the types of condensers. (7)
b) Sketch, temperature and velocity profiles in free convection on a vertical wall. (7)

MODULE III

15. a) What are the types of heat exchangers? (4)
b) Derive an expression for temperature difference using LMTD method. (10)

OR

16. a) What are the factors that are involved in designing a heat exchanger? (4)
b) Compare LMTD and NTU method of heat exchanger analysis. (10)

MODULE IV

17. a) Derive the Steady State molecular diffusion of A through stagnant gas B. (7)
b) Define Fourier number & Biot number for mass transfer. (7)

OR

18. a) Derive the governing equation for Diffusion mass transfer. (7)
b) Discuss the analogy between heat and mass transfer. (7)

MODULE V

19. a) Explain differential or simple distillation with neat flow diagram. (7)
b) Discuss about the McCabe-Thiele method for obtaining theoretical plates. (Including Assumptions, stepwise procedure and Limitations). (7)

OR

20. a) Write the equation for feed plate line (q line) and draw the q-line for various conditions of feed. (7)
b) Explain the calculation procedure of minimum reflux ratio. (7)
