

Register No:

Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SIXTH SEMESTER B.TECH DEGREE EXAMINATION(R,S), MAY 2024**B. Tech. Food Technology****(2020 SCHEME)****Course Code : 20FTT304****Course Name : Food Process Equipment and Design****Max. Marks : 100****Duration:3 Hours****Scientific calculator and statistical table is allowed in the examination hall.****PART A***(Answer all questions. Each question carries 3 marks)*

1. Discuss Hooke's Law and its significance in describing the linear elastic behavior of materials under mechanical loading.
2. What are the primary materials commonly used in the construction of sanitary pipes and fittings for food equipment?
3. Explain the term Sterilisation.
4. Explain Airy's theory.
5. Compare single effect and multiple effect evaporators in terms of energy efficiency and evaporation capacity.
6. Discuss the major limitation of plate heat exchangers.
7. Enumerate the considerations involved in the design of cold storage systems.
8. Explain the importance of insulation materials in maintaining the desired temperature in a cold storage facility.
9. Discuss one factor that influences the effectiveness of air screen cleaners in separating unwanted materials from grain.
10. Identify and describe an equipment that can separate the material from food grains according to specific gravity .

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

11. Explain the general design procedure in engineering, detailing each stage, its significance, and the methodologies employed. Provide examples from different industries to illustrate the application of this procedure, and discuss challenges and strategies for mitigating them throughout the design process. 14

OR

12. i) A machine element is subjected to the following stresses $\sigma_x = 60 \text{ MPa}$, $\sigma_y = 45 \text{ Mpa}$, $\tau_{xy} = 30 \text{ Mpa}$. Find the factor of safety if it is made of C45 steel having yield stress at 353 MPa, using the following theories of failure. 7
- ii) Summarize the various types of corrosion that occurs in equipment used in process plants. 7

MODULE II

13. Compare and contrast the design considerations for horizontal and vertical storage tanks, including factors such as space utilization, structural stability, and maintenance requirements. 14

OR

14. i) Describe the construction of pressure vessels and their components with neat diagrams. 10
ii) A thin cylindrical pressure vessel of 1.2 m diameter generates steam at a pressure of 1.75 N/mm². Find the minimum wall thickness, if (a) the longitudinal stress does not exceed 28 MPa; 4
and (b) the circumferential stress does not exceed 42 MPa.

MODULE III

15. Briefly explain the design of Louisiana State University (LSU) dryer with supporting figure. 14

OR

16. A chemical process requires cooling using a shell-and-tube heat exchanger. The process fluid enters the exchanger at 120°C and exits at 60°C, while the cooling water enters at 25°C and exits at 40°C. The overall heat transfer coefficient is 500 W/m²K, and the heat exchanger area is 50 m². Calculate the Log Mean Temperature Difference (LMTD) for this system and determine the length of the tube required for effective heat transfer. Discuss the significance of LMTD in optimizing heat exchanger performance and analyze the factors that may affect its accuracy in practical applications. 14

MODULE IV

17. Briefly explain the basic principle, working, design procedure of a single-screw extruder and identify one advantage it offers over twin-screw extruders. 14

OR

18. A spherical product is being frozen in an air blast wind tunnel. The initial product temperature is 150°C and that of cold air is -20°C. The product has a 6 cm diameter with a density of 1050 kg/m³ & the convective heat transfer coefficient for the air blast is 75 W/m²K. The thermal conductivity for the frozen product is 1.1 W/mK, the initial freezing temperature is -1.8°C and the latent heat of fusion is 300 kJ/kg. Compute the freezing time. 14

MODULE V

19. Describe the operational mechanisms employed by Magnetic Separators to achieve material separation based on magnetism. 14

OR

20. Describe the operating principles and applications of pneumatic separators? 14
