Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Examination (Regular and Supplementary), December 2020

Course Code: FT401
Course Name: FOOD PROCESS EQUIPMENT AND DESIGN

Max. Marks: 100   Duration: 3 Hours

PART A
Answer any two full questions, each carries 15 marks.   Marks

1 a) Explain in detail about the various materials of construction used in the fabrication of food processing equipments.   (10)

   b) Define pressure vessel, types based on geometry; mention the components of pressure vessel and functions with a schematic diagram.   (5)

2 a) State the various theories to predict the failure of a material subjected to combined stresses.   (10)

   b) Explain the safety considerations in equipment design.   (5)

3 a) Determine the standard plate thickness of a process vessel cylindrical wall made of grade 2B quality steel of IS code which have allowable stress of 120 N/mm^2 at working temperature with joint efficiency of 0.85 and working internal pressure of 0.476 N/mm^2, if diameter is 1250 mm and length 2500 mm. What maximum internal pressure a spherical vessel can take safely, if it is made of the same material and diameter?   (7.5)

   b) List out and explain the various types of corrosion and its control measures.   (7.5)

PART B
Answer any two full questions, each carries 15 marks.

4 a) Write down the general approach to estimate the power requirements in extrusion system.   (7.5)

   b) Derive Rankine's theory to determine the pressure inside a storage tank.   (3)

   c) Discuss about the types of insulation materials used for the thermal insulation of food process plant equipments.   (4.5)

5   A parallel flow heat exchanger has a hot and a cold water streams flowing through it. The flow rates are 600 kg/h and 1500 kg/h, respectively and inlet temperatures are 343 K and 298 K on the hot and cold side respectively. The exit   (15)

temperature on the hot side is required to be 323 K. Calculate the area of the heat exchanger by LMTD approach and Effectiveness- NTU approach. The individual heat transfer coefficients on both sides are 1600 W/ (m^2.K). Also find the outlet temperature of the cold water. Use C$_p$ for both hot and cold water as 4157 J/ (kg.K).

6 a) Explain in detail about the inspection and testing methods involved in piping of process plant.   (7.5)

   b) Write down the general design procedure to determine the heat transfer area and economy of the evaporator.   (7.5)

PART C
Answer any two full questions, each carries 20 marks.

7 a) Mention the various components of belt conveying system and explain its working mechanism with neat diagram.   (10)

   b) Explain the working of vapor compression refrigeration system with pressure-enthalpy diagram.   (10)

8   Describe in detail about the cleaners and graders used in the food process industries.   (20)

9 a) Derive the Plank's equation to calculate the freezing time of the food material for infinite plate/slab geometry.   (15)

   b) Differentiate the definition and importance of controlled and modified atmospheric storage of food materials.   (5)

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