Seat No.:

Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY BE – SEMESTER – VI (NEW).EXAMINATION – WINTER 2016

Subject Code: 2161401

Subject Name: Food Process Equipment Design Time: 10:30 AM to 01:00 PM

Date: 22/10/2016

Total Marks: 70

Instructions:

- **1.** Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- **3.** Figures to the right indicate full marks.
- 1 (a) Fill in the blanks
 - i. Corrosion allowance is taken for the design of wall thickness of pressure vessel is _____ meter
 - ii. _____ heads are preferred for high pressure design of pressure vessels.
 - iii. Turbine agitators are basically employed for generating ____
 - iv. Joint efficiency of a pressure vessel checked by radiograph at few places is considered as _____.
 - v. Units of toughness is ____
 - vi. Thickness of baffles should be _____ of the tank diameter of an agitator.
 - vii. In a thin pressure vessel ______ stress is considered negligible.
 - viii. In a thick pressure vessel thickness of the vessel should be more than ______ diameter of the vessel.
 - (b) Design a cylindrical pressure vessel and its shallow dished head to hold 5.5 kilo liter juice of specific gravity 1.06 at operating pressure of 0.26 ± 0.26 N/mm² and temperature of 52°C. The safety factor is 2 and all joints and joint checking efficiency is 90 and 85% respectively. The permissible stress at 30 and 100°C is 175 and 126 N/mm² respectively. Allowable H/D ratio is ranging from 1.5 to 2.5 only. Available plates in the stock are: Length : any Breadth : 710, 1250, 1500 and 2000 mm Thickness : 6, 7, 9, 11 and 15 mm Corners radius is 6 percent of heads radius. $V = \pi R^2 H$ $t_v = p D / \{2f \eta - p\}; t_h = \{p R W\} / 2f \eta; W = 0.25 [3+\{R_i / R_c\}^{0.5}]$
- Q.2 (a) Discuss the role of baffles in an agitator? What are different types of baffles uses 07 in the agitator? What are the dimensional limitations of baffles?
 - (b) Write a note on:

i.	Safety factor	02
ii.	Coefficient of performance	02
iii.	Crossed flow	03

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Write	a note on:	
i.	Regeneration	02
ii.	Chevron angle	02

iii. Total heat efficiency

(b)

- Q.3 (a) A pressure vessel is operating at pressure of s 0.25±0.03N/mm² at 54°C and the permissible stress is 47.3N/mm². Calculate whether the selection of material for 2.50 safety factor is safe or not, if allowable stress at 30°C and 100°C are 200 and 165 N/mm² respectively. The joints are butt type and they are randomly checked. Thus joint and its checking efficiency are 78 and 80% respectively.
 - (b) What is power number? Develop its equation and discuss its significance in the 07 process of agitation.

OR

- Q.3 (a) Describe process and material hazard of milk and milk products industry? 07 Suggest suitable measures to check them.
 - (b) Design a solid agitator shaft for the process of agitation if maximum bending moment and maximum torque developed in the process are 260 and 140 N m respectively. The material of the shaft have safe permissible tensile stress at the operating condition is 450 N/cm² and shear stress is 66% of the tensile stress.

Q.4	(a)	Differentiate	
		i. Forward feed and backward feed	03
		ii. Oven, Dryer and evaporator	04
	(b)	With neat sketch explain the working of rising film evaporator.	07
		OR	
Q.4	(a)	Differentiate between	
		i. Counter flow and parallel flow	03
		ii. Condensation, Crystallization and Evaporation	04
	(b)	With neat sketch explain the plate heat exchanger. How one can get the better	07
		performance of PHE?	
Q.5	(a)	Explain	
		(i) NTU	01
		(ii) Heat Exchanger Effectiveness	02
		(iii) Develop an equation for effectiveness for parallel flow.	04
	(b)	Write down the steps of designing pressure vessel?	07
		OR	
Q.5	(a)	Write down the steps of designing heat exchanger?	07
	(b)	i. What are the different types of dryers used in the food industry?	02
		ii. How the performance of dryer is evaluated?	02
		iii. How it can be improved.	03

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