GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161401

FOOD PROCESS EQUIPMENT DESIGN
VIth SEMESTER

Type of course: Professional Core Course

Prerequisite: Nil

Rationale: The students of food processing technology should be able to design the food process equipments, machines from the first principle considering their change in properties during the processing.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA(I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Design Consideration:** Introduction, stress created due to static and dynamic loads, design stress, elastic instability, combined stresses and theories of failure, brittle fracture, creep, temperature effects, radiation effects, and effects of fabrication method	8	14
2	**Heat Exchangers:** Introduction, Types of heat exchangers, design of shell and tube heat exchanger, plate heat exchanger design problems	7	16
3	**Pressure Vessel Design:** Introduction, operating conditions, design condition and stress, design of shell and its component, stresses from local and thermal gradient, design problems	7	12
4	**Evaporators:** Evaporators, types of evaporators, entrainment separators, materials of construction, design consideration, design problem	6	11
5	**Agitators:** Introduction, types of agitators, baffling, power requirements for agitation, design of agitation system components, drive for agitation and design problem	7	10
6	**Dryers:** Structural and thermal design, selection of dryer	4	8
7	**Process hazards and safety measures in equipment design:** Introduction, hazards in process industries, analysis of hazards, safety measures in equipment design, pressure relief devices	6	13
8	**Handling equipments:** Design considerations and design problem of chain conveyor, belt conveyor,, bucket elevator and screw conveyor	7	16

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	18	22	22	23	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Food Preservation and Processing, Manoranjan Kalia & Sangita Sood.
2. Food Science, N. N. Potter, C B S Publishers & Distributors.
3. Food Facts & Principles, N. Shankuntala M.& M. Shadakshara S., Wiley EasternLimited.
4. Unit Operations, K. M. Sahay and K. K. Singh.
5. Engineering of Dairy & Food Products, A. W. Farral

Course Outcome:

At the end of this module, the student will be able to:

Sr. No.	CO statement	Weightage (%)
CO-1	Students will be able to understand the process and design the food processing equipment or machine from first principle	40
CO-2	Students understand different process hazards and material hazards which may cause synergetic effect in failure of food processing equipment or machine	60

List of Open Source Software/learning website: http://foodscience.uark.edu/

a. http://www.ucc.ie/en/ace-dfsct/
b. http://www.sciencedirect.com/science/book/
c. http://ciftinnovation.org/food-processing

List of Experiments

1	Problem based on mass balance
2	Problems based on energy balance
3	Design based on evaporator
4	To determine the economy of single effect evaporator
5	To determine the economy of multiple effect evaporator
6	To determine the overall heat transfer coefficient in Agitated vessel
7	Design of shell & tube heat exchanger

8	Design of multiple shell and multiple pass heat exchanger
9	Design of PHE
10	Design of material handling equipments