

# GUJARAT TECHNOLOGICAL UNIVERSITY

## FOOD PROCESSING & TECHNOLOGY (14)

### FOOD PROCESS EQUIPMENT DESIGN

**SUBJECT CODE: 2161401**

**B.E. 6<sup>th</sup> SEMESTER**

**Type of course:** Food Processing Technology

**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 C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
				PA	ALA	ESE	OEP			
4	2	0	6	70	20	10	30	0	20	150

#### Content:

Sr. No.	Content	Total Hrs	% Weightage
<b>1</b>	<b>Design Consideration:</b> 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	<b>8</b>	14
<b>2</b>	<b>Heat Exchangers:</b> Introduction, Types of heat exchangers, design of shell and tube heat exchanger, plate heat exchanger design problems	<b>7</b>	16
<b>3</b>	<b>Pressure Vessel Design:</b> Introduction, operating conditions, design condition and stress, design of shell and its component, stresses from local and thermal gradient, design problems	<b>7</b>	12
<b>4</b>	<b>Evaporators:</b> Evaporators, types of evaporators, entrainment separators, materials of construction, design consideration, design problem	<b>6</b>	11
<b>5</b>	<b>Agitators:</b> Introduction, types of agitators, baffling, power requirements for agitation, design of agitation system components, drive for agitation and design problem	<b>7</b>	10
<b>6</b>	<b>Dryers:</b> Structural and thermal design, selection of dryer	<b>4</b>	8
<b>7</b>	<b>Process hazards and safety measures in equipment design:</b> Introduction, hazards in process industries, analysis of hazards, safety measures in equipment design, pressure relief devices	<b>6</b>	13
<b>8</b>	<b>Handling equipments:</b> Design considerations and design problem of chain conveyor, belt conveyor, bucket elevator and screw conveyor	<b>7</b>	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 Eastern Limited.
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:

1. Students will be able to understand the process and design the food processing equipment or machine from first principle
2. Students understand different process hazards and material hazards which may cause synergetic effect in failure of food processing equipment or machine

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

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

**ACTIVE LEARNING ASSIGNMENTS:** Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.