GUJARAT TECHNOLOGICAL UNIVERSITY

FOOD PROCESSING & TECHNOLOGY (14)
FOOD ENGINEERING OPERATIONS - II
SUBJECT CODE: 2161403
B.E. 6th SEMESTER

Type of course: Food Processing Technology

Prerequisite: Nil

Rationale:
Food engineering operations-II is a multidisciplinary field of applied physical sciences which combines science, microbiology, and engineering education for food and related industries.
This subject presents a comprehensive treatise of all normally used food engineering operations that are employed or applied for separation (Distillation, Leaching, Extaction and Filteration), preservation (Pasteurisation, Sterilisation) or conversion (Drying, Crystallisation) purposes in the Food industry.

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)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Pasteurization and Sterilization:** Introduction, Holding Method, High Temperature Short Time Pasteurization, Bottle Sterilization, UHT Processing, Direct Heating (Injection System Type), Fouling of Heat Exchanger and De-scaling.	**8**	14
2	**Centrifugation and Homogenization:** Homogenization, Technical Execution, Efficiency of Homogenization, Operation and Maintenance, Centrifugation, Stokes Law Clarifiers and Separators, Centrifugal Separators, Efficiency of Separation, Flow Rate, Power Requirement, Strength of Bowl, Construction of Separator, Bactofuge Treatment Exercises, Tri-process machines, Homogenizers	**10**	18
3	**Distillation:** Introduction, Flash distillation, Continuous distillation with reflux, Distillation in packed column, Batch distillation, Multi component distillation	**7**	13
4	**Leaching and Extraction:** Principle of leaching and its equipment, Principle of extraction and its equipment, Special extraction techniques.	**7**	15
5	**Crystallization:** Crystal geometry, Equilibria and yields, Nucleation, Crystal growth, Crystallization equipments, Crystallization from melts.	**7**	12
6	**Filteration:** Centrifugal filters, Filter media, Filter aids, Principle of cake filtration, clarifying filters, cross flow filtration, gravity sedimentation process, centrifugal sedimentation process, Bag filters, pressure drop in duplex filters	**7**	12

	and filter materials.		
7	**Freezers And Freeze Drying**:: Ice Cream Freezer, batch freezer and continuous Freezer, Ammonia and Freon Freezers, operation and trouble shooting, Material of construction, Booster pumps.	**7**	16

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
19	18	20	21	22	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. Unit operations of chemical engineering by McCabe and Smith. McGraw-Hill
2. Chemical engineering handbook by Perry RH. McGraw-Hill
3. Dairy plant engineering and management by Tufail Ahmad, Kitab Mahal Publications
4. Engineering for dairy and food product by Farrall AW. John Wiley and Sons
5. Milk Pasteurization by Hall CW. The AVI Publication
6. Introduction to Chemical Engineering By Salil K Ghosal, Shyamal K Sanyal, Siddhartha Datta, Tata Mcgraw Hill

Course Outcome:

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

1. Understand the engineering principles involved in the processing of food products.
2. Develop new food processes and modify existing ones.
3. Divide physical food processes into basic unit operations, each of which stands alone and depends on coherent physical principles.
4. Understand how the equipment operates, effect of various equipment parameters on overall quality of food product.
5. Prepare the student for working in the complex food industry of today

List of Experiments:

1. To study thermal processing with reference to pasteurization.
2. Determination of sterilization value.
3. To study the process of gravitational sedimentation and to determine rate of sedimentation of suspended solids.
4. To study constructional details of a centrifugal disc type cream separator.
5. To study leaching process in beetroot.
6. Computer applications in Food engineering:
    a. Determination of decimal reduction time from microbial survival data
    b. Determination of thermal resistance factor (z value) in thermal processing of food
7. Predicting freezing times in foods by using Planck's equation.
8. To determine the influence of changing the transport and distribution time on the quality of food.

9. To study and perform the crystallization process.
10. To study about energy of activation of vitamin degradation during food storage.
11. To study about constructional details of cyclone centrifugal separator. To calculate limiting diameter of particle.
12. To plot the freezing curve (Temperature Vs Time).

Design based Problems (DP)/Open Ended Problem:

The topics taught in this subject would be useful to develop insight and application based knowledge among students

Discuss a novel technique (a technique that has not yet been explored) that can be used for extraction of oil from oilseeds, its principle of operation and mechanism of action. Also enlist its advantages over existing techniques and limitations if any

Major Equipments & Instruments

a. Agitated vessel
b. Shell & tube heat exchanger
c. Single effect vertical tube evaporator
d. Sieve shaker
e. Fresh fruit & vegetable handling plant
f. Weighing balance
g. Digital calliper

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

a. http://rpaulsingh.com/lectures/lecturelist.html
b. http://rpaulsingh.com/animations/animations_master.html
c. http://rpaulsingh.com/learning/videos/video_top.html
d. http://www.bbc.co.uk/bitesize/ks3/science/chemical_material_behaviour/compounds_mixtures/revision/9/
e. http://www.britannica.com/EBchecked/topic/108875/separation-and-purification

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.