



GUJARAT TECHNOLOGICAL UNIVERSITY

BACHELOR OF ENGINEERING

Subject Code : 3165108

Subject Name : Food Engineering Operations - II

WEF Academic Year:	2023-24
Semester:	6
Category of the Course:	Open Elective - II

Prerequisite: Nil

Rationale: A interdisciplinary area of applied physical sciences, food engineering operations-II integrates science, microbiology, and engineering education for the food and associated sectors. This topic provides an extensive overview of all commonly utilized food engineering procedures that are utilized or applied in the food business for conversion (Drying, Crystallization), preservation (Pasteurization, Sterilization), and separation (Distillation, Leaching, Extraction, and Filtration).

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Practical		
				ESE (E)	PA(M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

Course Content:

Sr. No.	Course Content	No. of Hours	% of 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.	9	20
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, Construction of Separator	8	20
3	Distillation: Introduction, Flash distillation, Batch distillation Continuous distillation with reflux.	6	15
4	Leaching and Extraction: Principle of leaching and its equipment, Principle of extraction and its equipment	6	15
5	Crystallization: Equilibria and yields, Nucleation, Crystal growth, Crystallization equipments.	3	10
6	Filtration: Centrifugal filters, Filter media, Filter aids, Principle of cake filtration	3	10
7	Freezers And Freeze Drying:: Ice Cream Freezer, batch freezer and	3	10



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	continuous Freezer, Ammonia and Freon Freezers, operation and trouble shooting, Material of construction, Booster pumps.		
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Reference Book:

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:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level*
01	Understand the concept of thermal processing such as pasteurization and sterilization	RM
02	Understand the centrifugation and homogenization and apply in relevant food industry.	UN
03	Conceptualize the distillation and the calculation related to design of distillation unit.	AP
04	Understand the unit operations such as extraction, leaching, extraction, filtration and its application in food industry.	AN
05	Understand the concepts of freezing and different freezing equipments used in food industry.	EL

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggested Course Practical List:

- 1) To determine the adequacy of pasteurization.
- 2) To determine the adequacy of sterilization.
- 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) Predicting freezing times in foods by using Planck's equation.
- 7) To determine the influence of changing the transport and distribution time on the quality of food.
- 8) To study and perform the crystallization process.
- 9) To study about energy of activation of vitamin degradation during food storage.
- 10) To study about constructional details of cyclone centrifugal separator. To calculate limiting diameter of particle.

List of Laboratory/Learning Resources Required:

Equipment:



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1. Agitated vessel
2. Shell & tube heat exchanger
3. Single effect vertical tube evaporator
4. Sieve shaker
5. Fresh fruit & vegetable handling plant
6. Weighing balance
7. Digital calliper

List of Open Source Software/learning website:

1. <http://foodscience.uark.edu/>
2. <http://rpaulsingh.com/lectures/lecturelist.html>
3. http://rpaulsingh.com/animations/animations_master.html
4. http://rpaulsingh.com/learning/videos/video_top.html
5. http://www.bbc.co.uk/bitesize/ks3/science/chemical_material_behaviour/compounds_mixtures/revision/9/
6. <http://www.britannica.com/EBchecked/topic/108875/separation-and-purification>

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