



Gyanmanjari
Innovative University

Course Syllabus

Gyanmanjari Institute of Technology
Semester-5

Subject: Unit operations in Food Processing- BETFT15312

Type of course: Professional Core

Prerequisite: Students should have basic knowledge of food composition, heat and mass transfer, basic chemistry, mathematics calculations, food processing equipment, and laboratory safety practices before studying Unit Operations in Food Processing.

Rationale: This subject is aimed to develop an understanding among the students about various methods of handling, transportation and storage of food grains and perishables. It will also impart knowledge and skills as how to minimize post harvest loss of food commodities

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	Theory Marks		Practical Marks		CA	
				ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No.	Course content	Hours	%Weightage
1	Introduction to Evaporation: Introduction to unit operations-classification, Principle of evaporation -factors affecting evaporation, Mass and energy balance theory, Natural, forced circulation and falling thin film evaporator- Working principle –mechanism, Single effect and multiple effect evaporator- agitated thin film long tube evaporators - mechanism and applications, Calculation of Evaporator efficiency- Vapor recompression.	14	20
2	Size reduction and mixing: Principles of size reduction- Energy laws; Equipment of size reduction in solid food – hammer mill, ball mill, attrition mill – mechanism and working principle; Equipment of size reduction in liquid food- colloidal mill & homogenizer mechanism and	15	30



	working principle; Mixing: theory of solids mixing, criteria of mixer effectiveness and mixing indices, Theory of liquid mixing, power requirement for liquids mixing, Mixing equipments: Mixers for low medium-viscosity liquids -paddle agitators, impeller agitators, powder-liquid contacting devices, other mixers- Mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids.		
3	Filtration: Theory of Filtration, importance of filtration, Calculation of rate of filtration, pressure drop during filtration, applications, rate of constant-rate filtration and constant-pressure filtration, Filtration equipment: Plate and frame filter press mechanism and diagram, Rotary filters and centrifugal filters -mechanism and diagram- Filter aids- types -importance and applications	15	20
4	Crystallization and Distillation: Crystallization, equilibrium, solubility and equilibrium diagram, rate of crystal growth, equilibrium crystallization, Crystallization equipment, classification, construction and operation, tank, agitated batch, Swenson-Walker vacuum crystallizers, Distillation, binary mixtures, flash and differential distillation, steam distillation, Continuous distillation with rectification, vacuum distillation, Batch distillation- operation and process, advantages and limitations, Distillation equipment, construction and operation, factors influencing the operation	16	30

Continuous Assessment:

Sr. No.	Active Learn	Marks
1	Presentation: Students prepare a short presentation on types of food hazards with real-life examples and submit on GMIU Web portal.	10
2	Simulation exercise: Students develop a risk assessment matrix for a food processing line and submit it through the GMIU Web Portal.	10
3	Case study analysis: Students prepare a HACCP flowchart for a selected food product and submit to the GMIU Web Portal.	10
Total		30



Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	40%	30%	10%	-	-

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 the above table.

List of Practical

Sr. No.	Title	Hours
1.	Analysis of sampled foods for physical characteristics	2
2.	Determination of critical speed of ball-mill	2
3.	Size reduction and particle size distribution using hammer-mill	4
4.	Steam distillation of herbs	4
5.	Concentration by crystallization	4
6.	Clarification of apple juice using filter press	4
7.	Visit to a public distribution system (PDS) showing storage facilities, warehouse, cold storage, refrigeration system and slaughter house etc	4
8.	Visit to various food industries for demonstration of various unit operations	4
9.	Determination of settling characteristics of food suspensions	2
Total		30

Course Outcome:

After learning the course, the students should be able to:	
CO1	Characterize different unit operations in food processing and Identify and evaluate different types of evaporators
CO2	Analyze the energy requirement for the different size reduction operations
CO3	Understand the working of filtration equipments used in food industry
CO4	Remember and describe crystallization and distillation process and its applications

Instructional Method:

- The course delivery method will depend upon the requirement of content and the need of students. The teacher in addition to the conventional teaching method by blackboard, may also use any of the tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- From the content, 10% of topics are suggested for flipped mode instruction.



- Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.
- The internal evaluation will be done based on the Active Learning Assignment.

Reference Books:

1. Saravacos G D, Food Process Engineering Operations, Taylor and Francis, 2011, ISBN: 9781420083538
2. Fellows P J Food Processing Technology Principles And Practice, Elsevier, Fourth Edition (2020), ISBN 9789351073918
3. Zeki Berk, Food Process Engineering and Technology, Academic Press 3rd Edition(2018), ISBN: 9780128120187
4. Toledo R T, Fundamentals Of Food Process Engineering, Springer, Fourth Edition (2018), ISBN: 9783319900971
5. Theodoros Varzakas and Constantina Tzia, Food Engineering Handbook: Food Process Engineering, CRC Press; 1 edition (2014), ISBN: ISBN-13: 978-1482261660

