



FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: Bachelor of Technology (Food Processing Technology)

Semester: V

Course Code: 202070501

Course Title: Food Engineering Operations-1

Course Group: Professional Core Course

Course Objectives: To understand the basic unit operation like cleaning, grading, separation, size reduction, mixing and material handling. To develop the concept of heat and mass transfer phenomena in food processing.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Theory		J/V/P*		Total
				Internal	External	Internal	External	
3	0	2	4	50/18	50/17	25/9	25/9	150/53

* J: Jury; V: Viva; P: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Engineering properties of agricultural materials: Physical properties, Thermal properties, Rheological properties, Aero and hydrodynamic properties, Frictional properties	07
2	Cleaning, Grading and Size Reduction: Screening, Effectiveness of screen, Air screen cleaners, Screen analysis. Grading- Size grading, Colour grading, Specific gravity grading, Magnetic separation. Size reduction procedures, Energy requirements in size reduction, Size reduction equipments	08
3	Heat Transfer: Heat Transfer: Law of conduction, Steady and unsteady state conduction, Natural convection, Forced convection in laminar and turbulent flow, Emission of radiation, Combined heat transfer by conduction, Convection and radiation	09
4	Mass transfer: Theory of diffusion, Prediction of diffusivities, Mass transfer theories- Film theory, Boundary layer theory, Two film theory, Mass transfer coefficients, Transport phenomena, Finite element techniques and molecular transport in gas, Solids and liquid.	06



5	Mixing: Theory of solids mixing, criteria of mixer effectiveness and mixing indices, rate of mixing, theory of liquid mixing, power requirement for liquids mixing; Mixing equipment	05
6	Material Handling: Belt conveyors, Bucket Elevator, Screw conveyor, Pneumatic and hydraulic conveying systems	05
7	Membrane separation: General considerations, materials for membrane construction, ultra-filtration, processing variables, membrane fouling, applications of ultra-filtration in food processing, reverse osmosis, mode of operation, and applications	05
	Total	45

List of Practicals / Tutorials:

1	Determination of size and sphericity of given agricultural materials
2	Determination of bulk density, true density and porosity of agricultural materials
3	Determination of dynamic angle of repose of given grains
4	To study the specific gravity separator as separation machinery
5	To study the clean-O-grader as separation machinery
6	To find the fineness modulus and average particle size in ground product
7	Determination of the rate of drying for given food product
8	Estimation of mixing indices of food products
9	To study different types of size reduction equipments
10	Estimation of permeate flux for membrane processing

Reference Books:

1	Unit Operations of Agricultural Processing by Sahay K.M. and Singh K.K., Vikas Publishing House.
2	Physical Properties of Plant and Animal Products by Mohsenin N.N., Gordon and Breach.
3	Unit operations of chemical engineering by McCabe and Smith, McGraw-Hill.
4	Introduction to Food Engineering, 3rd Edition, R Paul Singh, Dennis R Heldman, Academic Press, USA.
5	Agro-Processing and Food Engineering by Harish Kumar Sharma and Navneet Kumar. Springer, Singapore.
6	Food processing handbook. by Brennan, J. G., & Grandison, A. S. (Eds.). WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany

Supplementary learning Material:

1	George D. Saravacos and Athanasios E. Kostaropoulos. 2002. Handbook of Food Processing Equipment. Springer Science, Business Media, New York, USA.
2	Eduardo Cao. 2010. Heat Transfer in Process Engineering. The McGraw-Hill Companies, Inc., New York, USA.
3	https://nptel.ac.in/courses/112108149
4	https://nptel.ac.in/courses/103105140
5	https://nptel.ac.in/courses/103103145



6	Bergman, T. L., Incropera, F. P., DeWitt, D. P., & Lavine, A. S. 2011. Fundamentals of heat and mass transfer. John Wiley & Sons.
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Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Industrial/ Field visits
- Course Projects

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						R: Remembering; U: Understanding; A: Applying; N: Analyzing; E: Evaluating; C: Creating
R	U	A	N	E	C	
20%	30%	20%	15%	15%	0%	

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.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	To understand the engineering properties of food materials	12.5
CO-2	To understand different types of cleaning, grading, separation and size reduction equipments	17.5
CO-3	To understand heat and mass transfer in food	40
CO-4	To understand the material handling equipments for food	10
CO-5	To understand mixing operation for food products	10
CO-5	To understand membrane separation operation for food products	10

Curriculum Revision:

Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2025