

GUJARAT TECHNOLOGICAL UNIVERSITY

FOOD PROCESSING & TECHNOLOGY (14)

FOOD ENGINEERING OPERATIONS – I

SUBJECT CODE: 2151404

B.E. 5th SEMESTER

Type of course: Food Processing Technology

Prerequisite: Nil

Rationale: This subject includes broad categories of unit operation like drying, particle size reduction/separation, Study properties of Grains, Storage and material handling Equipments.

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	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction: Structure and composition of food grains, Engineering properties of agricultural materials, Physical properties, Mechanical properties, Thermal properties, Rheological properties.	6	17
2	Cleaning, Grading and Separation: Screening, Types of screens, Grizzly, Revolving screen, Shaking screen, Rotary screen, Vibratory screen, Horizontal screen, Perforated metal screen, Wire-mesh screen, Ideal and actual screen, Effectiveness of screen, Airscreen cleaners, Screen analysis, Fineness modules, Crushing efficiency, Size reduction procedures, Grading- Size grading, Colour grading, Specific gravity grading, Magnetic separation, Energy requirements in size reduction.	14	23
3	Heat and Mass 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, 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.	15	25
4	Storage: Direct damages, Indirect damages, Sources of infestation, Traditional storage structures, Improved storage structures, Modern storage structures, Storage of agricultural perishables, Controlled and modified atmospheric storage, Sources of infestation and control.	9	22
5	Material Handling: Belt conveyors, Belt tension, Bucket Elevator, Screw conveyor, Drive mechanism, Pneumatic and hydraulic conveying systems.	5	13

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
19	16	22	23	20	-

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 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. Food Processing Technology: Principles and Practice, by P J Fellows, Woodhead Publishing Limited, Cambridge England

Course Outcome:

After learning the course the students should be able to:

1. Ability to use the techniques, skills, and engineering tools necessary for engineering practice
2. Understanding of the behavior and properties of food materials as they are altered and influenced by processing in size reduction
3. Ability to understand different types of mixers like diffusion, convection, pneumatic mixers
4. Ability to design and conduct experiments, as well as to analyze and interpret data
5. Understand granulation
6. Ability to identify, formulate, and solve engineering problems

List of Experiments:

1. Determination of size and sphericity of agricultural materials given
2. Determination of bulk density of different materials
3. Determination of dynamic angle of repose of given grains
4. Determination of the rate of drying for given food product
5. To find the fitness modulus and average particle size in ground product
6. To study the rate of drying for given food material using vacuum dryer
7. To study the specific gravity separator as separation machinery
8. To study the clean-O-grader as separation machinery
9. Study of different conveying equipments used in food material handling

Design based Problems (DP)/Open Ended Problems:

Characterization of size distribution of contaminant of waste stream like wastewater or any effluent from the plant, Energy consumption for size reduction and desired yield for any given product.

Major Equipments:

1. Vacuum dryer
2. Axial flow tray dryer

3. Gravity separator
4. Clean – O – grader
5. Angle of repose setup
6. Sieve shaker

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.