

19FT212 FOOD PROCESSING OPERATIONS

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	-	30	25	50	-	-	5	5



Source:

<http://agroindustriindonesia.blogspot.com/2011/01/manufacturing-operations-and.html>

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the principles and practices of multiple unit operations involved in processing industries. The objective of this course is to impart knowledge to students on engineering concepts of unit operations. Identify, formulate, review, and analyze complex engineering problems in food processing. Apply the range of equipment used to perform each major food processing operations.

COURSE OUTCOMES

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Apply the knowledge of physical properties of food to design various processing methods for particulate solids and material handling equipment.	1, 3
2	To investigate the validity of various laws of size reduction and analyse particle size using screen analysis.	4
3	Design and development of filtration system for separation of suspended solids.	3
4	Identify various agitation and mixing equipment and apply the principle of crystallization for various food application.	1, 2
5	Use of psychrometric tool for solving drying problems and analyse the concept of leaching in food processing.	4

SKILLS

- ✓ Perform cumulative and differential particle size analysis.
- ✓ Identify the suitable mixer required for mixing cohesive and non-cohesive solids.
- ✓ Recognize the required specifications of the size reduction equipment for a given feed.
- ✓ Identify the filtration equipment required for a specific application.
- ✓ Compare the efficiency of separation, size reduction, mixing and drying equipments

UNIT - I **L-9**

PROPERTIES AND CHARACTERIZATION OF SOLIDS : Properties, handling and characterization of particulate solids; Properties of particulate masses; Storage and mixing of solids; Mixers for cohesive and non-cohesive solids; Transportation of solid particulate mass - belt, screw, apron conveyers, bucket elevators, pneumatic conveying.

UNIT - II **L-9**

PRINCIPLE OF COMMINUTION : Laws of size reduction - rittingers law, kicks law, bonds crushing law, work index, problems; Classification of size reduction equipment - crushers, grinders, ultra-fine grinders, cutting machines, problems; Industrial screening - different types of screening equipment in industries, screen efficiency.

UNIT - III **L-9**

FILTRATION : Classification of filters based on nature of filtration and external force; Principles of cake filtration - specific cake resistance, filter-medium resistance; Types of membranes; Permeate flux; Concentration polarization; Micro filtration; Separation techniques - separations based on motion of particles through fluids, gravity settling, centrifugal settling, sink and float method, flotation, flotation agents.

UNIT - IV **L-9**

AGITATION AND MIXING OF LIQUIDS : Agitation equipment - impellers, propellers, paddles, turbines; Power consumption in agitated vessels; Crystallization - crystal geometry, principles of crystallization, nucleation, types of nucleation.

UNIT - V **L-9**

DRYING : Psychrometry - humidification and dehumidification operations; Drying theory - thin layer drying, deep bed drying, and types of dryers; Leaching-leaching principles, leaching process with examples.

LABORATORY EXPERIMENT

LIST OF EXPERIMENTS

TOTAL HOURS: 30

1. Determination of particle size using screen analysis.
2. Calculation of effectiveness of screen.
3. Verification of size reduction laws using jaw crusher.
4. Verification of size reduction laws using ball mill.
5. Verification of size reduction laws using roll crusher.
6. Determination of compressibility coefficient using sedimentation process.
7. Determination of filter medium resistance and cake resistance using plate and frame filter press.
8. Determine the efficiency of cyclone separator.
9. Drying characters of food material.
10. Determination of percentage recovery of coal from coal sand mixture using Froth Floatation cell.
11. Determination of energy consumption in size reduction (crushability test (roll or jaw crusher), Ball mill grindability indices).
12. Sampling of materials (Riffle sampling and cone quartering sampling).
13. Size separation: tabling, froth flotation.
14. Total energy calculation in mixing of two granular solids.
15. Determination of mixing index.

TEXTBOOKS:

1. R. L. Earle, "Unit Operations in Food Processing", 2nd edition, Pergamon Press, 2003.
2. W. L. Mc Cabe, J. C. Smith and P. Harriot, "Unit Operations of Chemical Engineering", 7th edition, McGraw-Hill. Inc., 2005.

REFERENCE BOOKS:

1. J. M. Coulson and J. F. Richardson, "Chemical Engineering" 1st to 5th volume, The Pergamon Press, 1999.
2. K. M. Sahay and K. K. Singh, "Unit Operation of Agricultural Processing", 2nd edition, Vikas Publishing House Pvt. Ltd, 2004.
3. C. J. Geankoplis, "Transport Process and Unit Operations", 4th edition, Prentice-Hall of India, 2004.