

MFT-202 Unit operations in Food Engineering

Teaching Scheme	Examination Scheme
Lectures: 3hrs./week	Internal Assessment Marks [IAM]: 30
Tutorials: 1 hr./week	[Class Test: 12, Teachers assessment: 6, Attendance: 12]
Credits: 4	End Semester Marks [ESM]: 70

Course Objectives:

1. To give knowledge of preliminary unit operations, material handling, cleaning, sorting and grading in food industry.
2. To give knowledge about engineering principles of various unit operations in food industry.
3. Gives knowledge of engineering of unit operations associated with preservation, pasteurization, evaporation and dehydration techniques.
4. To impart knowledge about refrigeration, freezing engineering.
5. To impart knowledge about technological principles of freezing operations, freezing systems.

Detailed Syllabus

MODULE 1
<p>Preliminary unit operations – material handling, cleaning, sorting and grading.</p> <p>Material handling – theory, classification of various material handling equipments, conveyors and elevators .</p> <p>Cleaning – types of contaminants found on raw foods, aims of cleaning, methods of cleaning dry, wet and combination methods; dry cleaning methods - screening, aspiration, magnetic cleaning and abrasive cleaning; wet cleaning methods- soaking, spray washing, flotation washing and ultrasonic washing.</p> <p>Sorting and grading – advantages of sorting and grading, grading factors, methods of sorting and grading.</p> <p>Engineering properties of food materials</p>
MODULE 2
<p>Conversion unit operations – size reduction, mixing and filtration.</p> <p>Size reduction- benefits of size reduction, nature of forces used in size reduction, criteria of size reduction, equipment selection (hardness of feed, mechanical structure of feed, moisture content and temperature sensitivity of feed); mode of operation of size reduction equipment – open circuit and closed circuit grinding, free crushing, choke feeding and wet milling; size reduction of solid foods, fibrous foods and liquid foods; effects of size reduction on solid and liquid foods.</p> <p>Mixing – mixing terminology (agitating, kneading, blending, and homogenizing), mixing equipments – mixers for liquids of low or moderate viscosity (Paddle agitators, turbine agitators and propeller agitators), mixers for high viscosity pastes (Pan mixer, horizontal</p>

mixer and dough mixer), mixers for dry solids (tumbler mixer & vertical screw mixer); effects of mixing on foods.
Filtration – filtration terminology (feed slurry, filtrate, filter medium, filter cake and filter), filtration methods/equipments – pressure filtration, vacuum filtration, & centrifugal filtration.

MODULE3

Preservation unit operations (high temperature operations)- pasteurization, evaporation and dehydration. Pasteurization– basic concept, effects of pasteurization on foods.
Evaporation – main functions of evaporation, factors affecting the rate of heat transfer, factors influencing the economics of evaporation, evaporation equipments –horizontal tube evaporators, vertical tube evaporator and plate evaporator; single and multiple effect evaporators.
Dehydration – objectives of dehydration, dehydration terminology, basic dehydration theory; drying curves, dehydration systems – tray drier, tunnel drier, drying time calculations.

MODULE4

Preservation unit operation (low temperature operations) - refrigeration, freezing and freeze drying. Refrigeration – introduction, components of refrigeration systems – compressor, condenser and expansion valve; mechanical refrigeration system.
Mechanical separations-Centrifugation and Sedimentation.

MODULE5

Freezing – technological principles of freezing operations, freezing systems- direct contact and indirect contact system; influence of freezing rate on food system; freezing time calculations. Freeze drying – conventional drying vs freeze drying; equipments used and effects of freeze drying on food quality.

Suggested readings

1. S. K. Sharma, S.J.Mulvaney, and S.S.H.Rizvi, Food Process Engineering: Theory and Laboratory Experiments, Wiley and Sons, 2000.
2. H. Pandey, H.K. Sharma, R.C. Chauhan, B.C. Sarkar and M.C. Bera, Experiments in Food Process Engineering, CBS Publishers and Distributors, 2004.
3. M.A. Rao, S.S. H.Rizvi and A.K.Dutta, Engineering properties of Foods, 3rd ed., Marcel Dekker, 2005.

CourseOutcomes:

After completing the course, students will be able to:

1. Understand the preliminary unit operations in food industry.
2. Understand engineering principles of various unit operations in food industry.
3. Understand engineering of unit operations associated with preservation, pasteurization, evaporation and dehydration techniques.
4. Understand refrigeration, freezing engineering.
5. Understand about freezing systems in food.