

- Assessment methods - quiz, identification tests, assignments
- End semester exams for theory and practical
- Feedback given to students for improving

**KEYWORDS**

- Food technology
- Dairy technology
- Milk processing

**DSC FT04 PRINCIPLES OF FOOD PROCESSING  
(CREDIT: 3+-1)**

**LEARNING OBJECTIVES:**

1. To understand freezer, dryer types and functioning
2. To understand the material handling, separation processes and thermal processing.

**COURSE OUTCOMES:**

1. Understand cold preservation, Freezer types and functioning
2. Understand Dehydration, Dryer types and functioning
3. Understand the material handling in food industry, conveyer types, separation processes by distillation, extraction, filtration
4. Understand thermal processing and fundamentals of thermal process calculations

**Credit: 3+1**

**Total Lecture (Nos): 45 hours**

**Course Coverage (in % of the total):**

Theory: 3 hours/week

Practical/ Field work/Hands-on-learning: 2 hours/week

<p>UNIT I <b>Cold Preservation and Freezers</b> Unit Description: Cold preservation and Freezers</p>	<p><b>No. of Lectures: 12</b></p>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> <li>• Refrigeration and Freezing: requirements of refrigerated storage - controlled low temperature, air circulation and humidity, modified gas atmosphere. Changes in food during refrigerated and frozen storage, Refrigeration load, factors determining freezing rate: food composition and non-compositional.</li> <li>• Freezing methods -direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing.</li> </ul>	
<p>UNIT II <b>Dehydration</b> Unit Description: This unit covers the dehydration technique</p>	<p><b>No. of Lectures: 12</b></p>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> <li>• Changes in food during drying, drying methods and equipments</li> </ul>	

air convection dryer, tray dryer, tunnel dryer, continuous belt dryer , fluidized bed dryer, spray dryer, drum dryer, vacuum dryer ,freeze drying ,foam mat drying.	
<b>UNIT III</b> <b>Thermal processing</b> Unit Description: The unit describes various concepts in Thermal processing	<b>No. of Lectures:</b> <b>9</b>
<i>Subtopics:</i> <ul style="list-style-type: none"> <li>Principles of thermal processing, Thermal resistance of microorganisms, Thermal Death Time, Lethality concept, characterization of heat penetration data, Thermal process Calculations, Aseptic processing of food</li> </ul>	
<b>UNIT IV</b> <b>Material handling and Separation processes</b> Unit Description: The unit describes Material handling and Separation processes	<b>No. of Lectures:</b> <b>12</b>
<i>Subtopics:</i> <ul style="list-style-type: none"> <li>Elementary concept of material handling in food industry, equipment and functioning of belt conveyor, screw conveyor, bucket elevator and pneumatic conveyor.</li> <li>Distillation principles and methods: steam, batch, continuous distillation with rectification and stripping.</li> <li>Extraction : Hildebrandt, Bollman, SCF extraction Filtration : Plate and frame , pressure leaf, continuous rotary vacuum ,batch and continuous filtration</li> </ul>	

#### **PRACTICAL**

**DURATION: 30 HRS (CREDIT 1)**

1. Preservation of food by freezing
2. Drying of food using Tray dryer/other dryers
3. Preservation of food by canning (Fruit/Vegetable/meat)
4. Cut-out analysis of canned food
5. Osmotic dehydration
6. Minimal Processing
7. Perform distillation of any food sample/by product
8. Processing of ready to eat frozen products
9. Study of Thawing Characteristics of frozen food

#### **COMPULSORY READING**

- Potter,N.N.and Hotchkiss,J.H.(2007). Food Science 5th Ed. New York: Chapman & Hall
- Ramaswamy, H. and Marcott, M. (2006). *Food Processing Principles and Applications*. CRC Press.

- Rao, P.G. (2010). *Fundamentals of Food Engineering*. New Delhi: PHI Learning Pvt Ltd.

#### **ADDITIONAL RESOURCES**

- Desrosier, N.W. and Desrosier, J.N. (1998). *The Technology of Food Preservation*. New Delhi: CBS Publication.
- Toledo, Romeo T. (2007). *Fundamentals of Food Process Engineering*. Aspen Publishers.

#### **TEACHING LEARNING PROCESS:**

- Lectured based teaching
- Power point presentations
- Experimental learning through practicals
- Along with pedagogy of flipped classroom students are encouraged to participate actively in the classroom through regular presentations on curriculum based topics, peer assessment

#### **ASSESSMENT METHODS:**

- As per University of Delhi norms
- Theory assessment methods – classroom assignment, test, quiz, presentation
- Continuous evaluation of practicals
- End semester exams for theory and practical
- Feedback given to students for improving

#### **KEYWORDS:**

Food Processing, Drying, Freezing, Canning, Minimal processing, material handling, conveyer belt system.

### **DSC FT05 TECHNOLOGY OF FOOD PRESERVATION (Credit: 3+1)**

#### **LEARNING OBJECTIVES:**

1. To learn science behind various preservation/processing technologies.
2. Technological application of concepts on conventional Indian foods.

#### **COURSE OUTCOMES:**

1. Understanding of the concept of different processing and preservation technologies
2. Appreciate significance of various preservation methods used in food industries.

**Credit: 3+1**

Total Lecture (Nos): **45 hours**

**Course Coverage (in % of the total):**

Theory: 3 hours/week

Practical/ Field work/Hands-on-learning: 2 hours/week

<b>Unit I: Introduction to Technology of Food Preservation</b>	<b>(No. of lectures)</b> <b>6</b>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> <li>• Introduction to historical evolution to food preservation techniques- Conventional to recent technologies</li> <li>• Classification of foods based on pH, concept of shelf life, perishable foods, semi perishable foods, shelf stable foods.</li> </ul>	
<b>Unit II: Food Preservation by Low temperature</b> Unit Description: Refrigeration, Chilling & Freezing	<b>(No. of lectures)</b> <b>14</b>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> <li>• Introduction to refrigeration, chilling, freezing as a means of preservation, cold storage</li> <li>• Principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e. slow freezing, quick freezing,</li> <li>• Introduction to thawing, changes during thawing and its effect on food</li> </ul>	
<b>Unit III: Food Preservation by Thermal Processing and Irradiation</b> Unit Description: Thermal processing and Food Irradiation	<b>(No. of lectures)</b> <b>10</b>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> <li>• Introduction to Thermal Processing- Blanching, pasteurization, sterilization, commercial sterilization.</li> <li>• Introduction, units of radiation, concept of cold sterilization, kinds of ionizing radiations, application in food industry.</li> </ul>	
<b>Unit IV: Food Preservation by Moisture control</b> Unit Description: Drying and Evaporation	<b>(No. of lectures)</b> <b>15</b>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> <li>• Introduction to Drying and Dehydration -Drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), normal drying curve, heat and mass transfer, factors affecting rate of drying and its application in food industry.</li> </ul>	

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| <ul style="list-style-type: none"> <li>• Introduction to Evaporation as a means of preservation – Definition, factors affecting evaporation, and its application in food industry.</li> </ul> |  |
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## PRACTICAL

**DURATION: 30 HRS (CREDIT 1)**

1. To study methods of sampling.
2. To study the concept of shelf life of different foods.
3. To perform blanching of plant foods.
4. To study the concept of sterilization
5. To perform pasteurization of fluids- juices/ milk/ squashes etc using different methods.
6. To determine the pH of different foods.
7. To evaluate the quality characteristics of foods preserved by solar drying/ dehydration/ freezing.

## ESSENTIAL READINGS:

- Potter, N. N., & Hotchkiss, J. H. (2012). *Food Science*. Springer Science & BusinessMedia.
- Fellows, P. J. (2009). *Food Processing Technology: Principles and Practice*. Elsevier.
- Bawa. A.S., Chauhan, O.P, Raju. P.S. (2013) ed. *Food Science*. New India Publishing agency.
- Stewart, G.F., & Amerine, M.A. (2012). *Introduction to Food Science and Technology*. Elsevier, 2nd Edition.

## SUGGESTED READINGS:

- Rao, E.S. (2019) *Fundamentals of Food Technology and Preservation*, Variety Books, New Delhi.
- Frazier, W.C. & West Hoff, D.C. 2004. *Food Microbiology*. TMH Publication, New Delhi,.
- Rao, D.G. 2010. *Fundamentals of Food Engineering*, PHI Learning Pvt Ltd, New Delhi,

## TEACHING LEARNING PROCESS

- Lecture method
- Power point presentation
- Projects
- Practical's

## ASSESSMENT METHODS

- As per University of Delhi norms
- Continuous evaluation of practicals
- Assessment methods - quiz, identification tests, assignments
- End semester exams for theory and practical

- Feedback given to students for improving

## KEYWORDS

Food, Preservation, Technology, Micro-organism, Temperature, Evaporation, Freezing, Drying

## DSC FT06 FRUITS, VEGETABLES & PLANTATION CROPS PROCESSING TECHNOLOGY (Credit: 3+1)

### LEARNING OBJECTIVES:

1. To impart knowledge of different methods of fruits and vegetables processing.
2. To learn about processing of various spices, tea, coffee and cocoa.

### COURSE OUTCOMES:

1. Understand the concept of quality of fruits and vegetables for developing good quality end products.
2. Understand the processing and preservation of fruits and vegetables using various techniques.
3. Understand processing of plantation crops.

**Credit: 3+1**

Total Lecture (Nos): **45 hours**

### Course Coverage (in % of the total):

Theory: 3 hours/week

Practical/ Field work/Hands-on-learning: 2 hours/week

<p><b>Unit I: Introduction to Fruits and Vegetables</b> Unit Description: Basic definition of fruits &amp; vegetables, Why &amp; How they should be preserved. Different modes of preservation.</p>	<p><b>(No. of lectures)</b>  <b>6</b></p>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> <li>• Importance of Fruits &amp; Vegetables</li> <li>• History &amp; need of preservation</li> <li>• Reasons of spoilage, method of preservation (Short &amp; Long Term)</li> <li>• Post harvest physiological &amp; biochemical changes in fruits &amp; vegetables</li> </ul>	
<p><b>Unit II: Canning &amp; Dehydration</b> Unit Description: Preservation of food by thermal processing &amp; removal of moisture</p>	<p><b>(No. of lectures)</b>  <b>11</b></p>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> <li>• Process of canning, factors affecting the process- time and temperature</li> </ul>	

<ul style="list-style-type: none"> <li>● Containers of packing, lacquering, syrups and brines for canning.</li> <li>● Spoilage in canned foods.</li> <li>● Sun drying &amp; mechanical dehydration</li> <li>● Process variation for fruits and vegetables</li> <li>● packing and storage. Case hardening</li> </ul>	
<b>Unit III: Fruits Beverages &amp; Tomato Products</b> Unit Description: Types, preparation & preservation of beverages	(No. of lectures)  13
<i>Subtopics:</i> <ul style="list-style-type: none"> <li>● Introduction &amp; Processing of fruit juices (selection, juice extraction, deaeration, straining, filtration and clarification)</li> <li>● Preservation of fruit juices (pasteurization, preservation with chemical, sugar &amp; salt, freezing, drying, tetra-packing, carbonation)</li> <li>● Processing of squashes, cordials, nectars, concentrates and powder</li> </ul> Tomato Products : processing of tomato juice, tomato puree, paste, ketchup, sauce and soup	
<b>Unit IV: Products preserved with class I &amp; class II preservatives</b> Unit Description: preservation by sugar, salt, vinegar & sodium benzoate & KMS	(No. of lectures)  7
<i>Subtopics:</i> <ul style="list-style-type: none"> <li>● Processing &amp; Technology of Jam, Jelly, Marmalade &amp; Pickles (Essential constituents, Role of pectin), Theory of jelly formation, defects in jelly,</li> <li>● Marmalade - Types, defects.</li> <li>● Pickles-- Processing , Types, Causes of spoilage in pickling</li> </ul>	
<b>UNIT V : Technology of Plantation Crops</b> Unit Description—Spices, Tea, Coffee & Cocoa	(No. of lectures)  8
Subtopics Spices <ul style="list-style-type: none"> <li>● Processing and properties of major and minor spices</li> <li>● Essential oils &amp; oleoresins, adulteration</li> </ul> Tea, Coffee and Cocoa <ul style="list-style-type: none"> <li>● Processing, Variety and Products</li> </ul>	

**PRACTICAL**

**DURATION: 30 HRS (CREDIT 1)**

1. Estimation of total soluble solids (TSS), pH, acidity of various products.
2. Estimation of brix: acidity ratio of various products.

3. Estimation of ascorbic acid and effect of heat treatment on it.
4. To study the steps of can making process.
5. Preparation & evaluation of pectin based product. (Jam)
6. Preparation & evaluation of tomato puree.
7. Dehydration of fruits and vegetables
8. Rehydration of fruits and vegetables
9. Extraction & estimation of polyphenols from fruit & Vegetable wastes.

### **ESSENTIAL READINGS**

- Girdharilal., Siddappaa, G.S and Tandon, G.L.(2009). Preservation of fruits & vegetables. ICAR, New Delhi.
- Thompson, A.K., (2003). Fruits and vegetables; Harvesting, handling and storage. Blackwell Publishing.
- Verma L.R. & Joshi VK. 2000. Post Harvest Technology of Fruits & Vegetables. Indus Publication.

### **SUGGESTED READINGS:**

- Crusess, W.B. (2004). Commercial Unit and Vegetable Products. W.V. Special Indian Edition. Agrobios India.
- Manay, S. and Shadaksharaswami, M. (2004). Foods: Facts and Principles. New Age Publishers.
- Ranganna S.(2007). Handbook of analysis and quality control for fruits and vegetable products. Tata Mc Graw-Hill publishing company limited, Second edition.
- Srivastava, R.P. and Kumar, S. (2006). Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co.
- Somogyi, L.P., Ramaswamy, H.S. and Hui, Y.H. (1996). Biology, Principles and Applications. Volume 1. Technomic Publishing Company, Inc.

### **Teaching Learning Process :**

- Interactive classes
- Power point presentations
- Demonstration of industrial process using videos
- Presentation by students on recent topics related to syllabus
- Projects on market survey to make students familiar with products launched by different companies

### **Assessment Methods**

- Presentation/assignment by students
- Class Test at Periodic Intervals
- Written Assignment
- Continuous evaluation in practicals
- End Semester University Theory and Practical Exams



**Key Words:** Fruits, Vegetables, Canning, Beverages, Dehydration, Preservation, Tea, Coffee, Cocoa, Pickles, TSS, Lacquering, KMS, Sodium benzoate, Chemical preservatives