BSC. (HONS.) FOOD TECHNOLOGY

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
PRINCIPLES OF FOOD PROCESSING	**4**	**3**	0	**1**	XII with PCM/PCB	NIL

Learning Objectives

The Learning Objectives of this course are as follows:

- To understand freezer, dryer types and functioning
- To understand the material handling, separation processes and thermal processing

Learning outcomes

The Learning Outcomes of this course are as follows:

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

SYLLABUSOF DSC-04

Unit1: Cold Preservation and Freezers (12 Hours)

- 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.
- Freezing methods -direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing.

Unit2: Dehydration (12 Hours)

Changes in food during drying, drying methods and equipments air convection dryer, tray dryer, tunnel dryer, continuous belt dryer , fluidized bed dryer, spray dryer, drum dryer, vacuum dryer, freeze drying ,foam mat drying.

Unit3: Thermal processing (9 Hours)

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

Unit4: Material handling and Separation processes (12 Hours)

Elementary concept of material handling in food industry, equipment and functioning of belt conveyor, screw conveyor, bucket elevator and pneumatic conveyor.

Distillation principles and methods: steam, batch, continuous distillation with rectification and stripping.

Extraction : Hildebrandt, Bollman, SCF extraction Filtration : Plate and frame , pressure leaf, continuous rotary vacuum ,batch and continuous filtration

Practical Exercises: 30 Hours

The learners are required to:

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

Essential/recommended readings

- 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 .
- 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.

- **Note: Learners are advised to use the latest edition of readings.**

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DSC 05 : TECHNOLOGY OF FOOD PRESERVATION

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
TECHNOLOGY OF FOOD PRESERVATION	**4**	**3**	0	**1**	XII with PCM/PCB	NIL

Learning Objectives

The Learning Objectives of this course are as follows:

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

Learning outcomes

The Learning Outcomes of this course are as follows:

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

SYLLABUS OF DSC-05

Unit1: Introduction to Technology of Food Preservation (6 Hours)
Introduction to historical evolution to food preservation techniques- Conventional to recent technologies Classification of foods based on pH, concept of shelf life, perishable foods, semi perishable foods, shelf stable foods.

Unit2:Food Preservation by Low temperature (14 Hours)
Introduction to refrigeration, chilling, freezing as a means of preservation, cold storage
Principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e. slow freezing, quick freezing, Introduction to thawing, changes during thawing and its effect on food

Unit3: Food Preservation by Thermal Processing and Irradiation (10 Hours)
Introduction to Thermal Processing- Blanching, pasteurization, sterilization, commercial sterilization. Introduction, units of radiation, concept of cold sterilization, kinds of ionizing radiations, application in food industry.

Unit4: Food Preservation by Moisture control (15 Hours)
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.
Introduction to Evaporation as a means of preservation – Definition, factors affecting evaporation, and its application in food industry.

Practical Exercises: 30 Hours

The learners are required to:

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

Essential/recommended readings

- Potter, N. N., & Hotchkiss, J. H. (2012). Food Science. Springer Science & Business Media.
- 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.
- 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,

- **Note: Learners are advised to use the latest edition of readings.**

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DSC 06 : FRUITS, VEGETABLES & PLANTATION CROPS PROCESSING TECHNOLOGYDSC 04 PRINCIPLES OF FOOD PROCESSING

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
FRUITS, VEGETABLES & PLANTATION CROPS PROCESSING TECHNOLOGY	**4**	**3**	0	**1**	XII with PCM/PCB	NIL

Learning Objectives

The Learning Objectives of this course are as follows:

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

Learning outcomes

The Learning Outcomes of this course are as follows:

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

SYLLABUS OF DSC-06

Unit1: Introduction to Fruits and Vegetables (6 Hours)

Importance of Fruits & Vegetables
History & need of preservation
Reasons of spoilage, method of preservation (Short & Long Term)
Post harvest physiological & biochemical changes in fruits &vegetables

Unit2: Canning & Dehydration (11 Hours)

Process of canning, factors affecting the process- time and temperature
Containers of packing, lacquering, syrups and brines for canning.
Spoilage in canned foods.
Sun drying & mechanical dehydration
Process variation for fruits and vegetables packing and storage. Case hardening

Unit3:Fruits Beverages & Tomato Products (13 Hours)

Introduction & Processing of fruit juices (selection, juice extraction, deaeration, straining, filtration and clarification)

Preservation of fruit juices (pasteurization, preservation with chemical, sugar & salt, freezing, drying, tetra-packing, carbonation)
Processing of squashes, cordials, nectars, concentrates and powder
Tomato Products : processing of tomato juice, tomato puree, paste, ketchup, sauce and soup

Unit4: Products preserved with class I & class II preservatives (7 Hours)

Processing & Technology of Jam, Jelly, Marmalade & Pickles (Essential constituents, Role of pectin), Theory of jelly formation, defects in jelly,
Marmalade - Types, defects.
Pickles-- Processing , Types, Causes of spoilage in pickling

Unit5: Technology of Plantation Crops (8 Hours)

Spices
Processing and properties of major and minor spices
Essential oils & oleoresins, adulteration Tea, Coffee and Cocoa
Processing, Variety and Products

Practical Exercises: 30 Hours

The learners are required to:

- Estimation of total soluble solids (TSS), pH, acidity of various products.
- Estimation of brix: acidity ratio of various products.
- Estimation of ascorbic acid and effect of heat treatment on it.
- To study the steps of can making process.
- Preparation & evaluation of pectin based product. (Jam)
- Preparation & evaluation of tomato puree.
- Dehydration of fruits and vegetables
- Rehydration of fruits and vegetables
- Extraction & estimation of polyphenols from fruit & Vegetable wastes.

Essential/recommended 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.
- 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.

- **Note: Learners are advised to use the latest edition of readings.**
- **Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.**

GE 02: CHEMISTRY OF FOOD

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
CHEMISTRY OF FOOD	4	3	0	1	XII with PCM/PCB	NIL

Learning Objectives

The Learning Objectives of this course are as follows:

- To understand the chemistry of foods - composition of food, role of each component
- To understand the different macromolecules and micro molecules in food
- To understand how food components contribute to overall quality of foods

Learning outcomes

The Learning Outcomes of this course are as follows:

- To understand the chemistry of foods - composition of food
- To understand the role of each component, their properties and reactions in food
- To comprehend how dietary components influence total food quality

SYLLABUS OF GE 02

Unit1: Introduction to chemistry of Food (5 Hours)

Introduction to Food Chemistry

Brief composition of food (Carbohydrates, fats, proteins, vitamins, minerals and pigments)

Unit2: Chemistry of Macromolecules (20 Hours)

Water: Definition of water in food, Structure of water and ice, Types of water, Role of water activity in shelf life and packaging Carbohydrates: Introduction, Classification, and Chemical reactions of carbohydrates Protein: Introduction, classification and structure, types of food protein (meat, egg, milk and wheat)

Lipids: Introduction, classification and structure of triglycerides, types of fatty acid, deterioration of fats and oils. (Autooxidation and lipolysis)

Unit3: Chemistry of Micro molecules (10 Hours)

Vitamins: Introduction, types (water soluble and fat soluble vitamins)

Minerals: Introduction, major and minor minerals, Toxic minerals in food

Unit4: Flavors and Pigments (10 Hours)

Definition and basic tastes

Description of some common food flavors

Introduction and classification of pigments

Practical Exercises: 30 Hours

The learners are required to:

- Preparation of primary and secondary solutions
- Estimation of moisture content
- Determination of gelatinization temperature range (GTR) of different starches
- Determination of effect of additives on GTR of starches
- Estimation of total nitrogen content by Kjeldahl method
- Estimation of fat
- Estimation of total ash and acid insoluble ash
- Estimation of reducing sugar

Essential/recommended readings

- DeMan, John M. (1995). Principles of Food Chemistry. 3rd Ed., Springer.
- Fennema, Owen R. (2008). Fennema's Food Chemistry-CRC Press (2008) - 4th Edition.
- Potter,N.N.and Hotchkiss,J.H.(2007). Food Science 5th Ed. New York: Chapman & Hall.
- Richard Owusu-Apenten. (2002) Introduction to Food Chemistry. CRC press
- Hans-Dieter Belitz, Werner Grosch, Peter Schieberle. (2009) Food Chemistry. Springer link

- **Note: Learners are advised to use the latest edition of readings.**

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.