

**Curriculum and Credit Framework for  
Undergraduate Programme  
(Single Major) as per NEP-2020**

**B.Sc. Food Science & Technology**  
*(Four-Year Undergraduate Programme)*

**1<sup>st</sup> & 2<sup>nd</sup> Semesters**

**For Batch W.e.f. Session: 2023-24**



**University School for Graduate Studies,  
Chaudhary Devi Lal University  
Sirsa-125055, Haryana  
2023**



## Exit options and Credit requirements

### SINGLE-MAJOR

<b>Exit with</b>	<b>Credit requirement</b>
<b>Certificate in Food Science &amp; Technology:</b> After successful completion of First year (Two semesters) of the Four-Year Undergraduate Degree Programme.	<b>48</b> (Including Internship of 4 Credits)
<b>Diploma in Food Science &amp; Technology:</b> After successful completion of Two years (Four semesters) of the Four-Year Undergraduate Degree Programme.	<b>94</b> (Including Internship of 4 Credits)
<b>Bachelor of Food Science &amp; Technology:</b> After successful completion of Three years (Six semesters) of the Four-Year Undergraduate Degree Programme.	<b>136</b>
<b>Bachelor of Food Science &amp; Technology (Honours/Honours with Research)</b> After successful completion of Four Years (Eight semesters) of the Undergraduate Degree Programme.	<b>184</b>

**B. Sc. Food Science and Technology (1<sup>st</sup> Semester) w.e.f. 2023-24 onwards**

Sr. No.	Subject	Course ID	Credits	Contact Hours per week	Internal Assessment (IA)*	External Exam	Maximum Marks	Duration Exam (hours)
1.	Introduction to Food Technology (T)	BSc/FST/SM/1/DSC/101	3	3	25	50	75	3
	Introduction to Food Technology (P)		1	2	-	25	25	3
2.	Basics of Food Microbiology (T)	BSc/FST/SM/1/DSC/102	3	3	25	50	75	3
	Basics of Food Microbiology (P)		1	2	-	25	25	3
3.	Food Chemistry (T)	BSc/FST/ SM /1/MIC/101	4	4	30	70	100	3
4.	Food Adulteration	BSc/FST/ SM /1/MDC/101	3	3	25	50	75	3
6.	Hindi – I	HINDI/AEC/101	2	2	15	35	50	2
5.	Food Safety Standards	BSc/FST/ SM /1/SEC/101	3	3	25	50	75	3
7.	EVS -I	EVS/VAC/101	2	2	15	35	50	2
<b>Total</b>			<b>22</b>	<b>24</b>	<b>160</b>	<b>390</b>	<b>550</b>	

**B. Sc. Food Science and Technology (2<sup>nd</sup> Semester) w.e.f. 2023-24 onwards**

**B. Sc. Food Science and Technology (2<sup>nd</sup> Semester) w.e.f. 2023-24 onwards**

Sr. No.	Subject	Course ID	Credits	Contact Hours per week	Internal Assessment (IA)*	External Exam	Maximum Marks	Duration of Exam (hours)
1.	Food Analysis (T)	BSc/FST/SM/2/DSC/103	3	3	25	50	75	3
	Food Analysis (P)		1	2		25	25	3
2.	Principles of Food Preservation (T)	BSc/FST/SM/2/DSC/104	3	3	25	50	75	3
	Principles of Food Preservation (P)		1	2		25	25	3
3.	Grain Storage & Handling (T)	BSc/FST/SM/2/MIC/102A	3	3	25	50	75	3
	Grain Storage & Handling (P)		1	2		25	25	3
	<b>OR</b>		<b>OR</b>					
	Postharvest Handling & Storage of Fruits & Vegetables (T)	BSc/FST/SM/2/MIC/102B	3	3	25	50	75	3
	Postharvest Handling & Storage of Fruits & Vegetables (P)		1	2		25	25	3
4.	Food Safety, Hygiene and Sanitation	BSC//FST/SM/2/MDC/102	3	3	25	50	75	3
5.	Communicative English - I	ENG/AEC/101	2	2	15	35	50	2
6.	Soft Skills at Workplace	BSC/FST/SM/2/SEC/102	3	3	25	50	75	3
7.	Communication Skills	CDLU/VAC/102	2	2	20	30	50	2
<b>Total</b>			<b>22</b>	30				

**FIRST  
SEMESTER**

## BSc/FST/SM/1/DSC/101

### **Introduction to Food Technology (Theory)**

**Credit: 3**  
**Periods per week: 3 Hrs**  
**Internal Assessment: 25**

**Duration of Exam: 3 Hrs.**  
**Max. Marks: 75**  
**End Term Exam: 50**

*Note for the paper setter:* The question paper will consist of 7 questions in all. The first question will be compulsory and will consist of 4 short questions of 2 marks each covering the whole syllabus. In addition, six more questions of 14 marks is will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting one question from each unit.

#### **UNIT-1**

**Wheat:** structure and composition, types (hard, soft/strong, weak) Diagrammatic representation of longitudinal structure of wheat grain. Gelatinization of starch, types of browning- Maillard & caramelization.

**Rice:** structure, composition and application **Corn:** structure, composition and uses.

**Meat:** Definition of carcass, composition of meat, marbling, and post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat.

#### **UNIT-II**

**Fruits and Vegetables:** Classification of fruits and vegetables, general composition,

**Postharvest changes in fruits and vegetables:** Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables.

#### **UNIT-III**

**Milk and Milk Products:** Definition of milk, chemical composition of milk, its constituents and their importance, physicochemical properties of milk, factor affecting the composition of milk.

**Processing of milk:** Pasteurization, homogenization, standardization and sterilization of milk.

**Poultry:** Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality.

#### **Recommended Readings**

1. Bawa, A.S., Chauhan, O.P. et.al., Food Science. New India Publishing agency, 2013.
2. Roday, S. Food Science, Oxford publication,2011.
3. B. Srilakshmi, Food science, New Age Publishers, 2002.
4. Meyer, Food Chemistry, New Age,2004.
5. De Sukumar, Outlines of Dairy Technology, Oxford University Press,2007.

**BSc/FST/SM/1/DSC/101**

**Introduction to Food Technology (Practical)**

Credits:1

Periods per week: 2 Hrs.

Duration of exam: 3 Hrs.

Max. Marks: 25

1. Study different types of browning reactions: enzymatic and non-enzymatic.
2. To study the gelatinization behavior of various starches.
3. To study the concept of gluten formation of various flours.
4. To study malting and germination.
5. To study dextrinization in foods.
6. Identification of pigments in fruits and vegetables and the influence of pH on them.
7. Quality inspection of animal foods.



## BSc/FST/SM/1/DSC/102

### **Basics of Food Microbiology (Theory)**

**Credit: 3**  
**Periods per week: 3 Hrs**  
**Internal Assessment: 25**

**Duration of Exam: 3 Hrs.**  
**Max. Marks: 75**  
**End Term Exam: 50**

*Note for the paper setter:* The question paper will consist of 7 questions in all. The first question will be compulsory and will consist of 4 short questions of 2 marks each covering the whole syllabus. In addition six more questions of 14 marks is will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting one question from each unit.

#### **UNIT-I**

**Introduction:** Origin of food microbiology as science, general features and importance of different groups of bacteria, yeasts and molds in foods.

**Microbial growth:** Food as nutrient for various microorganisms, factor affecting the growth and survival of microorganisms in foods.

#### **UNIT-II**

**Methods for microbial examination of food:-** Traditional, non-traditional and rapid methods for the microbial examination of food and food products.

**Fermentation:** definition and types, microorganisms used in food fermentations, fermented foods, types, methods of manufacture for vinegar, sauerkraut, beer, and wine.

#### **UNIT-III**

**Food Spoilage:** Microbial and biochemical aspect of food spoilage, role of bacteria, yeast and molds in food spoilage, foodborne infections and intoxications (Bacterial)

Spoilage of cereal and cereal products, fruits and vegetables, meat and meat products, milk and milk products, fish and fish products, spoilage of egg and poultry and heated canned foods.

#### **Books Recommended:**

1. Frazier WC and Westoff DC "Food Microbiology" 4<sup>th</sup> edition Tata Mcgraw-Hill Publishing
2. Jay JM "Modern Food Microbiology" 3<sup>rd</sup> edition CBS Publishers and distributors Delhi 1987
3. Adams MR and Moss MO "Food microbiology" New Age International (P) Ltd. 1996
4. Gunasekaran P. "Laboratory Manual in Microbiology", New Age International (P) Ltd. 1996.

**BSc/FST/SM/1/DSC/102**

**Basics of Food Microbiology (Practical)**

Credits:1

Periods per week:2 Hrs.

Duration of exam: 3 Hrs.

Max. Marks: 25

1. Sterilization and disinfection of equipment used in food microbiology laboratory.
2. Preparation of media, slant and broths required in the microbial analysis of foods.
3. To count the number of microorganisms by direct microscopic count method.
4. Study of different types of microorganism colony shapes on agarplates.
5. Study of the capsular and spore staining methods.
6. Study of dye reduction test of milk.
7. Microbiological analysis of egg, cereal product and fruit product.

**BSc/FST/ SM /1/MIC/101**  
**Food Chemistry (Theory)**

**Credit: 4**  
**Periods per week: 3 Hrs**  
**Internal Assessment: 30**

**Duration of Exam: 3 Hrs.**  
**Max. Marks: 100**  
**End Term Exam: 70**

*Note for the paper setter:* The question paper will consist of *nine* questions in all. The first question will be compulsory and will consist of 7 short questions of 2 marks each covering the whole syllabus. In addition, eight more questions of 14 marks will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting one question from each unit.

**UNIT-1**

**Introduction to Food Chemistry:** Composition of food, the definition of water in food, Structure of water and ice, Types of water, Role of water activity.

**Lipids:** Classification of lipids, Physical and chemical characteristics, Chemical deterioration of fats and oils (auto-oxidation, rancidity, lipolysis, flavor reversion).

**UNIT-II**

**Carbohydrates:** Classification, Structure and Chemical reactions of carbohydrates.

**Protein:** classification and structure, types of food proteins (plant and animal proteins), Physicochemical and functional properties of proteins.

**UNIT-III**

**Natural Food Pigments:** Introduction and classification, Types of food pigments (chlorophyll, carotenoids, anthocyanin and flavonoids, beet pigments, caramel).

**Food Flavors:** Definition and basic tastes, Description of some common food flavors.

**Minerals:** Major and minor minerals, Toxic minerals in food.

**UNIT-IV**

**Vitamins:** Types (Water soluble vitamins and Fat soluble vitamins).

**Enzymes:** Introduction, classification, General characteristics, Important enzymes in food processing. Physico-chemical and nutritional changes occurring during food processing.

**Browning Reactions in Food:** Types, Enzymatic and Non enzymatic Browning and their control measure.

**Recommended Readings:**

1. Fennema, Owen R1996. Food Chemistry, 3rd Ed., Marcell Dekker, NewYork,
2. Whitehurst and Law.2002. Enzymes in Food Technology, CRC Press,Canada
3. Potter, N.N. and Hotchkiss,J.H.1995. Food Science5th Ed., Chapman &Hall

## BSC/FST/SM/1/MDC/101

### **Food Adulteration**

**Credit: 3**

**Periods per week: 3 Hrs**

**Internal Assessment: 25**

**Duration of Exam: 3 Hrs.**

**Max. Marks: 75**

**End Term Exam: 50**

*Note for the paper setter:* The question paper will consist of 7 questions in all. The first question will be compulsory and will consist of 4 short questions of 2 marks each covering the whole syllabus. In addition six more questions of 14 marks is will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting one question from each unit.

#### **Unit I**

**Introduction and concept:** Food Adulteration – Definition, concept, classification of adulterants, Food Contaminants, difference between adulterants and contaminants

**Common food adulterants:** List of foods commonly adulterated, harmful effects of adulterants. Economic effect of adulteration.

#### **Unit II**

**Adulteration in milk and milk products:** Common adulterants in milk and milk products. Household and laboratory scale methods to detect adulterants in milk and milk products

**Adulteration in spices and additives:** Common adulterants in spices and food additives. Household and laboratory scale methods to detect adulterants in these commodities.

#### **Unit III**

**Public health hazards and food safety:** Foodborne illness, food poisoning, types of food poisonings, bacterial agents of foodborne illness,

**Food poisoning:** Food poisoning by *Clostridium*, *salmonella*, *E. coli*, *Staphylococcus*. etc.

#### **References books:**

1. N. Shakuntala Manay and M. Shadaksharaswamy (2008) Food Facts and Principles
2. [Edwin M. Bruce](#) Edwin M Bruce Detection of the Common Food Adulterants
3. Shyam Narayan Jha (2016) Rapid Detection of Food Adulterants and Contaminants

**Hindi -1**  
**हिंदी भाषा परिचय सामान्य :**  
**HINDI/AEC/101**

**Credit – 2**

**Duration:** 2 Hours per week

**परीक्षा समयघंटे 2 :**

**कुल अंक50 :**

**लिखित परीक्षा :35 अंक**

**आंतरिक मूल्यांकन: 15 अंक**

**Note for the Paper Setter:** The question paper will consist of five questions in all. The first question will be compulsory and will consist of seven short questions of 1 marks each covering the whole syllabus. In addition, four more questions of 14 marks each will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt one compulsory question and two more questions selecting one question from each unit.

**पाठ्यक्रम के उद्देश्य:**

हिंदी भाषा की विकास करवाना परिचय से यात्रा-

**पाठ्यक्रम के अपेक्षित परिणाम**

1. हिंदी भाषा के विकास व उसकी बोलियों का ज्ञान होगा
2. हिंदी भाषा के विविध रूप व प्रयोजनमूलकता से परिचित होंगे

**खंड एक—**

हिंदी भाषाविकास एवं उद्भव :

हिंदी की उपभाषाएं एवं बोलियों का वर्गीकरण

ब्रज एवं परिचय सामान्य का बोली खड़ी और अवधि , प्रवृत्तियाँ

**खंड दो-**

कंप्यूटर-परिभाषा, स्वरूप एवं महत्व

पारिभाषिक शब्दावली – बैंकिंग, वाणिज्य, मंत्रालय, उपक्रम, निगम, औद्योगिक क्षेत्र व मीडिया क्षेत्र

अनुवाद लेखन- अर्थ परिभाषा, स्वरूप, महत्व, प्रकिया प्रकार

टिप्पणी लेखन ,परिभाषा अर्थ -नियम, लेखन विधि, उदाहरण

**संदर्भ सूची:**

1. हिंदी भाषा का उद्भव एवं विकास तिवारी उदयनारायण ,
2. भाषा विज्ञान तिवारी भोलानाथ .डॉ ,
3. हिंदी भाषा का इतिहास वर्मा धीरेन्द्र लेखक ,
4. समसामयिक भाषा विज्ञाननारंग वैष्णव लेखक ,
5. हिंदी1965 इलाहाबाद ,महल किताब ,बाहरी हरदेव ,विकास और उद्भव :

**BSC/FST/SM/1/SEC/101**

**Food Safety Standards**

**Credit: 3**

**Periods per week: 3 Hrs**

**Internal Assessment: 25**

**Duration of Exam: 3 Hrs.**

**Max. Marks: 75**

**End Term Exam: 50**

*Note for the paper setter:* The question paper will consist of 7 questions in all. The first question will be compulsory and will consist of 4 short questions of 2 marks each covering the whole syllabus. In addition six more questions of 14 marks is will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting one question from each unit.

**UNIT-I**

**Introduction to food safety:** Definition, Historical background of food safety, Factors affecting Food Safety, Importance of Safe Foods.

**Food hazards of physical, chemical and biological origin:** Introduction, Physical Hazards with common examples, Chemical Hazards (naturally occurring environmental and intentionally added and contaminants due to processing), Seafood and Shell fish poisoning, Microbiological hazards (Bacterial and Fungal).

**UNIT-II**

**Introduction to food acts, laws and standards:** Food safety and standard act, prevention of food adulteration act, legal Metrology Act, Fruit product Order, Meat Food Product Order, Milk and Milk Products Regulations, Indian Standards, Agmark Standards.

International Standards: Codex Standards, ISO Standards, Food Safety and Standards Authority of India (FSSAI), The Export Inspection Council, World Health Organization (WHO), Food and Agriculture Organization (FAO), World Trade Organization (WTO).

**UNIT-III**

**Food safety management tools:** Prerequisites of food hygiene - GHPs, GMPs, HACCP, TQM – concept and need for quality, Microbiological tests for food safety related to (*Coliforms, Listeria, Staphylococci and Salmonella*), definition and principles of risk analysis.

Steps involved in the implementation of food safety programme. New approaches and advancements in to food safety.

**Recommended Books:**

1. Adam MR and Moss MO. Food microbiology. New Age International (P) Ltd. ND.
2. Jay JM. Modern Food Microbiology. CBS publishers ND.
3. Potter NN. Food Science. CBS Publishers ND.
4. Bhunia AK. Food borne Microbial Pathogens (Mechanism and Pathogenesis). Food Science text series Springer. Food Safety by Ian C Shaw: Publisher Wiley Blackwell.

## EVS/VAC/101

### **Environmental Studies – I**

**Credits: 2**

**Duration of Examination: 2 Hrs**

**Total Marks: 50**

**Internal Assessment: 15**

**Semester End Examination: 35**

**Objective:** The objective of this paper is to create the awareness among the students towards Environmental concepts and issues for smooth life of species and human at earth.

#### **UNIT I**

Introduction to Environment: The multidisciplinary nature of environmental studies: Definition, scope and importance, need for public awareness. Environmental Ethics: anthropocentric and eco-centric perspective. Natural resources: Renewable and non-renewable resources: Natural resources and associated problems. Forest resources: use and over-exploitation, Deforestation, Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, dams- conflicts over water and problems. Minerals resources: Use and exploitation, environmental effects of extracting and using minerals resources. Food resources: World food issues, changes caused by agriculture and overgrazing, effects of modern agriculture on agro ecosystem, agrochemical issues, water logging, salinity, Energy resources; Growing energy needs, renewable and non-renewable energy resources. Land resources: Land as resource: land degradation man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable life style. Sustainable development: concept, initiatives for sustainable development: regional, state and global, Sustainable Development Goals.

#### **UNIT II**

Ecosystem: Concept, Structure and Function. Producers, Consumers and Decomposers, Energy flow in the ecosystem, Concept and type of ecological succession, Food chains, food webs and Ecological pyramids, Introduction, types, characteristics features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, desert ecosystem, Aquatic eco system (Ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity and its conservation: Introduction-Definition: Genetic, species and Ecosystem diversity, Bio-geographical classification of India. Value of Biodiversity: consumptive use, productive use, social, ethical; aesthetic and optional. Biodiversity at local, National and Local levels. India as Mega-diverse a Nation. Hot spots of Biodiversity. Threats to biodiversity, Habitat loss, poaching of wildlife, man-wildlife conflicts. Endemic species, conservation of biodiversity: In situ and Ex-situ, conservation of biodiversity. Convention on biological diversity, Aichi targets. Water pollution: Natural and anthropogenic sources of water pollution and their effects. Marine pollution, Thermal pollution, Eutrophication, Ground water pollution. Air pollution: Sources, Classification and properties of air pollutants (Particulate matter, Inorganic gaseous pollutants, Organic gaseous pollutants), Smog, Acid rain, Ozone layer depletion, Green house effects, Global warming, Effects of air pollution on Human Health Soil pollution: Soil pollution from the use of agrochemicals (viz. Fertilizers and Pesticides), Heavy metals, Industrial effluents and Detrimental effects of soil pollutant, Remedial measures for soil pollution. Types and sources Solid waste, Electronic waste Radioactive and Noise pollution: Definition Sources of radioactive pollution, Radioactivity, effects of radioactive pollution, Sound pressure level, Frequency, noise monitoring and sound level meter, Sources and effects of noise pollution, Effects of noise pollution on human health. Role of individual in prevention of pollution.

**Suggested Readings:**

1. Agarwal, K.C. 2001 *Environmental Biology*, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, *The Biodiversity of India*, Mapin Publishing Pvt. Ltd., Ahmedabad- 380013, India.
3. Clerk R.S., *Marine Pollution*; Clarendon Press Oxford.
4. Down to Earth, Centre for Science and Environment.
5. Hawkins R.E., *Encyclopedia of Indian Natural History*, Bombay Natural History Society, Bombay.
6. Mhaskar A.K, *Matter Hazardous*, Techno-Science Publications.
7. Townsend C., Harper J, and Michael Begon, *Essentials ecology*, Blackwell Science.

**Note for the Paper Setter:** *The question paper will consist of **five** questions in all. The first question will be compulsory and will consist of **seven** short questions of **1** marks each covering the whole syllabus. In addition, **four** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **two** units. The candidates are required to attempt **one compulsory question** and **two more questions** selecting at least one question from each unit.*



**SECOND  
SEMESTER**



## BSc/FST/SM/2/DSC/103

### Food Analysis

**Credit: 3**  
**Periods per week: 3 Hrs**  
**Internal Assessment: 25**

**Duration of Exam: 3 Hrs.**  
**Max. Marks: 75**  
**End Term Exam: 50**

*Note for the paper setter:* The question paper will consist of 7 questions in all. The first question will be compulsory and will consist of 4 short questions of 2 marks each covering the whole syllabus. In addition six more questions of 14 marks is will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting one question from each unit.

#### UNIT-I

**Sampling:** basic concepts of sampling, types of samples and sampling. Storage and preservation methods for samples. Basic concept and methods to detect microbiological contamination in food materials.

**Analysis of properties of milk and milk products:** fat content, SNF (solid not fat), CLR (corrected lactometer reading), titer-able acidity, detection of various adulterants in milk

#### UNIT-II

**Chemical analysis of food products:** principles and basic concepts for moisture, carbohydrates, protein, fat, fiber and mineral analysis. Various analytical procedures and their principles: temperature, pH, turbidity etc.

**Rheological and pasting behaviour of food material:** Rheometer, visco-amylograph and farinograph: basic principle and working.

#### UNIT-III

**Sensory evaluation of foods:** sensory characteristics of foods. Methods for sensory evaluation: discrimination tests, rating tests, sensitivity tests, descriptive analysis and affective tests (consumer tests). Colour measurements: hunter colorimeter, basic concept and working principle.

#### Recommended Books:

1. AOAC International. 2003. Official methods of analysis of AOAC International. 17th Ed. Gaithersburg, MD, USA, Association of Analytical Communities.
2. Kirk RS & Sawyer R. 1991. Pearson's Chemical Analysis of Foods. 9th Ed. Longman Scientific & Technical.
3. Nielsen S. (Eds.). 1994. Introduction to Chemical Analysis of Foods. Jones & Bartlett.
4. Pomrenz Y & Meloan CE. 1996. Food Analysis - Theory and Practice. 3rd Ed. CBS.
5. Ranganna S. 2001. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2<sup>nd</sup> Ed. Tata-McGraw-Hill.

**BSc/FST/SM/2/DSC/103**  
**Food Analysis (Practical)**

Credits: 1  
Periods per week: 2 Hrs.

Duration of exam: 3 Hrs.  
Max. Marks: 25

1. Estimation of pH, conductivity, salinity and TDS (total dissolved solids) of different liquid foods and water.
2. Estimation of proteins, fat and fiber in given food sample.
3. Separation and identification of carotenoids by thin layer and/or column chromatography.
4. Isolation of starch and its analysis of its rheological properties.
5. Demonstration of instruments: GLC, HPLC, Atomic absorption, Flame photometer, Farinograph, UV-Vis spectrophotometer and microscopes.

## BSc/FST/SM/2/DSC/104

### Principles of Food Preservation(Theory)

**Credit: 3**  
**Periods per week: 3 Hrs**  
**Internal Assessment: 25**

**Duration of Exam: 3 Hrs.**  
**Max. Marks: 75**  
**End Term Exam: 50**

*Note for the paper setter:* The question paper will consist of 7 questions in all. The first question will be compulsory and will consist of 4 short questions of 2 marks each covering the whole syllabus. In addition six more questions of 14 marks is will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting one question from each unit.

#### UNIT-1

**Food Microbiology:** Principles of Food Preservation, microorganisms associated with foods- bacteria, yeast and mold, Importance of bacteria, yeast and molds in foods.

**Classification of microorganisms:** based on temperature, pH, water activity, nutrient and oxygen requirements, typical growth curve of micro-organisms. Definition of shelf life, perishable foods, semi perishable foods and shelf stable foods.

#### UNIT-II

**Food preservation by Freezing and Refrigeration:**, cool storage and freezing, definition, principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e., slow freezing, quick freezing, refrigeration load, effect of freezing and refrigeration of microbial growth.

**Food Preservation by Moisture control:** Drying and Dehydration - Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), heat and mass transfer, factors affecting rate of drying, normal drying curve, names of types of driers used in the food industry.

#### UNIT-III

**Thermal processing and food preservation:** Commercial heat preservation methods: Sterilization, commercial sterilization, Pasteurization, and blanching. effect of thermal processing on microbial growth.factors affecting evaporation, names of evaporators used in food industry.

**Radiation in food preservation:** Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, uses of radiation processing in food industry, concept of cold sterilization,

#### Recommended Readings

1. B. Srilakshmi, Food science, New Age Publishers, 2002
2. Meyer, Food Chemistry, New Age,2004
3. Bawa. A.S, O.P Chauhanetal.Food Science. New India Publishing agency,2013
4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi,2004

**BSc/FST/SM/2/DSC/104**

**Principles of Food Preservation (Practical)**

Credits:1

Periods per week: 2Hrs.

Duration of exam: 3 Hrs.

Max. Marks: 25

1. Methods of Sampling.
2. Estimation of shelf life of different foods.
3. Determination of pH of different foods using pH meter.
4. Study quality characteristics of foods preserved by drying/dehydration/freezing.
5. To perform pasteurization of fluids using different methods.

## BSc/FST/SM/2/MIC/102A

### Grain Storage & Handling (Theory)

**Credit: 3**  
**Periods per week: 3 Hrs**  
**Internal Assessment: 25**

**Duration of Exam: 3 Hrs.**  
**Max. Marks: 75**  
**End Term Exam: 50**

*Note for the paper setter:* The question paper will consist of 7 questions in all. The first question will be compulsory and will consist of 4 short questions of 2 marks each covering the whole syllabus. In addition six more questions of 14 marks is will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting one question from each unit.

#### **UNIT-I**

Pests of stored grains and their classification. General problems of grain storage. Sources of infestation in stored food grains and their detection. Causes, types and content deterioration in stored food grains and methods to check them.

#### **UNIT-II**

Internal feeders of stored grains and their management. External feeders of stored grains and their management.

Traditional and modern methods of bag and bulk storage. Chemical, non chemical and integrated methods of controlling stored grain insect pest.

#### **UNIT-III**

New methods employed in managing stored grain pests: insect proof bins, insect proof bags, traps, irradiation, nanoparticles, silos, microwave technology, controlled atmosphere, low and high temperatures.

Storage structures and their significance for different food grains.

#### **Recommended Books:**

1. Introduction of Insect –By Metalf & Lukemann.
2. Pesticides and Pollution–By Mollan.

**BSc/FST/SM/2/MIC/102A**  
**Grain Storage & Handling (Practical)**

Credits: 1  
Periods per week: 2 Hrs.

Duration of exam: 3 Hrs.  
Max. Marks: 25

1. To study various insect pests of grains.
2. To study the quality tests and physical parameters for grains.
3. To store the grains and check its shelf life.
4. To study the various pesticides used for grain storage.
5. To study the effect of moisture on spoilage of grains.
6. Visit to grain storage godowns.



## BSc/FST/SM/2/MIC/102B

### Post Harvest Handling & Storage of Fruits and Vegetables (Theory)

**Credit: 3**

**Periods per week: 3 Hrs**

**Internal Assessment: 25**

**Duration of Exam: 3 Hrs.**

**Max. Marks: 75**

**End Term Exam: 50**

*Note for the paper setter:* The question paper will consist of 7 questions in all. The first question will be compulsory and will consist of 4 short questions of 2 marks each covering the whole syllabus. In addition six more questions of 14 marks is will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting one question from each unit.

#### UNIT-I

**Introduction to Post Harvest Storage and Handling of Fruits and Vegetables:** Definition and importance of post harvest storage and handling, Overview of the post harvest storage and handling industry

**Pre-harvest factors affecting post harvest quality:** Plant physiology and maturity, Harvesting techniques, Pre-harvest treatments

**Post-harvest handling practices:** Sorting and grading, Washing and cleaning, Cooling and temperature management.

#### UNIT-II

**Controlled atmosphere storage:** Definition and principles of controlled atmosphere storage, Types of controlled atmosphere storage, Management of controlled atmosphere storage

**Modified atmosphere packaging:** Definition and principles of modified atmosphere packaging, Types of modified atmosphere packaging, Management of modified atmosphere packaging

**Cold storage:** Definition and principles of cold storage, Types of cold storage, Management of cold storage

#### UNIT-III

**Quality control in post harvest storage and handling:** Importance of quality control, Factors affecting quality, Quality control methods

Market demand for fresh produce, Distribution channels for fresh produce, Value-added products

**Food safety and regulations:** Food safety principles, Regulations governing post harvest storage and handling, Hazard Analysis and Critical Control Points (HACCP)

#### Refernce books:

1. Florkowski, W. J., Banks, N. H., Shewfelt, R. L., & Prussia, S. E. (Eds.). (2021). *Postharvest handling: a systems approach*. Academic press.
2. Siddiqui, M. W. (Ed.). (2015). *Postharvest biology and technology of horticultural crops: principles and practices for quality maintenance*. CRC Press.
3. Chakraverty, A., Mujumdar, A. S., & Ramaswamy, H. S. (Eds.). (2003). *Handbook of postharvest technology: cereals, fruits, vegetables, tea, and spices* (Vol. 93). CRC press.
4. Sinha, N. K., Hui, Y. H., Evranuz, E. Ö., Siddiq, M., & Ahmed, J. (2010). *Handbook of vegetables and vegetable processing*. John Wiley & Sons.
5. Evans, E. A., Ballen, F. H., & Siddiq, M. (2020). Postharvest Handling, and Processing. *Handbook of Banana Production, Postharvest Science, Processing Technology, and Nutrition*,
6. Mitra, S. K. (1997). Postharvest physiology and storage of tropical and subtropical fruits.

## **BSc/FST/SM/2/MIC/102B**

### **Post Harvest Handling & Storage of Fruits and Vegetables (Practical)**

Credits:1

Periods per week: 2Hrs.

Duration of exam: 3 Hrs.

Max. Marks: 25

- 1) Comparison of different harvesting techniques (such as hand picking, machine harvesting, and mechanical shaking) on post harvest quality of fruits and vegetables
- 2) Evaluation of different sorting and grading methods (such as manual sorting, optical sorting, and weight grading) on post harvest quality of fruits and vegetables
- 3) Effect of different washing and cleaning methods (such as water washing, brushing, and air drying) on post harvest quality of fruits and vegetables
- 4) Comparison of different cooling and temperature management methods (such as forced air cooling, hydrocooling, and vacuum cooling) on post harvest quality of fruits and vegetables
- 5) Evaluation of different controlled atmosphere storage conditions (such as low oxygen and high carbon dioxide) on post harvest quality of fruits and vegetables
- 6) Comparison of different modified atmosphere packaging materials (such as plastic films and coatings) on post harvest quality of fruits and vegetables
- 7) Evaluation of different cold storage conditions (such as temperature and humidity) on post harvest quality of fruits and vegetables
- 8) Assessment of different quality control methods (such as visual inspection, sensory evaluation, and chemical analysis) on post harvest quality of fruits and vegetables
- 9) Investigation of the effect of transportation and distribution methods (such as refrigerated trucks and air cargo) on post harvest quality of fruits and vegetables.

## BSC//FST/SM/2/MDC/102

### **Food Safety Hygiene & Sanitation (Theory)**

**Credit: 3**  
**Periods per week: 3 Hrs**  
**Internal Assessment: 25**

**Duration of Exam: 3 Hrs.**  
**Max. Marks: 75**  
**End Term Exam: 50**

*Note for the paper setter:* The question paper will consist of 7 questions in all. The first question will be compulsory and will consist of 4 short questions of 2 marks each covering the whole syllabus. In addition six more questions of 14 marks is will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt one compulsory question and four more questions selecting one question from each unit.

#### **UNIT-I**

**General principles of food hygiene:** personal hygiene of food handlers-habits, clothes, illness, education of handler in handling and service.

**Food plant sanitation:** Principles & methods, control and inspection. Sanitation in fruits & vegetables industry, cereals industry, dairy industry, meat, egg and poultry units

#### **UNIT-II**

**Cleaning agents and methods:** detergents, Sanitizers and disinfectants, sterilization, disinfection, heat and chemicals.

**Training programmes:** Planning and implementation of training programmes for food handlers and health personnels

#### **UNIT-III**

**Control of infestation:** rodent control, vector control, use of pesticides.

**Water Hygiene:** potable water supply and its quality standards. Planning and implementation of training programmes for health personnel.

#### **Recommended books:-**

1. Principles of Food Sanitation by Marriott, 5<sup>th</sup> ed., 2006, CBS Publisher, New Delhi.
2. Hobbs, B. C. and R. J. Gilbert Food Poisoning and Food Hygiene , 4<sup>th</sup> edition The English Language Book Society and Edward Arnold.
3. Principles of food sanitation –II Edition, AVI Book, Van Nostrand

# ENGLISH-I

## Communicative English-I

ENG/AEC/101

**Credits: 2**

**Duration of Examination:-2 Hrs**

**Internal Assessment: 15**

**Semester End Examination: 35**

**Total Marks: 50**

**Course Objective:** The course aims to introduce students to the theory, fundamentals and tools of communication and to develop effective communication skills for personal, social and professional interactions. Besides, the students shall learn the basics of English grammar and language.

**Course Learning Outcomes:**

- i) They will learn the importance and basics of communication
- ii) They will learn to receive, comment and respond to correspondences in English language.
- iii) They will learn to use English in their life practically.

**Note for the Paper Setter:** The question paper will consist of **five** questions in all. The **first** question will be compulsory and will consist of **seven** short questions of **1** mark each covering the whole syllabus. In addition, **four** more questions of **14** marks each will be set unit-wise comprising of **two** questions from each of the **two** units. The candidates are required to attempt **one** compulsory question and **two** more questions selecting at least **one** question from each unit.

### Unit - I: Listening, Reading and Speaking Skills

Definition, The Listening Process; Importance of Listening; Basic Types of Listening; Barriers to Effective Listening, Reading Comprehension, Intonation, Group Discussion, Interview

### Unit II: Writing Skills:

- Report Writing
- Paragraph Writing
- Letter Writing
- E-Mail
- Resume
- Blogs and Comments on Social Media

### Suggested Reading:

- I) Kumar, Sanjay and Pushp Lata. 2015. *Communication Skills*. Second Edition, New Delhi: Oxford University Press (OUP).
- II) Sethi, J. and P.V. Dhamija. 2006. *A Course in Phonetics and Spoken English*. Second Edition. New Delhi: Prentice-Hall of India.
- III) Balasubramanian. T. *A Text Book of English Phonetics for Indian Students*. Chennai: Macmillan Publishers India Ltd., 1981.
- IV) *On Track: English Skills For Success* by Orient Blackswan (Board of Editors, Solapur University).

## SOFT SKILLS AT WORK PLACE

### BSC/FST/SM/2/SEC/102

**Credit: 3**  
**Periods per week: 3 Hrs**  
**Internal Assessment: 25**

**Duration of Exam: 3 Hrs.**  
**Max. Marks: 75**  
**End Term Exam: 50**

***Note for the Paper Setter:** The question paper will consist of **seven** questions in all. The first question will be compulsory and will consist of **four** short questions of **2** marks each covering the whole syllabus. In addition, **six** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **three** units. The candidates are required to attempt **one compulsory question** and **three more questions** selecting one question from each unit.*

#### UNIT-I

- 1.1 The key areas addressed in Soft skills are Communication skills,
- 1.2 Body language and Etiquette, Group discussion skills,
- 1.3 Interview skills, Presentation skills, and Emotional Intelligence,
- 1.4 Time Management Skills, Preparation of CV and Life skills.

#### Unit-II

- 2.1 IT skills focuses on the basic principles of a computer, including the internal hardware,
- 2.2 The operating system like Microsoft Word, Excel and PowerPoint
- 2.3 social and ethical issues around the Internet
- 2.4 and Management Information System.

#### UNIT-III

- 3.1 Introduction to Soft Skills
- 3.2 Communication Skills Unit
- 3.3 Presentation Skills
- 3.4 Time Management Skills

#### SUGGESTION READING:

- Black Sam, **Role of Public Relations in Management**, Pitman, London
- Cutlip Scott M. & Centre A.H, **Effective Public Relations**, Englishwood Cliffs
- Roy S.K, **Corporate Image of India**, Sh. Ram Centre
- Balan R.K., **Corporate Public Relations**, Sterling Publisher
- Lehari Krishna Chander, **Publicity: Art and Literature with Special Reference to India**

## CDLU/VAC/101

### Communication Skills

**Credits: 2 (Theory)**

Lectures: 30

**Duration of Exam: 2 Hrs.**

**Max. Marks: 50**

Final Term Exam: 35

**Internal Assessment: 15**

**Note for the Paper Setter:** The question paper will consist of **five** questions in all. The first question will be compulsory and will consist of **seven** short questions of **1** marks each covering the whole syllabus. In addition, **four** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **two** units. The candidates are required to attempt **one compulsory question** and **two more questions** selecting at least one question from each unit.

#### Unit-1

**Listening:** Techniques of Effective Listening, Listening and Comprehension, Probing Questions Barriers to Listening.

**Speaking:** Pronunciation, Enunciation, Vocabulary, Fluency, Common Errors.

**Reading:** Techniques of Effective Reading, Gathering Ideas and Information from a Given Text, evaluating these Ideas and Information, Interpreting the Text.

**Writing and Different Modes of Writing:** The Writing Process, Effective Writing Strategies, Different Modes of Writing.

**Digital Literacy and Social Media:** Basic Computer Skills, Introduction to Microsoft (MS) Office Suite, Open Educational Resources, Basic Virtual Platforms, Trending Technologies, Machine Learning, Artificial Intelligence (AI), Internet of Things (IoT), Social Media, Introduction to Social Media Websites, Advantages of Social Media, Ethics and Etiquettes of Social Media, How to Use Google Search Better?, Effective Ways of Using Social Media, Digital Marketing, Introduction to Digital Marketing, Traditional Marketing versus Digital Marketing, Digital Marketing Tools, Social Media for Digital Marketing, Digital Marketing Analytics.

#### Unit-2

**Digital Ethics and Cyber Security:** Digital Ethics, Digital Literacy Skills, Digital Etiquette, Digital Life Skills, Cyber Security, Understanding and introducing the environment of security, Types of attacks and attackers, the art of protecting secrets.

**Nonverbal Communication:** Meaning of nonverbal communication, Advantages of using nonverbal communication, Introduction to modes of nonverbal communication, Open and Closed body language, Eye contact and Facial expression, Hand gestures, Do's and Don'ts in NVC, Learning from experts, Activities-based learning.

**Suggested Readings:** Follow Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0 at UGC website:

[https://www.cdlu.ac.in/assets/admin/miscellaneous/Implementation%20of%20Curriculum%20and%20Guidelines%20on%20Life%20Skills%20\(Jeevan%20Kaushal\)%202.0.pdf](https://www.cdlu.ac.in/assets/admin/miscellaneous/Implementation%20of%20Curriculum%20and%20Guidelines%20on%20Life%20Skills%20(Jeevan%20Kaushal)%202.0.pdf)

**Note for the Paper Setter:** The question paper will consist of **five** questions in all. The **first** question will be compulsory and will consist of **seven** short questions of **1** mark each covering the whole syllabus. In addition, **four** more questions of **14** marks each will be set unit-wise comprising of **two** questions from each of the **two** units. The candidates are required to attempt **one** compulsory question and **two** more questions selecting at least **one** question from each unit.