Scheme and Syllabi

(1st and 2nd Semesters)

of

B.Sc. (Food Science and Technology)

Three Years (6 Semesters)

(Under Choice Based Credit System)

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

Faculty of Life Sciences

Chaudhary Devi Lal University, Sirsa-125055

(Haryana)India

B. Sc. (Food Science and Technology)

Three Years (6 Semesters)

Session 2018-2019

Semester I

Paper Code	Nomenclature of Paper	Nature of Course	Credits	Hours per Week	External Marks	Internal Marks	Maximum Marks
BFST-CC-101	Environmental Studies	Ability Enhancement Compulsory Course	**4**	**4**	**70**	**30**	**100**
BFST-GE-101	Proficiency in English	Language-1	**4**	**4**	**70**	**30**	**100**
BFST-101	Fundamentals of Food Technology (Theory)	Core Course	**2**	**2**	**30**	**20**	**50**
BFST-102	Principles of Food Science (Theory)	Core Course	**2**	**2**	**30**	**20**	**50**
BFST-103	Technologyof Food Processing (Theory)	Core Course	**2**	**2**	**30**	**20**	**50**
BFST-104	Fundamentals of Food Technology (Practical)	Core Course	**2**	**4**	**50**	**00**	**50**
BFST-105	Principles of Food Science (Practical)	Core Course	**2**	**4**	**50**	**00**	**50**
BFST-106	Technology of Food Processing (Practical)	Core Course	**2**	**4**	**50**	**00**	**50**
	Total		**20**	**26**	**380**	**120**	**500**

Duration of Examination: Theory: 03 Hours and Practical: 05 Hours.

Semester II

Paper Code	Nomenclature of Paper	Nature of Course	Credits	Hours per Week	External Marks	Internal Marks	Maximum Marks
BFST-CC-201	Basics of Computer and Statistics (Theory)	Ability Enhancement Compulsory Course	**2**	**2**	**30**	**20**	**50**
BFST-CC-202	Basics of Computer and Statistics (Practical)	Ability Enhancement Compulsory Course	**2**	**4**	**50**	**00**	**50**
BFST-GE-201	Hindi	Language-2	**4**	**4**	**70**	**30**	**100**
BFST-201	Technology of Food Preservation (Theory)	Core Course	**2**	**2**	**30**	**20**	**50**
BFST-202	Food Processing Technology (Theory)	Core Course	**2**	**2**	**30**	**20**	**50**
BFST-203	Chemistry of Food (Theory)	Core Course	**2**	**2**	**30**	**20**	**50**
BFST-204	Technology of Food Preservation (Practical)	Core Course	**2**	**4**	**50**	**00**	**50**
BFST-205	Food Processing Technology (Practical)	Core Course	**2**	**4**	**50**	**00**	**50**
BFST-206	Chemistry of Food (Practical)	Core Course	**2**	**4**	**50**	**00**	**50**
	Total		**20**	**28**	**390**	**110**	**500**

Duration of Examination: Theory: 03 Hours and Practical: 05 Hours.

Semester-I

BFST-101: FUNDAMENTALS OF FOOD TECHNOLOGY (Core Course)

(Credits - 2)

Time: 3hours **Max. marks: 30**

Note: The question paper will consist of nine questions in all. The first question will be compulsory and will consist of six short question of 01 marks each covering the whole syllabus. In addition eight more question will be set unit-wise comprising of two question from each of the four units. The candidates are required to attempt four more question selection at least one question from each unit. All questions will carry equal marks.

UNIT 1

Historical evolution of food processing technology.Compositional, Nutritional and Technological aspects of Cereals and Millets:Structure and composition of cereals**,** Wheat- structure and composition, types (hard, soft/ strong, weak) Diagrammatic representation of longitudinal structure of wheat grain. Rice- structure and composition, parboiling of rice- advantages and disadvantages.Structure and composition of pulses, toxic constituents in pulses, processing of pulses soaking, germination, decortications, cooking and fermentation.

Unit ll Fruits and Vegetables

Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre.

Post harvest 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 Egg

Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layers.Milk and Milk Products- Definition of milk, chemical composition of milk, its constituents, processing of milk, pasteurization, homogenization. An overview of types of market milk and milk products.

UNIT lV Flesh Foods - Meat, Fish, Poultry

Meat - Definition of carcass, concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat. Fish - Classification of fish (fresh water and marine), aquaculture , composition of fish, characteristics of fresh fish, spoilage of fish- microbiological, physiological, biochemical. Poultry and poultry products.

Recommended Readings

1. Bawa. A.S, O.P Chauhanetal.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

BFST-102: PRINCIPLES OF FOOD SCIENCE (Core Course)

(Credits - 2)

Time: 3hours **Max. marks: 30**

Note: The question paper will consist of nine questions in all. The first question will be compulsory and will consist of six short question of 01 marks each covering the whole syllabus. In addition eight more question will be set unit-wise comprising of two question from each of the four units. The candidates are required to attempt four more question selection at least one question from each unit. All questions will carry equal marks.

UNIT 1

Food dispersions**:**Characteristics, sols, gels, pectin gels, colloidal sols, stabilization of colloidal system, syneresis, emulsions, properties of emulsions, formation of emulsion, emulsifying agent, food foams, formation stability and destruction of foam, application of colloidal chemistry to food preparation.Objectives, type of food panels, characteristics of panel member, layout of sensory evaluation laboratory, sensitivity tests, threshold value, paired comparison test, duotrio test, triangle test, hedonic scale, chemical dimension of basic tastes, Amoore's classification of odorous compounds. Sherman and Sczezniak classification of food texture.

Unit ll

Growth of microorganisms in foods: Food as a substrate for microorganism, factors affecting growth of microbes: pH, water activity, O-R potential, nutrient contents, inhibitory substance and biological structure. Hurdle technology:Principles and applications, Hurdle effect in fermented foods, shelf stable products, intermediate moisture foods, application of hurdle technology.

UNIT lll

Minimal processing: Minimal processing of foods with thermal methods and non thermal methods-safety criteria in minimally processed foods-Minimal processing in practice-fruits and vegetables-seafood-effect on quality-Future developments. Ohmic heating and High Pressure processing: Principles, equipment and processing, effect on food.

UNIT lV

Packaging: Objectives of packaging, flexible packaging, properties of the following packaging materials- low density polyethylene, high density polyethylene, polypropylene, polyvinyl chloride, polyvinylidene chloride, ethylene vinyl alcohol, polystyrene, polyethylene terepthalate, nylon, ethylene vinyl acetate, ethylene acrylic acid, ethylene methacrylic acid, ionomers.

Recommended Readings

1. Coles R, McDowell D and Kirwan MJ, Food Packaging Technology, CRC Press, 2003
2. De S, Outlines of Dairy Technology, Oxford Publishers, 1980
3. Deman JM, Principles of Food Chemistry, 2nd ed. Van Nostrand Reinhold, NY 1990
4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi, 2004
5. Jenkins WA and Harrington JP, Packaging Foods with Plastics, Technomic Publishing Company Inc., USA, 1991
6. Manay NS and Shadaksharaswamy M, Food-Facts and Principles, New Age International (P) Ltd. Publishers, New Delhi, 1987
7. Meyer LH, Food Chemistry, CBS Publication, New Delhi, 1987
8. Potter NH, Food Science, CBS Publication, New Delhi, 1998
9. Ramaswamy H and MarcottM,Food Processing Principles and Applications CRC Press, 2006
10. Ranganna S, Handbook of Analysis and Quality Control for Fruits and Vegetable Products, 2nd ed. TMH Education Pvt. Ltd, 1986

BFST-103: TECHNOLOGY OF FOOD PROCESSING (Core Course)

(Credits - 2)

Time: 3hours **Max. marks: 30**

Note: The question paper will consist of nine questions in all. The first question will be compulsory and will consist of six short question of 01 marks each covering the whole syllabus. In addition eight more question will be set unit-wise comprising of two question from each of the four units. The candidates are required to attempt four more question selection at least one question from each unit. All questions will carry equal marks.

UNIT 1

Refrigeration and Freezing: Requirements of refrigerated storage - controlled low temperature, air circulation and humidity, changes in food during refrigerated storage, progressive freezing, changes during freezing, Freezing methods -direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing. Dehydration : Normal drying curve , effect of food properties on dehydration ,change in food during drying, drying methods and equipments air convection dryer, tray dryer, tunnel dryer ,continuous belt dryer , fluidized bed dryer, dryer, drum dryer, vacuum dryer ,freeze drying ,foam mat drying.

UNIT ll

Thermal Processing of Foods: Classification of thermal processes, Principles of thermal processing, commercial canning operations, Aseptic Processing, UHT. Irradiation and microwave heating Principles, Dosage, Applications of Irradiation, Mechanism of microwave heating and applications. Technology of Colloids In Food : Characteristics, sols, gels, pectin gels, colloidal sols, stabilization of colloidal system, syneresis, emulsions, properties of emulsions, formation of emulsion, emulsifying agents, food foams, formation stability and destruction of foam, application of colloidal chemistry to food preparation.

UNIT lll

Water disposal and sanitation waste water, hardness of water, break point chlorination, physical and chemical nature of

Impurities, BOD, COD, waste water treatment, milk plant sanitation, CIP system, sanitizers used in food industry. Minimal processing and hurdle technology

UNIT lV

Food Additives - Introduction, need of food additives in food processing and preservation, Characteristics and classification of food additives, Chemical, technological and toxicological aspects. Contamination in Food- : Physical, chemical (heavy metals, pesticide residues, antibiotics, veterinary drug residues, dioxins, environmental pollutants, radionucleides, solvent residues, chemicals) Natural toxins.Food Laws and Regulations- Codex, HACCP, ISO, FSSA etc.

Recommended Readings:

1. Potter NH,1998, Food Science, CBS Publication, New Delhi
2. Ramaswamy H and Marcotte M,2009, Food Processing Principles and Applications CRC Press
3.Deman JM,2007, Principles of Food Chemistry, 3rd ed.Springer
4. Manay NS and Shadaksharaswamy M,1987, Food-Facts and Principles, New Age International (P) Ltd. Publishers, New Delhi

BFST-104: FUNDAMENTALS OF FOOD TECHNOLOGY (Practical)
(Credits-2)

1. Study different types of browning reactions: enzymatic and non enzymatic.
2. To study 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 influence of pH on them.
7. Quality inspection of animal foods.

BFST-105: PRINCIPLES OF FOOD SCIENCE
(Credits-2)

PRACTICAL

1. Estimation of reducing sugar by Fehlings procedure
2. Estimation of salt content in brine
3. Estimation of salt content in butter
4. Demonstration of the Soxhlet method for determination of fat content
5. Determination of acidity of water
6. Determination of alkalinity/ hardness of water
7. Demonstration of the Kjeldahl's method for estimation of protein content

BFST-106: Technology of Food Processing
(Credits-2)

PRACTICAL

1 Canning of foods
2 Preservation of food by the process of freezing
3 Drying of food using Tray dryer/other dryers
4 Estimation of Chemical Oxygen Demand (Demonstration)
5 Preparation of brix solution and checking by hand refractometer
6 Analysis of water
7 Minimal Processing of food

Semester-II

BFST-201 TECHNOLOGY OF FOOD PRESERVATION (Core Course)

(Credits - 2)
Time: 3hours **Max. marks: 30**

Note: The question paper will consist of nine questions in all. The first question will be compulsory and will consist of six short question of 01 marks each covering the whole syllabus. In addition eight more question will be set unit-wise comprising of two question from each of the four units. The candidates are required to attempt four more question selection at least one question from each unit. All questions will carry equal marks.

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 ofmicro-organisms. Classification of food based on pH, Food infection, food intoxication, definition of shelf life, perishable foods, semi perishable foods, shelf stable foods.

Unit II

Freezing and Refrigeration**:** Introduction to refrigeration, cool storage and freezing, definition, 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.

Unit III

Thermal Processing- Commercial heat preservation methods: Sterilization, commercial sterilization, Pasteurization, and blanching. 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.

Unit IV

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.
Evaporation – Definition, factors affecting evaporation, names of evaporators used in food industry.

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

BFST-202: FOOD PROCESSING TECHNOLOGY (Core Course)

(Credits - 2)

Time: 3hours **Max. marks: 30**

Note: The question paper will consist of nine questions in all. The first question will be compulsory and will consist of six short question of 01 marks each covering the whole syllabus. In addition eight more question will be set unit-wise comprising of two question from each of the four units. The candidates are required to attempt four more question selection at least one question from each unit. All questions will carry equal marks.

UNIT 1

Freezing: requirements of refrigerated storage - controlled low temperature, air circulation and humidity, changes in food during refrigerated storage, progressive freezing, changes during freezing – concentration effect and ice crystal damage, freezer burn. Refrigeration load, factors determining freezing rate-food composition and non compositional influences. Freezing methods -direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing**.**

UNIT ll

Normal drying curve , effect of food properties on dehydration , change 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**.** Ionizing radiation and sources, unit of radiations, direct and indirect radiation effects, safety and wholesomeness of irradiated food. Microwave heating and application**.**

UNIT lll

Packaging: Properties of packaging material, factors determining the packaging requirements of various foods and brief description of packaging of frozen products,dried products, k2fats and oils and thermally processed foods. Elementary concept of material handling in food industry, equipment and functioning of belt conveyor, screw conveyor, bucket elevator and pneumatic conveyor.

UNIT 7

Introduction, classification of Thermal Processes, Principles of thermal processing,Thermal resistance of microorganisms, Thermal Death Time, Lethality concept, characterization of heat penetration data, Thermal process Calculations. Principles and methods of: distillation, extraction, washing, filtration, sedimentation, sieving and centrifugation

Recommended Readings

1. Desrosier NW and Desrosier JN, The Technology of Food Preservation, CBS Publication, New Delhi, 1998
2. Paine FA and Paine HY, Handbook of Food Packaging, Thomson Press India Pvt Ltd, New Delhi-1992
3. Potter NH, Food Science, CBS Publication, New Delhi, 1998
4. Ramaswamy H and Marcott M, Food Processing Principles and Applications CRC Press, 2006
5. Rao PG, Fundamentals of Food Engineering, PHI Learning Pvt Ltd, New Delhi, 2010
6. Toledo Romeo T, Fundamentals of Food Process Engineering, Aspen Publishers, 199

BFST-203: CHEMISTRY OF FOOD (Core Course)

(Credits - 2)

Time: 3hours **Max. marks: 30**

Note: The question paper will consist of nine questions in all. The first question will be compulsory and will consist of six short question of 01 marks each covering the whole syllabus. In addition eight more question will be set unit-wise comprising of two question from each of the four units. The candidates are required to attempt four more question selection at least one question from each unit. All questions will carry equal marks.

UNIT 1

Introduction to Food Chemistry, Composition of food Definition of water in food, Structure of water and ice, Types of water, Role of water activity. Classification of lipids, Physical and chemical characteristics, Chemical deterioration of fats and oils (auto oxidation, rancidity, lipolysis, flavor reversion)

Unit ll

Protein classification and structure, types of food proteins (plant and animal proteins), Physicochemical and functional properties of proteins.Carbohydrates: Classification, Structure and Chemical reactions of carbohydrates.Vitamins: Types (Water soluble vitamins and Fat soluble vitamins). Minerals:Major and minor minerals, Toxic minerals in food

UNIT lll

Definition and basic tastes, Description of some common food flavors. Natural Food Pigments: Introduction and classification, Types of food pigments (chlorophyll, carotenoids, anthocyanins and flavonoids, beet pigments, caramel). New Food Product Development :Introduction, need, objectives and types.

UNIT lV

Browning Reactions in Food: Types, Enzymatic and Non enzymatic Browning and their control measure. Enzymes: Introduction, classification, General characteristics, Important enzymes in food processing. Physico-chemical and nutritional changes occurring during food Processing.

Recommended Readings:

1. DeMan, John M.1982. Principles of Food Chemistry ,3rd Ed., Springer
2. Desrosier, Norman W. and Desrosier.,James N.1977.The technology of food preservation, 4th Ed.,Westport, Conn. : AVI Pub. Co.
3. Fennema, Owen R1996. Food Chemistry, 3rd Ed., Marcell Dekker, New York,
4. Whitehurst and Law.2002. Enzymes in Food Technology, CRC Press, Canada
5. Wong, Dominic WS.1885. Food Enzymes, Chapman and Hall, New York
6. Potter,N.N.and Hotchkiss,J.H.1995. Food Science5th Ed., Chapman & Hall

BFST-204: TECHNOLOGY OF FOOD PRESERVATION (Credits-2)

PRACTICAL

1. Methods of Sampling.
2. Concept of shelf life of different foods
3. To study the concept of Asepsis and sterilization
4. Determination of pH of different foods using pH meter.
5. Study quality characteristics of foods preserved by drying/dehydration/ freezing.
6. To perform pasteurization of fluids using different methods.
7. To perform blanching of different plant foods

BFST-205: FOOD PROCESSING TECHNOLOGY (Credits-2)
PRACTICAL

1. Comparison of conventional and microwave processing of food
2. Preservation of food by the process of freezing
3. Drying of food using Tray dryer/other dryers
4. Preservation of food by canning(Fruit/Vegetable/meat)
5. Cut-out analysis of canned food
6. Osmotic dehydration
7. Minimal Processing
8. Testing of Packaging material

BFST-206: CHEMISTRY OF FOOD (Credits-2)
PRACTICAL

1. Preparation of primary and secondary solutions
2. Estimation of moisture content
3. Determination of gelatinization temperature range (GTR) of different starches and effect of additives on GTR
4. Determination of percent free fatty acids
5. Estimation of Peroxide Value
6. Estimation of Total Ash
7. Estimation of Protein Content