COURSE CURRICULUM AND SCHEME OF EXAMINATION

Under

Choice Based Credit System

For

B. Sc. (Food Science and Technology)

(w.e.f. Academic Session 2019-20 (1st and 2rd Semester))

University College

Chaudhary Devi Lal University

Sirsa - 125055

B. Sc. Food Science and Technology (1st Semester)									
Sr. No.	**Course ID**	**Subject**	**Type**	**Credits**	**Contact Hours per week**	**Internal Assesment (IA)***	**External Exam**	**Maximum Marks**	**Duration of Exam (hours)**
1	BFST-101	Principles of Food Science	CC	4	4	30	70	100	3
2	BFST-102	Technology of Cereals & Legumes	CC	4	4	30	70	100	3
3	BFST-103A	Technology of Food Processing	CEC (Any One)	4	4	30	70	100	3
	BFST-103B	Fundamentals of Food Technology		4	4	30	70	100	3
4	BFST-104	Lab-I Principles of Food Science	CC LAB	2	4	00	50	50	6: Two session of 3 Hrs. each
5	BFST-105	Lab-II Technology of Cereals & Legumes	CC LAB	2	4	00	50	50	6: Two session of 3 Hrs. each
6	BFST-106A	Lab-III Technology of Food Processing	CEC (Any One)	2	4	00	50	50	6: Two session of 3 Hrs. each
	BFST-106B	Lab-III Fundamentals of Food Technology		2	4	00	50	50	6: Two session of 3 Hrs. each
7	BFST-107	Environmental Studies	Ability Compulsory	2	2	20	30	50	3
Total				20	26	110	390	500	

*IA = 30 Marks (20-Midterm examination; 5-Assignment hand written; 5-Attendance)

B. Sc. Food Science and Technology (Open elective course)									
Sr. No.	**Course ID**	**Subject**	**Type**	**Credits**	**Contacts Hours per week**	**Internal Assesment (IA)***	**External Exam**	**Maximum Marks**	**Duration of Exam (hours)**
8	BFST-OE-101	Health & Nutrition	OEC	2	2	20	30	50	3

*IA = 30 Marks (20-Midterm examination; 5-Assignment hand written; 5-Attendance)

BFST-103B Fundamentals of Food Technology

Time: 3 Hrs. **Max. Marks: 100**
Credits: 4 **Theory: 70**
IA: 30

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

UNIT-1

Introduction: 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. Malting, gelatinization of starch, types of browning- Maillard & caramelization. Rice- structure and composition, parboiling of rice- advantages and disadvantages. Toxic constituents in pulses, processing of pulses soaking, germination, decortications, cooking and fermentation.

UNIT-ll

Fats and Oils: Classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids**.** Refining of oils, types - steam refining, alkali refining, bleaching, steam deodorization, hydrogenation**.** Rancidity – Types- hydrolytic and oxidative rancidity and its prevention.

UNIT-lll

Fruits and Vegetables: Classification of fruits and vegetables, general composition, enzymatic browning, namesand sources of pigments, dietary fiber.

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-lV

Compositional, Nutritional and Technological aspects of Animal foods

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 - Structure of hen’s egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality. 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

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.

BFST-101-Principles of Food Science

Time: 3 Hrs. **Max. Marks: 100**
Credits: 4 **Theory: 70**
IA: 30

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

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, duo-triotest, triangle test, hedonic scale.

UNIT-ll

Growth of microorganisms in foods: Food as a substrate for microorganism, factors affecting growth of microbes: pH, water activity, redox potential, nutrient contents. 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.

UNIT-lV

Water disposal and sanitation: Waste water, hardness of water, break point chlorination, physical and chemical of impurities, BOD, COD, waste water treatment, milk plant sanitation, CIP system, sanitizers used in food industry. 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,ethylenemethacrylic acid.

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 Marcott M, 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-103A Technology of Food Processing

Time: 3 Hrs. **Max. Marks: 100**
Credits: 4 **Theory: 70**
IA: 30

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

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 beltdryer , 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. Emulsions, sols, foams and gels: basic concept in foods.

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, radio-nucleides, 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-102 Technology of Cereals & Legumes

Time: 3 Hrs. **Max. Marks: 100**
Credits: 4 **Theory: 70**
IA: 30

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

UNIT-I

Wheat flour- types and usage, Improvers and Bleachers - their principle and action. Traditional and modern milling of paddy. Introduction and chemical composition of pulses. Decortication and polishing of pulses. Toxic constituents of pulses and their elimination.

UNIT-II

Quality criteria for wheat flour, physical dough testing instruments, major and minor ingredients used for bakery products, leavening agents. Preparation methods of bread, cookies and cakes.

UNIT-III

Parboiling of paddy-methods, advantages and disadvantages, various changes during parboiling Storage and uses of rice bran, extraction of rice bran oil and its use. Corn starch and corn sweeteners.

UNIT IV

Malting of barley, malt and its uses. Brewing of barley to prepare beer. Pulse protein concentrates-soybean curd and milk. Protein enriched cereal foods.

Recommended Books:

1. Technology of Cereals by Kent N. L. and Evers AD, 4th Ed., 1983, Woodhead Publishing Ltd., UK.
2. Principle of Cereal Science & Technology by Kent. NL, 1983, Pergamon Press, London, UK.
3. The Chemistry & Technology of Cereal as Food & Feed by Maiz S.A, 1996, CBS Publishers, New Delhi.
4. Food Science by Potter N, 5th Ed., 2006, CBS Publisher, New Delhi.

BFST-106B Lab-III Fundamentals of Food Technology

Time: 6 Hrs. **Max. Marks: 50**
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-104 Lab-I Principles of Food Science

Time: 6 Hrs. **Max. Marks: 50**
Credits: 2

1. Estimation of reducing sugar by Fehling's procedure.
2. Estimation of salt content in brine.
3. Estimation of salt content in butter.
4. Preparation of brix solution and checking by hand refractometer.
5. Application of collioidal chemistry to food preparation.
6. Demonstration of the Soxhlet method for determination of fat content.
7. Determination of acidity of water.
8. Determination of alkalinity/ hardness of water.
9. Demonstration of the Kjeldahl's method for estimation of protein content.

BFST-106A Lab-III Technology of Food Processing

Time: 6 Hrs. **Max. Marks: 50**
Credits: 2

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
8 Application of colloidal chemistry in food preparation

BFST-105 Lab-II Technology of Cereals & Legumes

Time: 6 Hrs. **Max. Marks: 50**
Credits: 2

1. Physico-chemical testing of wheat and rice.
2. Milling of rice and assessment of per cent of head, broken, immature kernels degree of polish etc.
3. Parboiling and evaluation of quality of parboiled rice.
4. Evaluation of cooking quality of rice.
5. Conditioning and milling of wheat.
6. Determination of quality characteristics of flours.
7. Rheological properties of dough using Farinograph/Extensograph/Mixograph.
8. Pasting properties of starches using Visco-amylograph/RVA.
9. Baking of bread, cookies and cakes and evaluation of their quality.
10. Processing of paste goods and evaluation of their quality.
11. Extrusion cooking and quality evaluation of extrudates.
12. Visit to wheat and rice, processing plants.

Open elective course offered by Department of Food Science and Technology, University College.

BFST-OE-101 Health & Nutrition

Time: 3 Hrs. **Max. Marks: 50**
Credits: 2 **Theory: 30**
IA*: 20

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

UNIT-I

Basic terminologies- nutrition, health, RDA (recommended dietary allowance), diet, hunger, satiety, BMR (basal metabolic rate), BMI (body mass index). Food and nutrients- basic definitions, function of food and nutrients, Water and its role in human health and nutrition.

UNIT-II

Obesity- it causes, body composition, weight for height measure, health implication of obesity. BMI and factor affecting BMI.
Carbohydrates- classification, dietary importance and function of carbohydrates.

UNIT-III

Fat- functions of fats, cholesterol, LDL & HDL and their health importance.
Protein - nature and function of proteins, biological value, net protein utilization, protein efficiency ratio, applications of amino acids.

UNIT-IV

Vitamins- sources and requirements of vitamins, functions of vitamin- A, D, E, K, C and vit. B complex.
Minerals- minerals in human health, macro and micro minerals, food sources and requirements of minerals.
Functional foods- concept and categories of functional foods and their importance.

Recommended Book:

Food Nutrition: M. Swami Nathan Vol. I, II.

BFST-107 ENVIRONMENTAL STUDIES

Time: 3 Hrs. **Max. Marks: 50**
Credits: 2 **Theory: 30**
IA*: 20

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

UNIT-I

The multidisciplinary nature of environmental studies: Definition, scope and importance, need for public awareness. Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, case studies. 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, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies. Land resources: Land as a 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 lifestyles.

UNIT-II

Ecosystem: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystems: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (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 option values, Biodiversity of global, National and local levels, India as mega-diversity nation, Hot-spots of biodiversity. Threats to Biodiversity: Habitat loss, poaching of wild life, man wildlife conflicts. Endangered and endemic. Conservation of Biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-III

Environmental Pollution: Definition-Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial

wastes. Role of an individual in prevention of pollution case studies Disaster management: floods, earthquake, cyclone and landslides.
Social Issues and the Environment: From unsustainable to sustainable development, Urban problems and related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation, Consumerism and waste products, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

UNIT-IV

Human population and the environment: Population growth, variation among nations, Population explosion-Family welfare programme, Environment and human health, Human rights, Value education, HIV/AIDS, Women and child welfare, Role of information technology in environment and human health, Case studies.
Field Work: Visit to a local area to document environmental assets river/forest/grassland/hill/mountain, Visit to a local polluted site – Urban / Rural / Industrial / Agricultural, Study of common plants, insects, birds, Study of simple ecosystems-pond, river, hill slopes, etc.

Suggested readings:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publ. Ltd. Bikaner.
2. Bharucha, Erach. The biodiversity of India. Mapin Publishing Pvt. Ltd. Ahmedabad 380013, India.
3. Clerk, RS., Down to Earth, Centre for Science and Environment, New Delhi.
4. Down to earth, centre for Science and Environment.
5. Hawkins R.E., Encyclopedia of Indian National History, BombayNatural History Society, Bombay.
6. Mhaskar A.K, Matter Hazardous, Techno-Science Publications.
7. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science.
8. Trivedi RK and PK Goel, Introduction to air pollution, Techno-Science Publications.
9. Trivedi RK. Handbook of Environmental Laws, Rules, Guidelines Comliances and Standards. Vol I and II, Envirol Media.
10. Wagner KD., 1998. Environmental Management. W.B. Saunders Co. Philadelphia, USA.

Open elective course offered by Department of Food Science and Technology, University College.

BFST-OE-101 Health & Nutrition

Time: 3 Hrs. **Max. Marks: 50**
Credits: 2 **Theory: 30**
IA*: 20

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

UNIT-I

Basic terminologies- nutrition, health, RDA (recommended dietary allowance), diet, hunger, satiety, BMR (basal metabolic rate), BMI (body mass index). Food and nutrients- basic definitions, function of food and nutrients, Water and its role in human health and nutrition.

UNIT-II

Obesity- it causes, body composition, weight for height measure, health implication of obesity. BMI and factor affecting BMI.
Carbohydrates- classification, dietary importance and function of carbohydrates.

UNIT-III

Fat- functions of fats, cholesterol, LDL & HDL and their health importance.
Protein - nature and function of proteins, biological value, net protein utilization, protein efficiency ratio, applications of amino acids.

UNIT-IV

Vitamins- sources and requirements of vitamins, functions of vitamin- A, D, E, K, C and vit. B complex.
Minerals- minerals in human health, macro and micro minerals, food sources and requirements of minerals.
Functional foods- concept and categories of functional foods and their importance.

Recommended Book:

Food Nutrition: M. Swami Nathan Vol. I, II.

B. Sc. Food Science and Technology (2nd Semester)									
Sr. No.	**Course ID**	**Subject**	**Type**	**Credits**	**Contact Hours per week**	**Internal Assesment (IA)***	**External Exam**	**Maximum Marks**	**Duration of Exam (hours)**
1	BFST-201	Technology of Food Preservation	CC	4	4	30	70	100	3
2	BFST-202	Chemistry of Food	CC	4	4	30	70	100	3
3	BFST-203A	Food processing Technology	CEC (Any One)	4	4	30	70	100	3
	BFST-203B	Basic Concepts of Oils & Fats		4	4	30	70	100	3
4	BFST-204	Lab-IV Technology of Food Preservation	CC LAB	2	4	00	50	50	6: Two session of 3 Hrs. each
5	BFST-205	Lab-V Chemistry of Food	CC LAB	2	4	00	50	50	6: Two session of 3 Hrs. each
6	BFST-206A	Lab-VI Food Processing Technology	CEC (Any One)	2	4	00	50	50	6: Two session of 3 Hrs. each
	BFST-206B	Lab-VI Basic Concepts of Oils & Fats		2	4	00	50	50	6: Two session of 3 Hrs. each
7	BFST-207	Proficiency in English	Ability Compulsory	2	2	20	30	50	3
Total				20	26	110	390	500	

BFST-201 Technology of Food Preservation

Time: 3 Hrs. **Max. Marks: 100**
Credits: 4 **Theory: 70**
IA: 30

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

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.
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 Chemistry of Food

Time: 3 Hrs. **Max. Marks: 100**
Credits: 4 **Theory: 70**
IA: 30

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

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 (Desrosire and Desrosier).

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-203A Food Processing Technology

Time: 3 Hrs. **Max. Marks: 100**
Credits: 4 **Theory: 70**
IA: 30

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

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 whole someness 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, fats 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-IV

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, 1999

BFST-203B Basic Concepts of Oils & Fats

Time: 3 Hrs. **Max. Marks: 100**
Credits: 4 **Theory: 70**
IA: 30

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

UNIT-I

Introduction to oils and fats and their nomenclature. Physical and chemical Properties of fats and oils. Nutritional importance of oils and fats.

UNIT-II

Source and physico-chemical properties of following oils:-

a) Animal – Butter oil, lard and tallow.
b) Plant – Groundnut, Sunflower, Soybean and Coconut oil.

Extraction of oils/fats.

UNIT-III

Problems during storage – rancidity, reversion.
Refining: degumming, choice of alkali, batch and continuous refining.
Bleaching: choice of adsorbent, batch and continuous bleaching.
Deodorization: process parameters: batch and continuous processing.

UNIT-IV

Hydrogenation of oils: mechanism, process parameters and batch processing.
Fractionation and winterization of oils.
Functions of oils and fats in foods processing: Frying, Cooking, Baking.
By products of oil processing: soap and lecithin.

Recommended Books:

1. Food Chemistry by Meyer LH, 2006, CBS Publisher, New Delhi
2. Food Science by Potter NN, 5th Ed, 2006, CBS Publisher, New Delhi
3. Food Oils & Fats: Technology, Utilization and Nutrition by Lawson H, 1995, CBS Publisher, New Delhi.

BFST-204 Lab-IV Technology of Food Preservation

Time: 6 Hrs. **Max. Marks: 50**
Credits: 2

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 Lab-V Chemistry of Food

Time: 6 Hrs. **Max. Marks: 50**
Credits: 2

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.

BFST-206A Lab-VI Food Processing Technology

Time: 6 Hrs. **Max. Marks: 50**
Credits: 2

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-206B Lab-VI Basic Concepts of Oils & Fats

Time: 6 Hrs. **Max. Marks: 50**
Credits: 2

1. To determine moisture content of oilseeds.
2. To determine FFA of oil.
3. Determination of Iodine Value, R.M. Value and Polenske Value.
4. To determine Saponification value, anisidine value and peroxide value of oil.
5. Determination of melting point of fats.
6. Detection of sesame oil in vanaspati by furfural test.
7. Detection of adulteration with mineral oil, Cotton seed oil or Ground nut oil.
8. Organoleptic evaluation of fats and oils.
9. Visit to vegetable oils industry.

BFST-207 PROFICIENCY IN ENGLISH

Time: 3 Hrs. **Max. Marks: 50**
Credits: 2 **Theory: 30**
IA*: 20

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

Objectives: The Objective of this course is to help the students in develop the communication skills with the use of English language.

UNIT-I

Grammar and Usage: A detailed study of Nouns, Pronouns, Adjectives, Articles, Verbs, Adverbs, prepositions, conjunctions and their correct use.

UNIT-II

Grammar and usage: Active and Passive Voice, Transformation of sentences from simple to compound/Complex sentences, narration/Reported speech.

UNIT-III

Vocabulary: Antonyms and Synonyms, words often confused, Important Latin and English Prefixes and Affixes, common legal terms (meaning and usage)

UNIT-IV

Composition skills: Formal letter writing, writing of business letters, official letters and CVs, paragraph writing and punctuation.

Suggested readings:

1. Wren and Martin: High School English Grammar and Composition
2. Tickoo and Subramaniam: A Functional Grammar and usage and composition
3. Murphy, Raymond: Essential English grammar, Cambridge University press
4. Maison, Margaret M. Examine Your English
5. Allen W.S. : Living English Structure
6. FlewingsHartin: Advanced English grammar, Cambridge University press
7. 50 ways to Improve Your Business English, without too much effort, Ken Taylor, Hyderabad: Orient Blackswan

Business Communication, Ed., Om P Juneja and Artimujumdar, Hyderabad: Orient Blackswan