

**NATIONAL EDUCATION POLICY-2020**  
**Common Minimum Syllabus for all**  
**Uttarakhand State Universities and Colleges**



**Syllabus Proposed**

**2023-24**

**Sri Dev Suman Uttarakhand University**  
**Badshahithol, Tehri (Garhwal)**

# पाठ्यक्रम निर्माण समिति, उत्तराखण्ड

## Curriculum Design Committee, Uttarakhand

क्र० सं०	नाम एवं पद	
1	प्रो० एन० के० जोशी कुलपति, श्रीदेव सुमन उत्तराखण्ड विश्वविद्यालय, टिहरी	अध्यक्ष
2	कुलपति, कुमाऊँ विश्वविद्यालय, नैनीताल	सदस्य
3	प्रो० जगत सिंह बिष्ट कुलपति, सोबन सिंह जीना विश्वविद्यालय, अल्मोड़ा	सदस्य
4	प्रो० सुरेखा डंगवाल कुलपति, दून विश्वविद्यालय, देहरादून	सदस्य
5	प्रो० ओ० पी० एस० नेगी कुलपति, उत्तराखण्ड मुक्त विश्वविद्यालय, हल्द्वानी	सदस्य
6	प्रो. एम० एस० एम० रावत सलाहकार—रूसा, रूसा निदेशालय, देहरादून	सदस्य
7	प्रो० के० डी० पुरोहित सलाहकार—रूसा, रूसा निदेशालय, देहरादून	सदस्य

**B.Sc. & M.Sc. Food Technology**  
**Syllabus as per NEP-2020**

**Food Technology**

**SEMESTER – I**

<b>Course</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>P</b>	<b>Credits</b>
Major	BFT-101	Introductory Microbiology	4		4
Major	BFT-102	Introductory Biochemistry	4		4
Major	BFT-103	Principles of Human Nutrition	4		4
Major	BFT-104	Fundamentals of Food Technology	4		4
Minor	BFT-105	Basic Computer Application in Food Industry	4		4
Practical	BFT-106	Practical-I		4	4
			<b>20</b>	<b>4</b>	<b>24</b>

**SEMESTER – II**

<b>Course</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>P</b>	<b>Credits</b>
Major	BFT-201	Analysis of Food Quality and Safety	4		4
Major	BFT-202	Food Process Equipment	4		4
Major	BFT-203	Food Laws and Legislation	4		4
Major	BFT-204	Energy Management in Food Industries	4		4
Practical	BFT-205	Practical-II		4	4
<b>Total</b>			<b>16</b>	<b>4</b>	<b>20</b>

### SEMESTER – III

Course	Course Code	Course Title	L	P	Credits
Major	BFT-301	Food Chemistry	4		4
Major	BFT-302	Baking & Confectionery Technology	4		4
Major	BFT-303	Technology of Dairy Products	4		4
Major	BFT-304	Technology of Cereals, Pulses and Oilseeds	4		4
Minor	BFT-305	Environmental Studies	4		4
Practical	BFT-306	Practical-III		4	4
		<b>Total</b>	<b>20</b>	<b>4</b>	<b>24</b>

### SEMESTER – IV

Course	Course Code	Course Title	L	P	Credits
Major	BFT-401	Principles of Food Preservation	4		4
Major	BFT-402	Processing of Spice and Plantation Crops	4		4
Major	BFT-403	Principles of Food and Dairy Microbiology	4		4
Major	BFT-404	Food Additives and Ingredients	4		4
Practical	BFT-405	Practical-IV		4	4
		<b>Total</b>	<b>16</b>	<b>4</b>	<b>20</b>

### SEMESTER – V

Course	Course Code	Course Title	L	P	Credits
Major	BFT-501	Food Packaging Technology	4		4
Major	BFT-502	Food Storage Engineering	4		4
Major	BFT-503	Fruits and Vegetable Processing	4		4
Major	BFT-504	Beverage Technology	4		4
Minor	BFT-505	Industrial Microbiology	4		4
Practical	BFT-506	Practical-V		4	4
<b>Total</b>			<b>20</b>	<b>4</b>	<b>24</b>
		Industrial Training – I (4 week)			<b>Qualifying</b>

### SEMESTER – VI

Course	Course Code	Course Title	L	P	Credits
Major	BFT-601	Functional & Minimally Processed Foods	4		4
Major	BFT-602	Quality Control in Food Industry	4		4
Major	BFT-603	Technology of Meat and Poultry Products	4		4
Major	BFT-604	Fish Processing Technology	4		4
Practical	BFT-605	Practical-VI		4	4
<b>Total</b>			<b>16</b>	<b>4</b>	<b>20</b>
		Industrial Training – II (4 week)			<b>Qualifying</b>

# FIRST SEMESTER

## **Introductory Microbiology (BFT-101)**

### **Major**

**Course Code: BFT-101**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Systematic study of major groups of micro-organism of importance in food industry; Principles and methods of food preservation; Food spoilage and its causes Factors affecting growth and survival of microorganisms in foods- Intrinsic factors: pH, water activity, nutrients etc. and Extrinsic factors: relative humidity, temperature and gaseous atmosphere. Food in relation to diseases

##### **Unit II**

Microbiology of different foods- cereals and cereal products, sugar and sugar products, fruits and vegetables, meat and meat products, fish, egg and poultry, canned foods, milk and milk products, microbiological grading of different food products

##### **Unit III**

Isolation and identification of micro-organisms involved in food spoilage; Enumeration and diagnosis of food poisoning organisms; microbial intoxication and infection- sources of contamination of food, pathogenic microorganisms and symptoms

##### **Unit IV**

Beneficial effects of microorganism- alcoholic drinks, dairy products, bread, vinegar, pickled foods, single cell protein

#### **BOOKS**

1. Frazier, W.C. 1988. Food Microbiology. Tata McGraw Hill.
2. Blakebrough N. Biochemical and Biological engineering Sciences.
3. Murry Moo-young. Biomass Conversion Technology.

## **Introductory Biochemistry (BFT-102)**

**Major**

**Course Code: BFT-102**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Introduction: Biochemistry & its scope; Carbohydrates: occurrence, classification & structures; physicochemical and metabolic functions; biological role of carbohydrates; metabolism of carbohydrates - glycolysis and respiration, production of ATP, oxidative and substrate phosphorylation

##### **Unit II**

Proteins: occurrence, classification & structures; physicochemical & metabolic functions; metabolism of proteins - breakdown of proteins, transamination, deamination, decarboxylation, nitrogen fixation; Enzymes: structure, classification, functions, significance

##### **Unit III**

Lipids: Occurrence, Classification & Structure; Physicochemical and metabolic functions; Biological role of lipids; classification and biosynthesis; Biological role of lipids; breakdown of triglycerides and phospholipids;  $\beta$ -oxidation of long chain fatty acids, ketosis, biosynthesis of fatty acids, triglycerides and phospholipids

##### **Unit IV**

Nucleic Acids: Classification, structure & biosynthesis of nucleic acid; Metabolism RNA and DNA metabolism. Vitamins; Sources and classification, Chemistry and Metabolic functions, deficiency syndromes, Minerals; Sources and classification, Chemistry and Metabolic functions, deficiency syndromes.

#### **Books**

1. N. Shakuntala Manay, Foods Facts and Principles
2. Biochemistry by S Rastogi Publisher, Tata Mcgraw Hill



## **Principles of Human Nutrition (BFT-103)**

**Major**

**Course Code: BFT-103**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Food, functions of food, nutrients and non-nutrients in foods, food groups; composition and importance of following foods: cereals, legumes and oilseeds, fruits and vegetables, milk and milk products, eggs, meat, fish and poultry, sugar and fats; balanced diet; meal planning and menu planning.

##### **Unit II**

Physiology of nutrition, digestive system, phases of digestion and absorption, metabolism as continuous life sustaining cellular process, delivering of nutrients through circulatory and lymphatic system, excretion of waste products via several routes.

##### **Unit III**

Macronutrients: Water- its metabolism, distribution of body water, structural and regulatory functions; Proteins and amino acids: classification, sources, functions and requirements, nitrogen balance, deficiency of protein; Carbohydrates: classification, sources, deficiency of carbohydrate, functions and requirements; Lipids and fatty acids: classification, sources, deficiency of lipid, functions and requirements.

##### **Unit IV**

Energy: food energy value; three basic types of functions of energy: basal metabolism, physical activity and thermogenesis and factors influencing them; energy imbalance.

#### **BOOKS**

1. Christian, J. L. and Gregor, J. L. 1985. Nutrition for Living. The Benjamin. Cummings Publishing House, Inc. 600p.
2. Groff, J. L. and Gropper, S. S. 2000. Advanced Nutrition and Metabolism. Wadsworth Thompson Learning, Australia. 584p.
3. Smolin, L. A. and Grosvenor, M. B. 1999. Nutrition: Science &

Applications. Saunders College Publishing, New York. 597p.

4. Stipanuk, Martha. 2006. Biochemical, Physiological and Molecular Aspects of Human Nutrition. 2<sup>nd</sup> edition. Elsevier. New York. 1232p.

## **Fundamentals of Food Technology (BFT-104)**

### **Major**

**Course Code: BFT-104**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Introduction to food technology and food processing; importance of food technology and food processing; objective of food processing; scope of food processing in India

##### **Unit II**

Food preservation- principles and methods; preservation by high temperature-food drying and dehydration, pasteurization, sterilization, blanching, canning; preservation by low temperature-freezing and methods of freezing; preservation by chemicals; preservation by irradiation-types and doses

##### **Unit III**

Food packaging- functions, characteristics, types of packaging, packaging materials- types and properties; fruits and vegetable processing- present scenario, canning, manufacturing of various products; processing of meat and meat products- composition, aging of meat, preservation methods, post mortem changes

##### **Unit IV**

Processing of milk and milk products- milk standards, physico-chemical properties of milk, methods; processing of marine products- composition, classification, canning, preservation methods, cooking of fish; important food industries in India; role of food technology in national economy.

#### **BOOKS**

1. Fellows, P. Food Processing Technology Principles and Practices. CRC Press, Boca Raton Boston New York Washington, DC.

## **Basic Computer Application in Food Industry (BFT-105)**

### **Minor Elective**

**Course Code: BFT-105**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Interaction with personal computer components: Processor, motherboard, storage devices, multimedia components and scanners. Server and nodes, Networking components: switches/hubs, routers, gateway, modem, VSAT Windows basics, working with MS windows XP/Vista, Desktop components. Control panel, finding files and folders, windows explorer, creating new folders, system and hardware profile. My documents and recycle bin, virus scanners Accessories: Entertainment, communications and Internet,

##### **Unit II**

MS office tools. Electronic documentation through MS word: Opening/creating file, saving file, document preparation, editing, formatting, page layout, spell and grammar check. Inserting header/footer, table, text box, picture and object. Hyperlinking. Security: Password.

##### **Unit III**

Creating presentation through Power Point: slide layout, design, template and background. Inserting movies and sound. Inserting picture. Slide show: transition and animation.

##### **Unit IV**

MS Excel basics, work book and work sheet, cell formatting. Data entry in work sheet. Chart wizard: title, axes, gridlines, legends, date label. Analyzing data: Correlation, Standard deviation, F-test, t-test. Developing skill for database preparation

##### **Unit V**

Using Outlook Express for e-mail uses: mail message, import/export, send/receive, updating address book. Setup e-mail accounts, setup multiple profiles Internet basics. Configuring TCP/IIP. Web addresses (URLs), using web browsers Netscape/Internet explorer for web surfing. Using search Engines for knowledge bases. Using file transfer protocol (FTP) and Telnet. Downloading files through FTP. FTP and Telnet through web browser Creating web

page (Using MS front page): basic formatting, inserting picture, linking pages, mailto. Practice on web page creation

## **BOOKS**

1. Introduction to computer science by ITL education solutions Ltd.
2. Programming with C written by K. R. Venugopal and Sudeep R. Prasad.
3. Computer Fundamentals by P. K. Singh. Introduction to Computers by Peter Norton.

# SECOND SEMESTER

## **Analysis of Food Quality & Safety (BFT-201)**

### **Major**

**Course Code: BFT-201**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Objective, function and importance of quality control; grades and standards; description of different quality control system (Codex, TQM, USFDA, BIS, HACCP, ISO 9000 series)

##### **Unit II**

Cleaning and sanitation; permitted food additives; food adulteration and food safety; chemical changes in foods during processing

##### **Unit III**

Physical and rheological properties of foods; changes in flavor components and natural food pigments during processing and storage; sensory evaluation methods for foods

##### **Unit IV**

Enzyme inhibitors: lathyrogens; goitrogens; cyanogenic glycosides; phenolics; oxalates; phytates; alkaloids; carcinogens; polycyclic aromatic hydrocarbons; allergens

#### **BOOKS**

1. Yeshajahu Pomeranz and Clifton E. M.. 2002. Food Analysis: Theory and Practice
2. R.D King. 1984. Developments in Food Analysis Techniques -2
3. Fox, J. 1993. Quality through design: the key to successful product development. (London: Mc Graw Hill)

## **Food Process Equipment (BFT-202)**

**Major**

**Course Code: BFT-202**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Design principles and parameters for food processing equipments- general design methodology; selection of materials- material characteristics, commonly used materials

##### **Unit II**

Design of handling equipment- belt conveyer, bucket conveyer, screw conveyer, pneumatic conveyer; design of milling equipments; dryers- drying mechanism, classification of dryers, factors affecting drying process; heat exchangers- classification; pressure vessels; storage system

##### **Unit III**

Optimization of design with respect of process efficiency- methods; design of fluid conveyance system; design of evaporator, vapor separator and condenser.

##### **Unit IV**

Equipment layout and ventilation in food processing plants, computer assisted design; storage system.

#### **BOOKS**

1. Phirke , P. S.2004. Processing and Conveying Equipment Design. Jain Brothers , New Delhi.
2. Joshi, M.V. Process Equipment Design, 2nd Edition, Mac Millan India Limited, Delhi, 1981
3. Perry, R.H. and Chitton, C.H. Chemical Engineering' Handbook, Mcgraw Hill Kogakusha Ltd. Tokyo, 5th Edition, 1973
4. Spivakovsky, A. and Dyachkov, V., conveyors and related equipment, translated by Don Danemanis, Peace Publishers, Moscow.
5. Backhurst, J.R. and Harker, J.H., Process Plant Design, Heinmann Educational Books, London, 1973



## **Food Laws & Legislation (BFT-203)**

**Major**

**Course Code: BFT-203**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Concept and significance of Food Legislation, Introduction to Indian Food Laws and Legislation, Need for enforcing the laws

##### **Unit II**

Prevention of Food Adulteration (PFA)- Introduction and objectives of the Act, Important definitions, Salient features of the Act; Bureau of Indian Standards (BIS)- Introduction and important definitions, Objectives and functions of the standard, Salient features of the standards, Activities of the standard

##### **Unit III**

Agmark- Introduction and definitions, Salient features of the Act, List of commodities under AGMARK; Agricultural and Processed Food Products Export Development Authority (APEDA)- Introduction and definitions, Salient features, Objectives and significance

##### **Unit IV**

FSSAI- Introduction and Objectives of FSSA, 2006, Features of FSSA, 2006, Composition of FSSAI, Functions of FSSAI, Introduction and definitions, Objectives, Salient features; International Standardization and Organization (ISO)- Introduction and definitions, Objectives, Salient features

##### **Unit V**

Codex Alimentarius Commission(CAC)- Introduction and purpose of CODEX, Definitions, Scope of CODEX Standards, Structure of CAC, CODEX general principles of food hygiene: HACCP; Food Laws and legislation in EU, Middle East, SAARC and ASEAN.

#### **BOOKS**

1. Dr. R.H. Jaju, A textbook of food laws and regulations, 2<sup>nd</sup> edition
2. Debasis Bagchi, Nutraceutical and functional food regulations in the united states and around the world

## **Energy Management in Food Industries (BFT-204)**

**Major**

**Course Code: BFT-204**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Energy: Basic concepts, energy sources, renewable and non renewable, energy auditing- definition, role and types, management of energy sources, efficiency and utilization, solar energy, drying of agricultural food products

##### **Unit II**

Solar water heating system- types, design and mechanism; solar distillation- definition, design and mechanism; solar cooker- design and mechanism; power generation through photovoltaic system- mechanism, components, advantages, limitations, fuel efficiency and performance of furnaces- testing methods and factors affecting furnace performance

##### **Unit III**

Biomass gasification- biogas production and application in food industry; heat energy recovery unit and its advantages; energy from vegetable and municipal solid waste

##### **Unit IV**

Wind energy- wind energy conversion system (WECS); classification and advantages of WECS; horizontal-axis wind turbine (HAWT)- principle, components, types; vertical-axis wind turbine (VAWT)- principle, components, types; wind energy for pumping and electric power generation

#### **BOOKS**

1. Handbook of water and energy management in food processing, Edited by J Klemes and R Smith and J-K Kim, Woodhead Publishing June 2008
2. Pimental D. 1980. *Handbook of Energy Utilization in Agriculture*. CRC Press.
3. Rai GD. 1998. *Non-conventional Sources of Energy*. Khanna Publ.
4. Twindal JW & Anthony D Wier 1986. *Renewable Energy Sources*. E & F. N. Spon Ltd.
5. Verma SR, Mittal JP & Surendra Singh. 1994. *Energy Management and Conservation in Agricultural Production and Food Processing*. USG Publ. & Distr., Ludhiana.

# THIRD SEMESTER

## **Food Chemistry (BFT-301)**

### **Major**

**Course Code: BFT-301**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Physico-chemical properties of foods- solution, osmotic pressure, acids, bases, pH, buffers, boiling point, freezing point, colloids, viscosity, surface tension, emulsions; water- moisture content of food, types of water, water activity, relative humidity; enzymes- definition, classification, enzyme inhibition, factors affecting enzyme activity, enzyme immobilization, application of enzymes in food industry; browning- enzymatic and non-enzymatic browning.

##### **Unit II**

Carbohydrates - structure, functions of starches, dextrin, cellulose, fibers, hemicellulose, pectins, gums, function of sugar in food browning, dietary fibre; Lipids- classification, physical characteristics, structure and functions, effect on cooking properties of lipids in foods, rancidity; Proteins- classification, physical characteristics, structures, functions, types of food proteins, effects on cooking properties of various animal & plant proteins, denaturation properties, proteins gels

##### **Unit III**

Pigments and color- role and effects of cooking on chlorophyll's, myoglobin, hemoglobin, anthocyanins, flavonoids, tannins, carotenoids, quinones, xanthonenes, pectins; use of synthetic colours in food.

##### **Unit IV**

Flavour- sensation of taste, smell, visual appearance, flavour texture of food; flavour compounds- terpenoids, flavonoids, sulphur compounds & others volatile flavour compounds and their role in sensory evaluations.

#### **BOOKS**

1. Lillian Hoagland Meyer, Food Chemistry

2. Chemical, Biological, and Functional Aspects of Food Lipids, Second Edition By Anna Kolakowska, Zdzislaw Z. E. Sikorski, Anna Kolakowsk

## **Baking & Confectionery Technology (BFT-302)**

**Major**

**Course Code: BFT-302**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Introduction to baking; role of bakery ingredients and their functions; quality evaluation and functional properties used in baking; characterization and grading of wheat flour

##### **Unit II**

Bread technology; quality control of bread making; baked products from soft wheat- cookies, biscuits, cake, pastry; macroni products

##### **Unit III**

Storage of bakery ingredients; specification of raw materials used in bakery; packaging of baked products

##### **Unit IV**

Confectionery- cocoa and chocolate manufacturing; stages of sugar cookery; confectionery products

#### **BOOKS**

1. Neelam Khetarpaul, Bakery Science and Cereal Technology.
2. N. Shakuntala Manay, Food Facts and Principles.

## **Technology of Dairy Products (BFT-303)**

### **Major**

**Course Code: BFT-303**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Fluid Milk: composition of milk and factors affecting it; physico-chemical characteristics of milk and milk constituents; production and collection, cooling and transportation of milk; packaging, storage and distribution of pasteurized milk- whole, standardized, toned, double toned and skim milk

##### **Unit II**

Test for milk quality and adulteration; UHT processed milk, flavored, sterilized milk; cleaning and sanitation of dairy equipment

##### **Unit III**

Cream: definition, classification and physico-chemical properties of cream

Butter: definition, classification, composition and methods of manufacture

##### **Unit IV**

Ice cream: definition, classification, composition, constituents and their role; preparation of mixes and freezing of ice cream, over run, judging, grading and defects of ice cream

##### **Unit V**

Evaporated and condensed milk: method of manufacture, packaging and storage; roller and spray drying of milk solids; instantization, flowability, dustiness, reconstituability, dispersability, wettability, sinkability; manufacture of casein, whey protein, and lactose from milk or use in formulated foods.

#### **BOOKS**

1. M.R. Adams and M.O. Moss.2007. Food Microbiology.
2. James M Jay. 2000. Modern Food Microbiology.
3. W.C. Frazier. 1968. Food Microbiology.

## Processing of Cereals, Pulses & Oil Seeds (BFT-304)

### Major

**Course Code: BFT-304**

### Course Outline

#### **THEORY**

##### **Unit I**

Structure and processing characteristic of cereal grains, legumes and oilseeds; post harvest- post processing practices for their safe storage; parboiling and milling of paddy; quality characteristics; curing and aging of rice; processed rice products

##### **Unit II**

Wheat and its quality characteristics of milling into flour and semolina, flour milling, turbo grinding and air classification, flour grades and their suitability for baking purpose, assessment of flour quality and characteristics, milling of durum wheat, macaroni products

##### **Unit III**

Ingredients, technology and quality parameters for baked products; bread, biscuits and cakes; breakfast cereals

##### **Unit IV**

Dry and wet milling of corn, starches and its conversion products, malting of barley, pearling of millets, milling of legume-pulses by traditional and improved processes

##### **Unit V**

Processing of oil seeds for direct use and consumption, oil and protein products, processing of extracted oil refining, hydrogenation, interestrification, processing of de-oiled cake into protein concentrates and isolates; textured protein, functional protein preparations, peanut butter, margarine and spread.

#### **Books**

1. Chakraverty, A., Mujumdar, A. S., Raghvan, G. S. V. and Ramaswamy, H. S. 2003. Handbook of Post Harvest Technology: cereals, fruits, vegetables, tea and spices. Marcen Dekker Inc., New York



## **Environmental Studies (BFT-305)**

### **Minor Elective**

**Course Code: BFT-305**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Definition, scope and importance; ecosystem- concept of an ecosystem, structure and function of an ecosystem, producer, consumer and decomposes, energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids; introduction, types, characteristic features, structures and function of the following ecosystems: forest ecosystem, grassland ecosystem, desert ecosystem and aquatic ecosystem;

##### **Unit II**

Social issues and the environment- from unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problem and concerns, case studies.

##### **Unit III**

Environmental ethics, climatic change, wasteland reclamation, consumerism and waste products; Environmental Protection Act; Air (Prevention and control of pollution) Act; issues involved in enforcement of environmental legislation; public awareness; natural resources: forest resources, water resources, mineral resources, food resources, energy resources, land resources; role of an individual in conservation of natural resources; equitable use of resources for sustainable life style.

##### **Unit IV**

Biodiversity and its conservation- introduction, definition, genetic, species and ecosystem diversity; bio geographical classification of India; value of diversity, consumptive use, productive use, social, ethical aesthete and option values; biodiversity at global, national and local levels; India as mega-diversity nation; hot-spot of biodiversity; threat to biodiversity- habitat loss, poaching of wild life, man-wild life conflicts; endangered and endemic species of India; conservation of biodiversity; in-situ conservation of biodiversity

##### **Unit V**

Environmental pollution- definition, causes, effect and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards; solid waste management- causes, effect and control measures of urban and industrial wastes; role of an individual in prevention of pollution; pollution case studies; disaster management- flood, earthquake, cyclone and landslides

## **BOOKS**

1. Weiner, R.F. and Matthews, R., Environmental Engineering 4<sup>th</sup> edition, Butterworth Heinemann, New York
2. Gupta, K.M., Environmental Studies, Umesh Publication, Delhi

# FOURTH SEMESTER

## **Principles of Food Preservation (BFT-401)**

### **Major**

**Course Code: BFT-401**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Food processing and preservation principles, method of preservation: pasteurization (definition, time-temperature combination and equipment) sterilization (definition, time-temperature combination and equipment), blanching (definition, time-temperature combination and equipment, adequacy in blanching), canning (definition, manufacturing process, defects of cans)

##### **Unit II**

Freezing and Refrigeration: Introduction to refrigeration, cool storage; Freezing: introduction, principle of freezing, freezing methods- air freezing, plate freezing, liquid immersion freezing and cryogenic freezing, changes during freezing, advantages and disadvantages of freezing and changes in food during freezing storage; introduction to thawing, changes during thawing and its effect on food.

##### **Unit III**

Food drying/ dehydration: definition, free and bound moisture, concept of water activity, factors affecting drying, moisture content (wet basis and dry basis), drying methods and equipment: sun/solar drying, cabinet dryer, tunnel dryer, spray dryer, freeze dryer, fluidized bed dryer; changes in food during drying.

##### **Unit IV**

Food irradiation- definition, units of radiation, mechanism of actions, uses of radiation processing in food industry, kinds of ionizing radiation used in food irradiation; food fermentation.

## **BOOKS**

1. Fellows, P. Food Processing Technology Principles and Practices. CRC Press, Boca Raton Boston New York Washington, DC.
2. Jongen, W. M. F. 2002. Fruit and Vegetable Processing: Improving quality, Woodhead Publishing Ltd, England
3. Somogayi, L. P., Ramaswamy, H. S. and Hui, Y. H. 1996. Processing Fruits: Science and Technology, Vol 1. Biology, Principles and Applications. CRC Press, Florida
4. Smith, D. S., Cash, J. N., Nip, Y. K. and Hui, Y. H. 1997. Processing vegetables: Science and Technology. Technomic Publishing Company Inc, USA.
5. Dauthy, M. E. 1995. Fruit and Vegetable Processing. Food and Agriculture Organization of the United Nations, Rome

## **Processing of Spice and Plantation Crops (BFT-402)**

### **Major**

**Course Code: BFT-402**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Production and processing scenario of spice, flavour & plantation crops and its scope.

##### **Unit II**

Major Spices: Post Harvest Technology, composition, processed products of following spices- ginger, chilli, turmeric, onion, garlic, pepper, cardamom, areca nut, cashew nut, coconut.

##### **Unit III**

Minor Spices, herbs and leafy vegetables: tea, rubber and palm oil, processing and utilization of all spice, annie seed, sweet basil, caraway seed, cassia, cinnamon, clove, coriander, cumin, dill seed, fennel seed, nutmeg, mint, marjoram, rose merry, saffron, sage, savory, thyme, ajwain, asafoetida, curry leaves

##### **Unit IV**

Tea- types, processing, quality control; coffee & cocoa: processing; vanilla and annatto processing.

##### **Unit V**

Flavour of major spices- spice oil and oleoresins; flavours of soft drinks; baking and confectionery; standards specification of spices; functional packaging of spices and spice products

#### **Books**

1. A. Chakravarty, A.S. Majumdar, G.S.V. Raghavan & H.S. Ramaswamy Hand Book of Post Harvest Technology, Cereals, Fruits, Vegetables, Tea & Spices
2. J.S. Pruthi Minor Spices and condiments crop management and Post Harvest Technology

## **Principles of Food & Dairy Microbiology (BFT-403)**

**Major**

**Course Code: BFT-403**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Introductory concepts; role of intrinsic and extrinsic parameter that affect microbial growth of foods

##### **Unit II**

Classification of new organism; control of microbial population; food Spoilage- causes, preventive measures

##### **Unit III**

Microbiology of food fermentation or respiration; mechanism of energy production- oxidation and substrate level phosphorylation

##### **Unit IV**

Fermenters- type, functions design and control, fermentation - mechanism, conditions and factors affecting fermentation

#### **BOOKS**

1. M.R. Adams and M.O. Moss.2007. Food Microbiology.
2. James M Jay. 2000. Modern Food Microbiology.
3. W.C. Frazier. 1968. Food Microbiology.

## **Food Additives and Ingredients (BFT-404)**

**Major**

**Course Code: BFT-404**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Scope, permitted food additives, general principles for the use of food additives; GRAS and international regulatory status (FAO, WHO, WTO) of food additives, functions, types, modes of action, consequences of use, risks and benefits of food additives

##### **Unit II**

Nutritional additives, preservatives, antimicrobial agents, antioxidants, emulsifiers, enzymes, flavoring agents and flavor enhancers; uses and functions of acid, base, buffer systems

##### **Unit III**

Chelating/sequestering agents; low calorie and non nutritive sweeteners, anti-caking agents, humectants, thickeners, firming agents; flour bleaching agents and bread improvers

##### **Unit IV**

Anti microbial agents; food colour, pigments, their importance and utilization; flavoring agents and related substances; clarifying agents, methods used for safety evaluation, food additives and hypersensitivity,

#### **BOOKS**

1. Alfred Larry Branen, 1. CRC Press, Cleveland.
2. Rao, D.G. 2005 Introduction to Biochemical Engineering, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
3. Bailey, J.E. and Ollis, D.V. 1994 Biochemical Engineering Fundamentals, McGraw-Hill book Company, New Delhi



# FIFTH SEMESTER

## **Food Packaging Technology (BFT-501)**

### **Major**

**Course Code: BFT-501**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Introduction and principles of food packaging, functions of food packaging, package requirements, properties of different packaging materials, types of packaging and packaging material

##### **Unit II**

Package materials- classification of packages, paper as package material, its manufacture, types, advantages of corrugated and paperboard, etc.; traditional packaging

##### **Unit III**

Glass as packaging material- manufacture, advantages and disadvantages; metal as packaging material- manufacture, advantages and disadvantages; plastic as packaging material- classification, properties and uses

##### **Unit IV**

Chemical and physical properties of packaging materials; interaction between package and food; selection and evaluation of packaging materials and systems; quality testing of packaging materials

##### **Unit V**

Aseptic packaging; active packaging; symbols used in package and labels; CIP systems and procedure; labeling requirements

#### **BOOKS**

1. Robertson G. L. 2005. Food Packaging: Principles and Practice. Marcel Dekker, New York, Basel, and Hong Kong. 2<sup>nd</sup> edition.
2. Food Packaging by Standey Sacharow and Roger c. Griffin
3. Blakistone B. A. 1999. Principle and Application of Modified Atmospheric packaging of Foods, ASPEN publication, Chapman & Hall, New York



## **Food Storage Engineering (BFT-502)**

### **Major**

**Course Code: BFT-502**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Introduction- post-harvest physiology of semi- perishables and perishables, climacteric and non-climacteric fruits, respiration, ripening, changes during ripening, ethylene bio-synthesis; Damages- direct damages, indirect damages, causes of spoilage in storage (moisture, temperature, humidity, respiration loss, heat of respiration, sprouting), destructive agents (rodents, birds, insects, etc.), sources of infestation and control

##### **Unit II**

Storage structures- Traditional storage structures, improved storage structures, modern storage structures, godown layout, staking pattern and rodent proof godown design; Farm silos: Horizontal silos, tower silos, pit silos, trench silos, size and capacity of silos

Storage of grains- Respiration of grains, moisture and temperature changes in stored grains; conditioning of environment inside storage through ventilation

##### **Unit III**

Aeration and stored grain management- Purposes of aeration, aeration system design, aeration system operation

Storage pests and control- Damage due to storage insects and pests, its control, seed coating, fumigations, etc.; Damage caused by rodents and its control

##### **Unit IV**

Storage of perishables- Cold storage, controlled and modified atmospheric storage, evaporative cooling storage, conditions for storage of perishable products, control of temperature and relative humidity inside storage

#### **Books**

1. P.H. Pandey. 2014. Principles and Practices of Agricultural Structures and Environmental Control. Kalyani Publishers, Ludhiana.
2. Myer Kutz. 2007. Handbook of Farm, Dairy, and Food Machinery. William Andrew, Inc., Norwich, NY, USA.

3. A.M. Michael and T.P. Ojha. 2004. Principal of Agricultural Engineering, Vol. I. Jain Brothers, New Delhi.
4. L.W. Newbaver and H.B. Walker. 2003. Farm Buildings Design. Prentice-Hall Inc., New Jersey, USA.

## **Fruits and Vegetable Processing (BFT-503)**

**Major**

**Course Code: BFT-503**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Unit operations- receiving, washing, grading, peeling, size reduction, blanching, sulphiting/sulphuring, syruping/brining, exhausting, processing and packaging

##### **Unit II**

Processing technology of the manufacture of new products from fruits and vegetables; beverages, preserve, sauces, pickles, soups, jam and jelly; preservation technologies

##### **Unit III**

Packaging requirements; spoilage of processed fruits, vegetables and their control; nutritional evaluation of processed foods;

##### **Unit IV**

Plant layout and hygiene; fruit and vegetable plant layout, design, personal hygiene, plant sanitation and waste disposal; quality control in fruits and vegetables processing industry

#### **BOOKS**

1. Satish Kumar Sharma, Post Harvest Management and Processing of Fruits and Vegetables
2. Jongen, Fruits and Vegetable Processing

## **Beverage Technology (BFT-504)**

**Major**

**Course Code: BFT-504**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Introduction, classification, beverage industry in India, traditional beverages; manufacturing technology of mineral water, packaged drinking water and carbonated drinks; water quality, treatment and fortification process

##### **Unit II**

Manufacturing, bottling, packaging, storage and transportation of fruit beverages-squash, cordial, nectar, crush; alcoholic beverages- wine, beer, distilled spirits

##### **Unit III**

Milk beverages; selection and economics of different beverages packaging materials; selection, operation and maintenance of beverage machines/equipment

##### **Unit IV**

Automation in beverage industries, quality control and safety in beverage industries, waste management in beverage industries, marketing of beverages

#### **BOOKS**

1. Barnard Devis, Andrew Lockwood, Food and Beverage Management, Elsevier Publications

## **Industrial Microbiology (BFT-505)**

### **Minor Elective**

**Course Code: BFT-504**

### **Course Outline**

#### **THEORY**

##### **Unit I**

History of industrial microbiology; Primary and secondary metabolites produced by the microorganisms; Screening of microorganisms; Preservation of microorganisms; Organizations involved in microbiological work Fermentation media, Industrial sterilization;

##### **Unit II**

Fermenter: Components of a fermenter, parts of fermenters, peripheral parts and accessories, additional accessories and peripherals. Types of fermenters Types of fermentations; Alcoholic beverages: types, production and quality;

##### **Unit III**

Microorganisms involved Probiotics; Industrially important secondary metabolites, their production and downstream processing, biopesticides, antibiotics, enzymes, exopolysaccharides, biopolymers, steroids, biomers; Importance, role in fermented foods, organisms involved, beneficial effects.

##### **Unit IV**

Bacteriocins and Nisin Production of microbial enzymes; Downstream processing Cell disruption methods: Mechanical disruption methods and non-mechanical disruption methods; Extraction; Purification; Concentration; Product recovery. Microbial cell products i.e. Mushroom, SCP, Baker's yeast, blue green algae and spirulina Measures to improve yield of fermented products.

#### **BOOKS**

1. Industrial Microbiology, Casida LE, Wiley, 1968.
2. Industrial Applications of Microbiology , Rajvaidya N., APH Publishing, 2006.
3. Brewing Science and Practice., Dennis EB, Woodhead Publishing Ltd. Cambridge, England. 2004.



4. Modern Industrial Microbiology and Biotechnology , Nduka Okafor, Science Publishers, Enfield, New Hampshire, USA. 2004.
5. Handbook of Indigenous Fermented Foods, Steinkraus KS, Marcel Dekker, 1996

# SIXTH SEMESTER

## **Functional & Minimally Processed Foods (BFT-601)**

### **Major**

**Course Code: BFT-601**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Foods and its functions, Composition of foods, general and specific for different foods of plant and animal origin. Restoration, enrichment, fortification and supplementation of foods, Effect of processing on components, properties and nutritional value of foods.

##### **Unit II**

Basic tastes, threshold tests for basic tastes, subjective and objective sensory evaluation, different types of tests. Instrumental tests for sensory attributes- colour, texture and odour.

##### **Unit III**

Starch, hydrocolloids and gums: occurrence, functions in food systems, properties, gelatinization, retrogradation and modified starches. Fermentation technology: different fermented products.

##### **Unit IV**

Browning in foods: Enzymatic and non enzymatic- mechanism, method of prevention, relationship to health. Sugar and jaggery: Principles of sugar crystallization, Fats and oils: Properties, manufacture, uses in food systems (as cooking media and shortening). Rancidity- types, mechanism and prevention. Uses of fat replacers in processed foods.

#### **BOOKS**

1. Desroiser N. W. & Desroiser J. N. 1977. The Technology of Food Preservation. AVI Publication.
2. Potty V. H. and Mulky M. J. 1993. Food Processing. Oxford & IBH Publishing House.
3. Srilakshmi B. 2001. Food Science. New Age International.

## **Quality Control in Food Industry (BFT-602)**

**Major**

**Course Code: BFT-602**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Hygiene regulation, control of airborne contamination, HACCP implementation, Microbiological control methods,

##### **Unit II**

Instrumental measurements of sensory attribute of foods; appearance, color, volume, density and specific gravity,

##### **Unit III**

Rheological and textural characteristics, Textural profile analysis, Relation between instrumental and sensory analysis of food quality attributes.

#### **BOOKS**

1. Yeshajahu Pomeranz and Clifton E. Meloan. 2002. Food Analysis : Theory and Practice
2. R.D King. 1984. Developments in Food Analysis Techniques -2
3. R.P Srivastav and Sanjeev Kumar. 2003. Fruits and vegetable preservation Principles & Practices
4. Official methods of analysis of AOAC

## **Technology of Meat & Poultry Products (BFT-603)**

**Major**

**Course Code: BFT-603**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Meat and poultry industries in India – kinds of meat animals and poultry birds – pre-slaughter care – methods of stunning – slaughtering – dressing of meat and poultry –post slaughter care and post-mortem inspection – classification and quality of meat

##### **Unit II**

Aging, curing smoking, canning and irradiation preservation of meat, Freezing and dehydration of meat and meat products, curing agents and additives – meat products – formed and sectioned meat – sausage products, hygiene and sanitary conditions in a meat processing plant;

##### **Unit III**

Formation, structure, chemical composition and nutritive value of eggs – Collection, handling, grading and quality parameters of eggs – methods of preservation of egg and their products – spoilage of egg and their products – hygiene and sanitation, regulations;

##### **Unit IV**

Recent development in meat and poultry processing, quality processing, quality and safety control measures, Planning, Layout design consideration in meat and poultry processing unit, export regulation of meat and poultry products.

#### **BOOKS**

1. J. Gracey, David Collins & Robert Huey : Meat Hygiene

## **Fish Processing Technology (BFT-604)**

### **Elective II**

**Course Code: BFT-604**

### **Course Outline**

#### **THEORY**

##### **Unit I**

Importance of fisheries, Classification of aquatic animals; Composition and Nutritional Quality of Fish; Transportation and storage of fish;

##### **Unit II**

Unit operations in fish processing, preservation by curing, chilling and freezing of fish, drying, fish products, canning of fish products, modified atmosphere packaging of fish and fish products;

##### **Unit III**

HACCP and quality assurance of sea food.

#### **BOOKS**

1. N.C. Flemming, S. Vallerga, N. Pinardi: Operational Oceanography, Elsevier Publications
2. Principles of Aseptic Processing and Packing by Philip E. Nelson
3. Food packing and Shelf Life: A Practical Guide by Gordon L. Robertson

