

Syllabus for Undergraduate Programme

Bachelor of Science in Food Technology



Manipur University,
CanchipurImphal-795003

Course Structure of B.Sc. Food Technology

Semester	Paper Code	Title of Paper	Semester Exam	Internal Assessment	Total Marks
First Semester	BFT-101	Food Chemistry	80	20	100
	BFT-102	Microorganisms and Microbiology of Food	80	20	100
	BFT-103	Principles of Food Processing Technology	80	20	100
	BFT-104	Computer Fundamental and Analytical Instrumentation	80	20	100
	BFP-105	Laboratory course- I: Food Chemistry & Food Microbiology	80	20	100
	BFP-106	Laboratory course- II: Analytical Instrumentation & Computer Fundamental	80	20	100
	Total First Semester				
Second Semester	BFT-201	Food Biochemistry	80	20	100
	BFT-202	Industrial Microbiology and Modern Food Microbiology	80	20	100
	BFT-203	Food Plant Equipment	80	20	100
	BFT-204	Food Additives and Legislation	80	20	100
	BFT-205	Laboratory course- III: Biochemistry	80	20	100
	BFT-206	Laboratory course- IV	80	20	100
	Total Second Semester				
Third Semester	BFT-301	Cereals and Legumes Processing Technology	80	20	100
	BFT-302	Oils and Fats Processing Technology	80	20	100
	BFT-303	Milk and Milk Products Technology	80	20	100
	BFT-304	Traditional and Fermented Foods	80	20	100
	BFT-305	Laboratory course- V: Cereals and Legumes Processing Technology	80	20	100
	BFT-306	Laboratory course- VI: a) Oils and Fats Processing Technology b) Milk and Milk Products Technology	80	20	100
	Total Third Semester				
Fourth Semester	BFT-401	Fruit and Vegetable Processing Technology	80	20	100
	BFT-402	Egg, Poultry, Meat and Fish Processing Technology	80	20	100
	BFT-403	Bakery Confectionary Technology	80	20	100
	BFT-404	Snacks Food and Beverages Technology	80	20	100
	BFT-405	Laboratory course- VII: a) Fruits and Vegetables Processing Technology b) Egg, Poultry, Meat and Fish Processing Technology	80	20	100
	BFT-406	Laboratory course- VIII: a) Bakery and Confectionary b) Snacks Food Technology and Beverages Technology	80	20	100
	Total Forth Semester				
Fifth Semester	BFT-501	Sensory Evaluation	80	20	100
	BFT-502	Food Plant Organization and Management	80	20	100
	BFT-503	Food Packaging	80	20	100
	BFT-504	Food Safety and Quality Control	80	20	100
	BFT-505	Laboratory course- IX: Sensory Evaluation	80	20	100
	BFT-506	Laboratory course- X: a) Food safety and Quality Control b) Food Packaging and Quality Control	80	20	100
	Total Fifth Semester				

Sixth Semester	BFT-601	Food Laws and Regulatory Issues	80	20	100
	BFT-602	Environmental Issues in Food Industry	80	20	100
	BFT-603	Food Biotechnology	80	20	100
	BFT-604	Entrepreneurships, Business Management and International Trade	80	20	100
	BFT-605	Laboratory course- XI	80	20	100
	BFT-606	Project Work			100
	Total Sixth Semester				

First Semester

BFT- 101: FOOD CHEMISTRY (Max.marks80+20=100)

UNIT-I

Food Chemistry-Definition and importance. Carbohydrates-chemical reactions, functional properties of sugars and polysaccharides in foods. Applications and preparations of sugars and polysaccharides. *20 marks*

UNIT-II

Protein and amino acids: structure, classifications, sources, denaturation and functional properties of proteins. Maillard browning.
Lipids: classification, and use of lipids in foods, physical and chemical properties, effects of processing on functional properties. *30marks*

UNIT-III

Vitamins and Minerals, Effect of processing on vitamins and minerals. Enzymatic browning in foods and industrial applications of enzymes. Water in food, water activity and shelf life of food. *20 marks*

UNIT-IV

Natural food flavours, extraction methods and characterization. Pigments in food and their industrial applications. *10 marks*

Books Recommended:

1. Aurand, L.W. and Woods, A.E. 1973. Food Chemistry. AVI, Westport.
2. Birch, G.G., Cameron, A.G. and Spencer, M. 1986. Food Science, 3rd Ed. Pergamon Press, New York.
3. Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. Marcel Dekker, New York.
4. Meyer, L.H. 1973. Food Chemistry. East-West Press Pvt. Ltd., New Delhi.
5. Potter, N.N. 1978. Food Science. 3rd Ed. AVI, Westport.

BFT- 102: MICROORGANISMS AND MICROBIOLOGY OF FOOD (Max. marks 80+20=100)

UNIT-I

Classification, morphology, physiology, growth, nutrition and reproduction, Pure culture techniques and maintenance of cultures, control of microorganisms by physical, chemical, antibiotic and other chemotherapeutic agents. *15 marks*

UNIT-II

Basic Concepts of genetics, mutation and immunology: Genetics: Conjugation, Transformation, Transduction (Generalized and Specialized), DNA, Double helix model, RNA, Types of RNA.

Mutation: Mutagen (Chemical and Physical) Types of mutation, Mutagenesis, concepts Immunology: Immunity, Antigen, Antibodies/Immunoglobulins, Antigen-Antibody reactions, cell mediated immunity, humoral Immunity, T & B lymphocytes, Organs involved in Immune response, phagocytosis. *25 marks*

UNIT-III

Incidence of microorganisms in foods, sources of contamination. Principles underlying spoilage and preservation of foods. Contamination, spoilage and preservation of cereal products, sugar products, fruit and vegetables, meat products, fish and sea foods, egg and poultry products, milk and milk products and other foods, microbiological standards of foods. *20 marks*

UNIT-IV

Food borne infections and intoxication, food plant sanitation inspection and control, personnel hygiene, HACCP in food industry. *10 marks*

UNIT-V

Beneficial microorganisms and their utilization in food fermentation. *10 marks*

Books Recommended:

1. "Microbiology" by M. J. Pelczar Jr., E.C.S. Chan and N.R. Krieg, Vth edn., TMH Book Company (1993).
2. "Modern Food Microbiology" by James M. Jay, IVth edn. CBS Publishers Delhi (1993).
3. "Food Microbiology" by W. C. Frazier & D.C. Westhoffs, IV thedn., TMH (1993).

BFT-103: PRINCIPLES OF FOOD PROCESSING TECHNOLOGY (Max. marks 80+20=100)

Unit-I

Basic considerations: Aims and objectives of preservation & processing of foods, Characteristics of tissues and non-tissues foods, Degree of perishability of unmodified foods, Causes of quality deterioration and spoilage of perishable foods, intermediate moisture foods, wastage of foods. *15 marks*

Unit-II

Preservation of foods by low temperatures:

(A) Chilling temperatures: Consideration relating to storage of foods at chilling temperatures, Applications and procedures, Controlled and Modified atmosphere storage of foods, Post storage handling of foods.

(B) Freezing temperatures: Freezing process, Slow and fast freezing of foods and its consequence, other occurrences associated with freezing of foods. Technological aspects of pre freezing, Actual freezing, frozen storage and thawing of foods. *20 marks*

Unit-III

Preservation of foods by high temperatures: Basic concepts in thermal destruction of microorganisms D,Z,F values. Heat resistance and thermophilic microorganisms. Cooking, Blanching, Pasteurization and Sterilization of foods. Assessing adequacy of thermal processing of foods, General process of canning of foods, Spoilage in canned foods. *15 marks*

Unit-IV

Preservation by water removal:

(a) Principles, Technological aspects and application of evaporative concentration process; Freeze concentration and membrane process for food concentrations.

(b) Principles, Technological aspects and application of drying and dehydration of foods, Cabinet, tunnel, belt, bin, drum, spray, vacuum, foam mat, fluidized-bed and freeze drying of foods. *20 marks*

Unit-V

Principles, Technological aspects and application of sugar and salt, Antimicrobial agents, Biological agents, non ionizing and ionizing radiations in preservation of foods. Hurdle technology. *10 marks*

Books Recommended:

1. O.R.Fennema Principles of Food science
2. V.Kyzlink Principle of Food Preservation
3. James M.Jay Modern Food Microbiology

BFT-104:COMPUTER FUNDAMENTAL & ANALYTICAL INSTRUMENTATION

COMPUTER FUNDAMENTAL(Max. marks 80+20=100)

UNIT-I:

Introduction to computer organization, computer generations, input-output units; computer memory system; system and application softwares; Fundamental concepts of operating systems, Booting process, file and directory concepts through DOS and Windows .10 marks

UNIT-II:

Introduction to Word Processors; Creating and editing files in MS-Word, designing and formatting Word-documents.10 marks

UNIT-III:

Introduction to spreadsheets, menus and capabilities of MS-Excel, using inbuilt mathematical and statistical functions in Excel, modification and editing of Excel work sheets, creating and editing graphs, introduction to macros -programming, data import and export.10 marks

UNIT-IV:

Introduction to DBMS, creating, retrieving and updating files, sorting, indexing and using multiple files, creating and printing reports under the Data base package.10 marks

ANALYTICAL INSTRUMENTATION

UNIT-I:

Colorimetry and Spectrophotometry: Principles, working and applications

- a) Colorimetry: The Beer-Lambert's law. Measurement of extinction coefficient.
- b) Spectrophotometry: Absorptiometric analysis- absorption spectra. Types of spectrophotometers. UV- Visible spectrophotometer. Flame Photometer.Atomic absorption spectrophotometer.15marks

UNIT-II:

Spectrophotometry with special reference to phosphorous and ascorbic acid. Atomic absorption study of Iron, Calcium and trace elements.5 marks

UNIT-III:

Fluorimetry: Principles, working and applications of Fluorimeter. Fluorometric determination of Thiamin and Riboflavin. 5 marks

UNIT-IV:

Principles and techniques of separation methods.

- a) Chromatography: Principles and applications of paper Chromatography, Thin layer Chromatography, Gas – liquid Chromatography, High Performance liquid Chromatography.

b) Electrophoresis: Principles, working and applications of Paper Electrophoresis Moving boundary Electrophoresis, Electrophoresis related to agar and β carotene. *15 marks*

BFT-105: Laboratory Course-I (Max. marks 80+20=100)

FOOD CHEMISTRY (LAB)

1. Determination of moisture content.
2. Detection of reducing sugar by Fehling and Benedict test.
3. Quantitative determination of reducing sugar by Lane and Eynon method.
4. Determination of fiber content of different food material and compare them.
5. Detection of amino acid, containing aromatic ring, by Xanthoproteic test.
6. Detection of amino acid, protein and peptides by Ninhydrin test.
7. Determination of protein quantity by Kjeldal method.
8. Determination of acid test.
9. Extraction of fat by Soxhlet apparatus.
10. Determination of Ash content.
11. Detection of presence of starch by Iodine test.
12. Determination of water activity of different food materials.
13. To distinguish between mono-saccharides and di-saccharides of Barfoed test.

FOOD MICROBIOLOGY (LAB)

1. Prepare NAM (Nutrient agar medium) and PDA (potato dextrose agar) medium and sterilization by autoclave.
2. Isolate the microorganisms (bacteria and fungi) from air by plate exposure method.
3. Isolate microorganism from soil by dilution method.
4. Prepare camera lucida diagram of given fungal slide.
5. Measure the size of sporangiophore and sporangia by using micrometry.
6. Differentiate bacteria by gram- staining technique
7. Isolate the fecal coliform from sewage water and determine the MPN (Most probable no.) of sample.
8. Test the quality of milk by using methylene blue reduction test (MBRT).
9. Enumerate the no. of spores per ml. of given spore suspension.
10. Count the no. of spores 1 ml of given spores by Breed method.

BFT-106: Laboratory Course-II (Max. marks 80+20=100)

Analytical instrumentation (LAB)

1. Demonstration of principle and working of analytical instrument
 - i) Hot air oven
 - ii) Balances
 - iii) Water Bath
 - iv) Colorimeter
 - v) Deionizer
 - vii) Flame Photometer

viii) Distillation Plant

2. Estimation of Lactose in milk by Fehling Method
3. Estimation of Vitamin C in tablets / Lemon / Tomato
4. Estimation of Cholesterol from food sample
5. Detection and Separation of amino-acids, steroids, terpenoid, alkaloid, flavanoid by Chromatographic techniques.
6. Isolation of Starch from Potatoes
7. Determination of pH of various food samples by using pH meter
8. Detection of adulteration of milk products

Computer Fundamental (LAB)

1. Operating system commands and exercises pertaining to the above mention theory packages.

Second Semester

BFT-201: FOOD BIOCHEMISTRY (Max. marks 80+20=100)

UNIT-I

Nutrition: Function's and energy of foods, basal energy metabolism, dietary allowances and standards for different age groups. Assessment of nutritional quality of foods, mineral and vitamins as functional constituents in human metabolism and deficiency diseases associated. Effect of processing on nutritive values of food. *20 marks*

UNIT-II

Enzyme: Classification, nomenclature, activation energy, Michaelis-Menten equation, Line-weaver Burk Plot, factors affecting enzymes action, mechanism of enzyme action. *15 marks*

UNIT-III

Proteins: Utilization of protein in body proteins products of protein metabolism. Disorders in metabolism, clinical proteins associated with excess and deficiency of proteins. *15 marks*

UNIT-IV

Carbohydrates: Utilization of carbohydrates in body metabolism of carbohydrates and disorder in metabolism. *15 marks*

UNIT-V

Lipids: Utilization of fats, biosynthesis of fatty acids and fats, clinical disorders associated with fats. *15 marks*

Books Recommended:

1. Food: Facts and Principles-N. Shakuntala Manay, N. Shadksharawamis.
2. Food Science-B. Srilakshmi
3. Fundamentals of Nutrition-L Loyd McDonald
4. Principles of Biochemistry-Lehninger

BFT-202: INDUSTRIAL MICROBIOLOGY & MODERN FOOD MICROBIOLOGY

(Max. marks 80+20=100)

Part A-INDUSTRIAL MICROBIOLOGY*UNIT-I:*

Introduction, scope and historical developments; Isolation screening and genetic improvement of industrially important organisms. *10 marks*

UNIT-II:

Fermenter design and various types of fermentation systems (submerged, surface and solid state); Fermentation substrates, Principles and production of amino acids, enzymes, nucleotides, organic acids, food colours, Baker's yeast, alcoholic beverages, vinegar. *15 marks.*

UNIT-III:

Principles and production of microbial proteins, lipids, polysaccharides and vitamins – properties and applications; mushroom cultivation. *10 marks*

UNIT-IV:

Utilization and disposal of industrial wastes through microorganisms; use of genetically modified microorganisms in food processing. *10 marks*

Part B- MODERN FOOD MICROBIOLOGY*UNIT-V:*

Microbial growth in food: intrinsic, extrinsic and implicit factors, Microbial interactions, Inorganic, organic and antibiotic additives. Effects of enzymes and other proteins, Combination systems, Effect of injury on growth or survival, Commercial available databases. *15 marks*

UNIT-VI:

Microbial behaviour against the newer methods of food processing, Adaption and resistance development, Microbes as test organisms, as sensors and as tools for future applications in energy production and food and non-food industrial products. *10 marks*

UNIT -VII:

Modern methods of cell culture: synchronous and co- cell culture, continuous cell culture in liquid and solid media, Cell immobilization and applications, Pre and probiotics cultures. *10 marks*

Books Recommended:

1. Perman D. 1977-79. *Annual Reports of Fermentation Processes*. Vols. I-III.
2. Prescott SC & Dunn CG. 1959. *Industrial Microbiology*. McGraw Hill.
3. Waits MJ. 2001. *Industrial Microbiology*. Blackwell Science.
4. Ward OP. 1989. *Fermentation Biotechnology*. Prentice Hall.
5. Adams M. 2006. *Emerging Food-borne Pathogens*. Woodhead Publ.
6. Adams MR & Moss MO. 2000. *Food Microbiology*. Panima.
7. Easter MC. 2003. *Rapid Microbiological Methods in the Pharmaceutical Industry*.
8. Harrigan W. 2003. *Laboratory Methods in Food Microbiology*. University of Reading, UK, Elsevier.
9. James MJ, Loessner MJ & David A. 2005. *Modern Food Microbiology*. 7th Ed. Golden Food Science Text Series.
10. Pederson CS. 1979. *Microbiology of Food Fermentations*. AVI Publ.
11. Roberts R. 2002. *Practical Food Microbiology*. Blackwell Publ.
12. Rossmore HW. 1995. *Handbook of Biocide and Preservative*. Blackie.
13. Wood JBB. 1999. *Microbiology of Fermented Foods*. Vols. I, II. Blackwell Academic. Yousef AE. 2002. *Food Microbiology: A Laboratory Manual*. AVI.

BFT-203: FOOD PLANT EQUIPMENT (Max. marks 80+20=100)

UNIT -I

Milling Equipments: Types of equipment used for milling rice and wheat, pearling and flaking equipment; dhal mills. *15 marks*

UNIT -II

Washing, Filtration & Centrifugation equipment. Different Fruits and Vegetable washing systems; Conveyor belts - types, material of construction, product specific conveyors. Screw, bucket, belt, oscillating and vibratory conveyors. Filtration of liquid foods (dairy, fruit & vegetables); centrifugation systems: Solid bowl and disc bowl centrifuges; cyclone separator and self-cleaning centrifuge. *20 marks*

UNIT -III

Heat Processing & Cooling Equipments: Heat exchangers – Plate, shell and tube etc. Autoclaves - types, operation; Different Dryers and freezers – Tray, tunnel, Fluidized. Spray dryer, Blast and IQF, Freezers, short tube and pan evaporators; Roasting & confectionery equipments. *15 marks*

UNIT -IV

Mixing, Blending, extrusion and Filling Equipments: Agitation and mixing of liquid foods, powders and pastes; Mixers - ribbon blenders, augur, nauta, cone. Cold and hot extruders, single screw, twin screw, extrusion cooking. Liquid and powder filling machines - like aseptic system, form and fill (volumetric and gravimetric), bottling machines. Form Fill Seal (FFS) and multilayer aseptic packaging machines. *20 marks*

UNIT -V

GMP and Hygienic Design Aspects: Basic principles: as applied to various equipment-sanitary pipes and fittings, pumps, machines, tanks. Clean-in-Place (CIP) system; corrosion process and their control.

10 marks

Books Recommended:

1. Lopez – Gomez, A. and Barbosa – Canovas, G.V. “Food Plant Design”, Taylor & Francis, 2005.
2. Smith, P.G. “Introduction to Food Process Engineering”, Springer, 2005.
3. Rao, M.A. S.S.H. Rizvi and A.K. Datta, “Engineering Properties of Food”, 3rd Edition, Taylor & Francis, 2005.

BFT-204: FOOD ADDITIVES AND LEGISLATION (Max. marks 80+20=100)

UNIT-I:

Food additives- definitions, classification and functions, Preservatives, antioxidants, colours and flavours (synthetic and natural), emulsifiers, sequestrants, humectants, hydrocolloids, sweeteners, acidulants, buffering salts, anticaking agents, etc. - chemistry, food uses and functions in formulations; indirect food additives; toxicological evaluation of food additives. *30 marks*

UNIT-II:

Flavour technology: Types of flavours, flavours generated during processing – reaction flavours, flavour composites, stability of flavours during food processing, analysis of flavours, extraction techniques of flavours, flavour emulsions; essential oils and oleoresins; authentication of flavours etc. *20 marks*

UNIT-III

Food standards and Specifications: Compulsory and voluntary trade and Company standards. Consumer Protection Act (1986) and relevant Food Legislation (Act, orders, standards): PFA(1954), FPO(1955), SWMA, MPO(1977), VCO(1978), AGMARK, BIS, US, Canadian, EU, ISO and Codex Food Standards, Export Quality Control and Inspection act (1963), Environment Protection Act (1986), WTO & GATT. *30 marks*

Books Recommended:

1. Branen AL, Davidson PM & Salminen S. 2001. *Food Additives*. 2nd Ed. Marcel Dekker.
2. Gerorge AB. 1996. *Encyclopedia of Food and Color Additives*. Vol. III. CRC Press.
3. Gerorge AB. 2004. *Fenaroli's Handbook of Flavor Ingredients*. 5th Ed. CRC Press.
4. Madhavi DL, Deshpande SS & Salunkhe DK. 1996. *Food Antioxidants: Technological, Toxicological and Health Perspective*. Marcel Dekker.
5. Morton ID & Macleod AJ .1990. *Food Flavours*. Part A, BC. Elsevier.
7. Nakai S & Modler HW. 2000. *Food Proteins. Processing Applications*. Wiley VCH.
8. Stephen AM. (Ed.). 2006. *Food Polysaccharides and their Applications*. Marcel Dekker
9. Food Chemistry O.R.Fennema
10. Food Chemistry Belitz, Grosch
11. Various acts, orders, standards & specification

BFT-205: Laboratory Course-III (Max. marks 80+20=100)

Biochemistry

1. Estimation of ascorbic acid in lemon juice.
2. Preparation of sample for mineral estimation by ashing method.
3. Qualitative estimation of a Calcium in given sample.
4. Estimation of cholesterol in a given sample by zaks method.
5. Determine the iso-electric point of peas.
6. Study the effect of enzyme concentration on enzyme kinetics.
7. Determination of reducing sugar from unknown solution by using 3, 5- di-nitro salicylic Acid (DNS).
8. Determine the Protein content of a given sample by Lowry's method.
9. Detect the presence of protein in urine by sulfosalicylic acid test.
10. Check the presence of Glucose (Carbohydrate) in urine sample by conducting benedict test.
11. Detect the presence of protein by heat coagulation test.
12. Estimation of preservatives, sweeteners, fibres, colours, antioxidants, flavour enhancers;
13. Isolation, modification, and functional properties of native and modified proteins, starches and lipids;
14. extraction of essential oil and oleoresins;
15. applications of additives and ingredients in foods

BFT-206: Laboratory Course-IV (Max. marks 80+20=100)

1. Isolation of industrially important microorganism from natural environments and foods.
2. Study and operation of laboratory fermenter.
3. Laboratory scale production of microbial metabolites such as organic acids, lipids, exopolysaccharids etc.
4. BOD and COD measurements in industrial effluents.

5. Visit to related industries
6. Evaluation of microorganism in raw and processed products by using various techniques.
7. Study of factors influencing growth of microorganism.
8. Determination of effects of various preservatives including antibiotics on the suppression of microbial growth.
9. Development of cell culture using various techniques and development of probiotics in lab

Third Semester

BFT-301: CEREALS AND LEGUMES PROCESSING TECHNOLOGY

(Max. marks 80+20=100)

UNIT-I

Importance of cereals and legumes, Post-harvest quality and quantity losses. Recommended pre-processing practices for handling of cereals and pulses for their safe storage, including control of infestation, National and International quality and grading standards. *15 marks*

UNIT-II

Structure, types, composition, quality characteristics and physicochemical properties of wheat. Cleaning, tempering and conditioning, and milling processes for different wheat's. Turbo-grinding & Air Classification. Blending of flours. Milling equipments and milling products (Dalia, Atta, Semolina and flour). Flour grades and their suitability for baked goods. Quality characteristics and rheological properties of wheat milling products and its assessment. By-product utilization. *20 marks*

UNIT-III

Structure, types, composition, quality characteristics and physicochemical properties of rice. Milling and parboiling of paddy, Curing and ageing of paddy and rice. Criteria in and assessment of milling, cooking, nutritional and storage qualities of raw & parboiled rice. Processed rice products (flaked, expanded and puffed rice). By-product (husk and rice bran) utilization. *15 marks*

UNIT-IV

Structure, types and composition of corn. Dry and wet milling of corn. Starch and its conversion products. Processed corn products (popped corn, corn flakes etc.) Structure and composition of barley, bajra, jowar and other cereal grains and millets. Malting of barley. Pearlring of millets. Parched and snack products. *15 marks*

UNIT-V

Structure, composition and properties of legumes. Cleaning, grading, pretreatments for difficult-to-mill (urad, arhar, moong, moth) and easy-to-mill (chana, masoor and pea)

legumes, milling practices and actual milling of different legumes. Sweet and savory products from legumes in India. *15 marks*

Books Recommended

1. Cereals Technology by Samuel A.Matz. CBS Publications.
2. Technology of Cereals by N.L.Kent.
3. Food Facts and Principles by Mannay;New age International (P) Ltd.
4. Food Science by Norman N.Potter;CBS Publications.
5. Chemistry and Technology of Food and Food Products by M.B. Jacobs
6. Manuals on Rice and its Processing by CFDRI.
7. Cereals & Cereals Products-Chemistry & Technology by DAV Dendy&B.J.Dobraszezck, Aspen Publication.
8. Development in Milling & Baking Technology by AFST (I), CFDRI, Mysore, India.
9. Food Industries of CEEDC, IIT, Madras.
10. Articles on Pulse Milling in India Food Industry &JFST,both Publications of AFST (I).

BFT-302: OILS AND FATS PROCESSING TECHNOLOGY (Max. marks 80+20=100)

UNIT-I

Sources; chemical composition; physical and chemical characteristics; functional and nutritional importance of dietary oils and fats. Post-harvest handling storage and processing of oilseeds for direct use and consumption. *15 marks*

UNIT-II

Extraction of oil by mechanical expelling and solvent extraction and obtaining deoiled cakes suitable for edible purposes. Processing of other plant sources of edible oils and fats like coconut, cottonseed, rice bran, maize germ, etc. *15 marks*

UNIT-III

Refining: Clarification, degumming, neutralization (alkali refining), bleaching, deodorization techniques / processes. Blending of oils. *15 marks*

UNIT-IV

Processing of refined oils: Hydrogenation, fractionation, winterization, inter-esterification etc. for obtaining tailor-made fats and oils. *15 marks*

UNIT-V

Production of butter oil, lard, tallow, Margarine, Cocoa butter equivalents, shortenings, low fat spreads, peanut butter etc. Speciality fats and designer lipids for nutrition and dietetics, especially by biotechnology. *20 marks*

Books Recommended

1. Bailey's Industrial Oil & Fat Products, 4th Ed. John Wiley & Sons.
2. The Industrial Chemistry of Fats & Waxes 3rd. by Balliere, Tindall & Cox.
3. Handling & Storage of Oil seeds, Oils, Fats & Meal by Paterson, HBW.
4. Modern Technology in the Oils & Fats industry by S.C. Singhal, OTA (I).

BFT-303: MILK AND MILK PRODUCTS TECHNOLOGY (Max. marks 80+20=100)

UNIT-I

Introduction: Status of Dairy Industry in India. Cooperative Dairying. Operation Floods. Chemical composition, microbiological quality, and nutritional importance of milk and milk product in PFA Act, Rules, 1955 as amended to date. *20 marks*

UNIT-II

Fluid Milks: Physicochemical characteristics and factors affecting them. Production, collection, testing quality, cooling, storage, and transportation of liquid milks. Receiving and quality assessing of liquid milk in dairy industry for detection of adulteration, decision for acceptance/rejection, and determination of price of the milk. *15 marks*

UNIT-III

Standardization and/or processing (pasteurization, sterilization and UHT processing), storage, packaging and distribution of liquid milks: whole, standardized, toned, double-toned, and skim milk. Recombined, reconstituted, and flavoured milks. Cleaning and sensitization of dairy equipment and plant as a whole. *15 marks*

UNIT-IV

Milk Products: Definition, composition, methods of preparation/production, quality and/or grading parameters, packaging, storage characteristics, uses and shelf-life of cream, butter and ghee; evaporated and condensed milks, skimmed, whole and instant milk powders. *15 marks*

UNIT-V

Ice-Creams, fermented milks (Curd, yogurt etc.) and milk-products (cheeses, butter milk, lassi etc.); other milk products (khoa, casein, whey proteins, lactose etc.); milk and milk product-based sweetmeats (burfi, rasogolla, milk-cake, kalakand, ruberii etc.). *15 marks*

Books Recommended:

1. Outlines of Dairy Technology by Sukumar De, Oxford University Press.
2. Principles of Dairy Processing by James N. Warner, Wiley Eastern Ltd.
3. Milk and Milk Products by Eckles, Combs; and Macy, Tata McGraw Hill.
4. Technology of Indian Milk Products by Aneja et al. A Dairy India Publication.
5. PFA Act 1954 & Rules 1955 as amended to date.

BFT-304: TRADITIONAL AND FERMENTED FOODS (Max. marks 80+20=100)

UNIT-I

Fermentation process. Fermentation products of importance. Isolation and maintenance of pure culture. Preparation of substrates/media, inoculums. *15 marks*

UNIT-II

Features of different types of Fermenter. Process variables and its control, recovery of fermentation products and conversion into marketable /storage forms.*15 marks*

UNIT-III

Production of baker's yeast, food yeast, SCP, beer, wine, cider, vinegar, organic acids (eg. Citric and lactic acids) and enzymes (eg. Amylases, protease, lipases, pectinases, celluloses, hemicellulose etc.). IMFL/ distilled spirits (eg. Rum, gin, whisky). *20 marks*

UNIT-IV

Oriented Fermented Products, soy sauce, pickles, fermented milks & cheeses. Microbial fats.*15 marks*

UNIT-V

Indian traditional sweet, savory and snack food products: Sweetmeats, Namkins, Papads, wari, Idli, Dosa, Dhokla etc.*15marks*

Books Recommended:

1. Industrial Microbiology - Prescott & Dunn
2. Industrial Microbiology - L.E. Casida
3. Principle of Fermentation Technology - Whittaker and Stanbury
4. Handbook of Indigenous Fermented Foods - K.H. Steinkrus
5. Food Microbiology - Adams and Moss
6. Mushroom Cultivation - J. N. Kapoor, ICAR

BFT-305: Laboratory Course-V (Max. marks 80+20=100)

CEREALS & LEGUMES PROCESSING TECHNOLOGY (LAB)

1. Determination of physical properties of different cereal grains
2. Determination of sedimentation value of the Maida.
3. Determination of alcoholic acidity of the sample of the wheat flour / Maida.
4. To determine the water absorption capacity of the wheat flour / Maida.
5. Determination of adulterant (NaHCO₃) in wheat flour/ Maida.
6. Estimation of Protein content of different Cereals and Legumes.
7. Assessment of market samples of wheat, rice, and pulses for conforming to some PFA specifications.

8. Storage studies of cereal and legume grains having different moisture levels.
9. Determination of Gluten content in wheat flour samples.
10. Determination Polenske value of wheat flours.
11. Visit to a working modern roller flour mill and FCI godowns.
12. Visit to working rice mill, collection of samples at various steps of milling and analysis for efficiency of cleaning, shelling, paddy separation, and degree of polish.
13. Preparation of expanded & puffed rice from raw and parboiled materials and assessment of quality of products including expansion in volume.
14. Traditional and improved pretreatments and its effect on dehusking of some legumes.
15. Pearling of some millets.

BFT-306: Laboratory Course-VI (Max. marks 80+20=100)

OILS AND FATS PROCESSING TECHNOLOGY (LAB)

1. Effect of certain preparative treatments (flaking, heat treatment, dehusking, moisture conditioning) on rates of oil extraction from certain oilseeds.)
2. Determination of efficiency of oil extraction techniques (mechanical expelling and solvent extraction).
3. Determination of some quality parameters in oils extracted by different techniques (eg. Colour and FFA contents).
4. Demonstration and/or evaluation of techniques for clarification degumming, dewaxing, alkalirefining, bleaching, deodorization of oils.
5. Visit to an oil extraction, refining and vanaspati unit.
6. Determination of certain analytical constants of edible fats and oils for conformation to BIS standards/detection of adulteration.
7. Determination of stability of fats & oils.
8. Determination of deep-fat frying performance of some refined oils.
9. Identity tests for various oils.

MILK AND MILK PRODUCTS TECHNOLOGY (LAB)

1. Determination of quality of raw milk (eq. COB, MBRT, Resazurin Test, Lactometer reading, pH & acidity, fat contents, SNF content, specific gravity etc).
2. Determination of adequacy of pasteurization (Phosphatase test).
3. Determination of microbiological quality (TPC/SPC) of pasteurized and sterilized/ flavoured milk samples & some milk products like ice cream.
4. Preparation of certain dairy products (eg. Khoya, paneer, flavoured milk, yogurt, cream, ice cream, srikhand etc.) and assessment of yield and quality of the prepared products
5. Determination of solubility, dispersibility of dried milk powders (spray & drum-dried samples).
6. Determination of certain key parameters in dairy products (eg overrun in ice cream, salt content in butter, moisture content in ghee etc.)
7. Visit to a dairy/ice cream factory.

Fourth Semester

BFT-401: FRUIT AND VEGETABLE PROCESSING TECHNOLOGY (Max. marks 80+20=100)

UNIT-I

Current status of production and processing of fruits and vegetables. Structural, compositional and nutritional aspects. Post-harvest physiology, handling, losses and conservation of fruits and vegetables. *15 marks*

UNIT-II

Techniques of extension of shelf life of unmodified produce: use of adjuncts, novel packaging, controlled and modified atmosphere storages. Processing for conversion into products and preservation by use of chemical preservatives, chilling & freezing, sterilization & canning, concentration & dehydration and other special techniques. *20 marks*

UNIT-III

Technology of Products: juices & pulps, concentrates & powders, squashes & cordials, nectars, fruit drinks & beverages carbonated and its quality control. Fermented products (Cider, wine, brandy). *15 marks*

UNIT-IV

Jam, Jelly & Marmalades; candied fruits, dried fruits and fruit products (eg. Aampapads, bars); soup mixes; sauces & ketchups; puree & pastes; chutneys & pickles. *15 marks*

UNIT-V

Spices & condiments, spice oils oleoresins, Processing of cashew nuts, coffee & cocoa beans, and tealeaves, Specialty fruit and vegetable products. *15 marks*

Books Recommended

1. Food science by B.Srilakshami;New Age International.
2. Fundamentals of Foods and Nutrition by R. Madambi& M.V. Rajgopal.
3. Foods :Facts and Principles by N Shakuntalamanay;New Age International (P) Ltd.
4. Preservation of Fruits and Vegetable by Girdharilal and Sidappa; CBS Publications
5. Food Science and Processing Technology, Vol., 2 by Mridula and Sreelata
6. Food Preservation by Sandeep Sareen
7. Fruit and Vegetable Preservation by Shrivastava and Kunal.
8. Post-Harvest Physiology & Handling of Fruits & Vegetables by Wills, Lee, Graham, McGlasson& Hall (AVI)
9. Literature from Spice Board of India,etc.

BFT-402: EGG, POULTRY, MEAT & FISH PROCESSING TECHNOLOGY
(Max. marks 80+20=100)

UNIT-I

Current levels of production, consumption and export of category products. Nutritional, safety/health and hygienic considerations. *15 marks*

UNIT-II

Egg: Structure, composition, nutritional and functional characteristics of eggs. Grading, spoilage, storage and transportation of whole eggs. Processing of eggs for liquid products (white, yolk and whole egg) and solid products (albumen, whole egg powder) for preservation through freezing & drying. *20 marks*

UNIT-III

Poultry: Pre-slaughter care and consideration; Operations in preparation of dressed poultry, its storage and marketing; Quality and safety considerations; utilization of by-products. Poultry cuts. *15 marks*

UNIT-IV

Meat: Ante-mortem examination of meat animals, scientific techniques of slaughtering, dressing, post-mortem inspection, storage, tenderization, cuts, packaging; beef, mutton, pork as human foods, cured meat products, sausages, by-products, frozen and canned meat products.

Fish: Types, catch, examination; care in handling & transportation; processing of shell-fish, crabs, oysters, lobsters, frog legs etc. for domestic and export markets. Filleting and freezing, canning salting & drying of fish. Fish sauce and protein concentrates. *30 marks*

Books Recommended:

1. Meat Science by R.A. Lawrie, Pergamon Press.
2. Poultry Products Technology by G.J. Mountney.
3. Meat, Poultry & Sea Food Technology by R.L. Henricksons.
4. Poultry Meat and Egg Production by Parkhurst & Mountney.

BFT-403: BAKERY CONFECTIONARY TECHNOLOGY (Max. marks 80+20=100)

UNIT-I

Current status, growth rate, and economic importance of Bakery and Confectionary Industry in India. Product types, nutritional and safety of products, pertinent standards & regulations. *20 marks*

UNIT-II

Bakery Products: Ingredients & processes for breads, biscuits, cookies & crackers, cakes & pastries; doughnuts; rusks; other baked products. *15 marks*

UNIT-III

Equipment used, product quality characteristics, faults and corrective measures for above bakery products. Defining and assessing quality of ingredients & products. *15 marks*

UNIT-IV

Confectionary Products: Hard-boiled candies, toffees fruit drops, chocolates and other confections: ingredients, equipment & processes, product quality parameters, faults and corrective measures. *15 marks*

UNIT-V

Production & quality of chewing and bubble gums, cocoa products, breakfast cereals, macaroni products, sprouted grains. *15 marks*

Books Recommended

1. Bakery Technology and Engineering by Samuel a. Matz, CBS Publications.
2. Cereals as Food and Feed by Samuel A. Matz, CBS Publications
3. Industrial Chocolate Manufacture by Beckette.
4. Dough rheology and baked product texture by FaridiFaubion, CBS Publications.
5. Chocolate, Cocoa and Confectionary by Minifie B.W.
6. Cookies & Cracker Technology by S.A. Matz.
7. Baking Science and Technology by Pyler
8. Basic Baking by S.C. Dubey.

BFT-404: SNACKS FOOD AND BEVERAGES TECHNOLOGY(Max. marks 80+20=100)

Part A-SNACKS FOOD TECHNOLOGY

UNIT-I:

Technology for grain-based snacks: whole grains – roasted, toasted, puffed, popped and flakes, coated grains-salted, spiced and sweetened; flour based – batter and dough based products; *savoury* and *farsans*; formulated chips and wafers, papads, instant premixes of traditional Indian snack foods. *20 marks*

UNIT-II:

Technology for fruit and vegetable based snacks: Chips, wafers; Technology for coated nuts – salted, spiced and sweetened; *chikkis*. *10 marks*

UNIT-III:

Extruded snack foods: Formulation and processing technology, colouring, flavouring and packaging. *5 marks*

UNIT-IV:

Equipments for frying, toasting, roasting and flaking, popping, blending, Coating, chipping. *5 marks*

Books Recommended:

1. Edmund WL. *Snack Foods Processing*. AVI Publ.
2. Frame ND .1994.*The Technology of Extrusion Cooking*. Blackie Academic.
3. Gordon BR.1997 *Snack Food*. AVI Publ.
4. Samuel AM.1976. *Snack Food Technology*. AVI Publ.

Part B- BEVERAGES TECHNOLOGY

UNIT-I:

Types of beverages and their importance; status of beverage industry in India; synthetic beverages; technology of still, carbonated, low-calorie and dry beverages; isotonic and sports drinks; role of various ingredients of soft drinks, carbonation of soft drinks. *15 marks*

UNIT-II:

Specialty beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, beverages. *5 marks*

UNIT-III:

Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipments used for brewing and distillation, wine and related beverages, distilled spirits. *10 marks*

UNIT-IV:

Packaged drinking water- definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water. *10 marks*

Books Recommended:

- Hardwick WA. 1995. *Handbook of Brewing*. Marcel Dekker.
- Hui YH. *et al* 2004. *Handbook of Food and Beverage Fermentation Technology*. Marcel Dekker.
- Priest FG & Stewart GG. 2006. *Handbook of Brewing*. 2nd Ed. CRC.
- Richard P Vine. 1981. *Commercial Wine Making - Processing and Controls*. AVI Publ.
- Varnam AH & Sutherland JP. 1994. *Beverages: Technology, Chemistry and Microbiology*. Chapman & Hall.
- Woodroof JG & Phillips GF.1974. *Beverages: Carbonated and Non-Carbonated*. AVI Publ.

BFT-405: Laboratory Course-VII (Max. marks 80+20=100)

Fruits and Vegetables Processing Technology

1. Evaluation of pectin grade;
2. Canning of mango/guava/papaya;
3. Preparation and quality evaluation of fruit jam: apple/ mango/ guava /papaya /aonla / strawberry and fruits of regional importance;fruit jelly, sweet orange/mandarin/guava; fruit marmalade; fruit preserve and candy; fruit RTS, squash, syrup and candy;
4. Processing of tomato products;
5. Preparation of papaya /guava cheese;
6. Preparation of pickles, dried onion and garlic, preparation of banana and potato wafers, dehydrated vegetables.

Egg, Poultry, Meat and Fish Processing Technology

1. Slaughtering and dressing of meat animals; study of post-mortem changes; meat cutting and handling; evaluation of meat quality;
2. Preservation by dehydration, freezing, canning, curing, smoking and pickling of fish and meat;
3. shelf-life studies on processed meat products;
4. Evaluation of quality of eggs; preservation of shell eggs;
5. Estimation of meat: bone ratios;
6. Preparation of meat products- barbecued sausages, loaves, burger, fish finger; visit to meat processing plants.

BFT-406: Laboratory Course-VIII (Max. marks 80+20=100)

Bakery and Confectionary Technology

1. Determination of dough relaxation constants and their interpretation;
2. Effect of mixing method on the quality of baked product;
3. Effect of mixing time on the rheological characteristics of dough;
4. Effect of mixing time on the crispness and firmness of biscuits;
5. Effect of additives on the quality and textural characteristics of bakery products;
6. Development and quality evaluation of baked products based on composite flour;
7. Preparation and quality evaluation of cakes, biscuits, croissant, doughnuts, and pizza base;
8. Effect of syrup consistency and temperature on the quality characteristics of hardboiled sweets;
9. Preparation and quality evaluation of chocolate;
10. Visit to bakery and confectionery industries.

SNACK FOODS TECHNOLOGY & BEVERAGES TECHNOLOGY

1. Preparation of various snack foods based on cereals, legumes, nuts, fruits, vegetables and extrusion cooking their quality evaluation.
2. Development of instant food premixes.
3. Determination of shelf-life and packaging requirements.
4. Visits to industries manufacturing snack foods.
5. Chemical and microbiological analysis of raw water quality.
6. Preparation of regional fruit juices.
7. Preparation of whey-based beverages.
8. Preparation of iced and flavoured tea beverage.
9. Preparation of carbonated and noncarbonated soft drinks.
10. Preparation of wine and beer.
11. Preparation of soy milk, fruit milkshakes, herbal beverages.
12. Visit to relevant processing units.

Fifth semester

BFT-501:SENSORY EVALUATION(Max. marks 80+20=100)

UNIT-I:

Introduction to sensory analysis; general testing conditions, Requirements of sensory laboratory; organizing sensory evaluation programme.20 marks

UNIT-II:

Selection of sensory panellists; Factors influencing sensory measurements;Sensory quality parameters -Size and shape, texture, aroma, taste, color and gloss;Detection, threshold and dilution tests.20 marks

UNIT-III:

Different tests for sensory evaluation– discrimination, descriptive, affective;Flavour profile and tests; Ranking tests; Methods of sensory evaluation of different foodproducts.20 marks

UNIT-IV: Computer-aided sensory evaluation of food & beverage, statistical analysis of sensory data.20 marks

Books Recommended

1. Amerine MA, Pangborn RM & Rossles EB. 1965. *Principles of Sensory Evaluation of Food*. Academic Press.
2. Early R. 1995. *Guide to Quality Management Systems for Food Industries*. Blackie Academic.
3. Jellinek G. 1985. *Sensory Evaluation of Food - Theory and Practice*. Ellis Horwood. Lawless HT & Klein BP. 1991. *Sensory Science Theory and Applications in Foods*. Marcel Dekker.

4. Macrae R, Rolonson Roles & Sadlu MJ. 1994. *Encyclopedia of Food Science & Technology & Nutrition*. Vol. XI. Academic Press.
5. Maslowitz H. 2000. *Applied Sensory Analysis of Foods*. Vols. I, II. CRC Press.
6. Piggot JR. 1984. *Sensory Evaluation of Foods*. Elbview Applied Science Publ.
7. Potter NN & Hotchleiss JH. 1997. *Food Science*. 5th Ed. CBS.
8. Rai SC & Bhatia VK. 1988. *Sensory Evaluation of Agricultural Products*. Indian Agricultural Statistics Research Institute (ICAR).
9. Stone H & Sidel JL. 1985. *Sensory Evaluation Practices*. Academic Press.
10. Watts CM, Ylimaki CL, Jaffery LE & Elias LG. 1989. *Basic Sensory Methods for Food Evaluation*. Int. Dev. Res. Centre, Canada.

BFT-502: FOOD PLANT ORGANIZATION AND MANAGEMENT (Max. marks 80+20=100)

UNIT -I

Operation Research, definition and scope, techniques in operation research. Food plant management. Factors bearing on location and layout of food plants. Regulatory requirements of food industries. *15 marks*

UNIT -II

Structure and operation of food plants. Executive design making in a food plant. Decision protocols. Evolution and role of management planning, organising and controlling. Decision processed for raising efficiency, productivity and quality in food plant operation. System analysis, its need and methodology. *20 marks*

UNIT -III

Model building- deterministic and probabilistic models. Management decision making, problems of productions, production intending, marketing-sales forecasting, inventory, finance-Break down maintenance, inventory, finance replacement. *20 marks*

UNIT -IV

Network models.. Computer applications, database operating systems, networking project management, spread sheeting and Statistical Quality Control (SQC). *10 marks*

UNIT -V

Industrial cost accounting, purchase procedure, stores procedure, material accounting, overhead costing, budget and budgetary control, process costing,. Cost factor in fixation of prices, job costing and product costing. *15 marks*

BFT-503: Food Packaging (Max. marks 80+20=100)

UNIT -I

Introduction to packaging. Packaging Media & Materials : Primary packaging media , Properties and application manufacturing and applications of textiles and wood, paper and paperboard, metal, glass, plastics; combined package systems; Identification methods used for plastic food packaging materials; Shaping and manufacturing processes used for the production of moulded plastic food containers; Edible films and coatings used in the food packaging industry; Labels, caps and closures and adhesives, inks and lacquers, cushioning materials, reinforcements. *20 marks*

UNIT -II

Packaging systems and methods : Vacuum packaging, gas flush packaging, Tamper-evident packaging; aseptic packaging; modified atmosphere packaging (MAP), Controlled atmosphere packaging (CAP) & aseptic & retort pouch technology, box in box; microwave packaging; active packaging; bio-degradable packages, edible packages; Use of smart packaging by the food industry; Use of sensor technology within the food packaging industry; Industrial packaging: unitizing, palletizing, containerizing, stacking and materials handling; distribution systems for packaged foods including prevention of shock damage to articles during transportation; Rigid and semi-rigid containers; flexible containers; form-fill-seal systems; Testing & evaluation of packaging media – retail packs & transport packages. *20 marks*

UNIT -III

Packaging Fresh and Processed Food : Packaging requirements for different foods and processing methods- General classification and packaging types, varieties and trends; Protective packaging of foods; packaging of food products sensitive to oxygen, light, moisture; special problems in canned foods; packaging of convenience foods; Packaging of Food products-; fruits and vegetables; packaging requirements of fresh fruits and vegetables; packaging of fruit juices; fats and oils; packaging of spices; packaging of meat and poultry; packaging and transportation of fish and other sea-foods; criteria for selection of proper packaging based on the shelf life desired; dairy products; beverage products; cakes and snack foods; different packaging requirements for thermal- processed, dehydrated, frozen, irradiated and other specially processed foods. *20 marks*

UNIT -IV

Status of current packaging; critical review of the existing knowledge in packaging of products. Special needs: Packaging for gamma irradiation, packaging for HHP processing. Active packaging. Edible packaging. Recent developments in packaging. *10 marks*

UNIT -V

Packaging Design & Environmental Issues in Packaging: Food marketing and role of packaging- Packaging aesthetic and graphic design; Coding and marking including bar

coding; Consumer attitudes to food packaging materials; Packaging – Laws and regulations, safety aspects of packaging materials; sources of toxic materials and migration of toxins into food materials; Packaging material residues in food products; Environmental & Economic issues, recycling and waste disposal. *10 marks*

Books Recommended:

1. Robertson, G.L. Food Packaging: Principles and Practice (2nd ed.), Taylor & Francis 2006
2. Parry R. T. and Blakistone B. A. Principles & Applications of MAP –Springer, New York, 1999
3. Food Packaging Technology Handbook. NIIR Board, National Institute of Industrial Research, 2003
4. Ahvenainen, R. (Ed.) Novel Food Packaging Techniques, CRC Press, 2003
5. Han, J.H. (Ed.) Innovations in Food Packaging, Elsevier Academic Press, 2005
6. Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) Food Packaging Technology, CRC Press, 2003
7. CRC Press, 2003

BFT-504: Food Safety and Quality Control (Max. marks 80+20=100)

UNIT-I

Hazards – microbiological, nutritional, environmental, natural toxicants, pesticide residues and food additives. *10 marks*

UNIT -II

Sanitary and hygienic practices; HACCP; Quality manuals, documentation and audits; Indian and international quality systems and standards like ISO and Food Codex; export, import policy, export documentation, laboratory quality procedures and assessment of laboratory performance; applications in different food industries; food adulteration and food safety. IPR and patent. *20 marks*

UNIT -III

Introduction to quality control and quality assurance. Food safety measures. Current concepts of quality control. *15 marks*

UNIT -IV

Quality assurance programme: Quality plan, documentation of records, product standards product and purchase specifications, process control, hygiene and housekeeping, corrective action. *15 marks*

UNIT -V

Concepts of quality management: objectives, importance and functions of quality control; quality management systems in India; sampling procedures and plans; Food safety and Standards Act 2006; domestic regulations; global food safety initiative; various organization dealing with inspections, traceability and authentication, certification and quality assurance (PFA,FPO,MMPO,MPO,AGMARK,BIS), labelling issues, international scenario, international food standards.20 marks

Books Recommended:

1. Early. R. (1995): Guide to Quality Management Systems for the Food Industry, Blackie, Academic and professional, London.
2. Gould, W.A and Gould, R.W. (1998).. Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
3. pomeraz, Y. and MeLoari, C.E. (1996): Food Analyasis: Theory and Practice, CBS publishers and Distributor, New Delhi.
4. Bryan, F.L. (1992): Hazard Analysis Critical Control Point Evaluations A Guide to Identifying Hazards and Assessing Risks Associated with Food Preparation and Storage. World Health Organisation, Geneva.
5. Kirk, R.S and Sawyer, R. (1991): Pearson's Composition and Analysis of Foods, Longman Scientific and Technical. 9th Edition, England.
6. Food and Agricultural Organisation (1980): Manuals of Food Quality Control. 2- Additives Contaminants Techniques, Rome.

BFT-505: Laboratory Course-IX (Max. marks 80+20=100)

SENSORY EVALUATION

1. Selection and training of sensory panel;
2. Detection and threshold tests;
3. Ranking tests for taste, aroma colour and texture;
4. Sensory evaluation of various food products using different scales, score cards and tests;
5. Estimation of color and texture;
6. Relationship between objective and subjective methods.

BFT-506: Laboratory Course-X (Max. marks 80+20=100)

FOOD SAFETY AND QUALITY CONTROL (LAB)

Market sample evaluation and statistical application of:

1. Qualitative tests for detection of adulterants
2. Test for assessment of purity of water
3. Test for assessment of quality of milk and milk products
4. Test for assessment of quality of cereals/milletts
5. Test for assessment of quality of pulses
6. Test for assessment of quality of fats and oils

7. Test for assessment of quality of meat/fish products
8. Test for assessment of quality of canned/bottle fruits and vegetables
9. Test for assessment of quality of baked foods

FOOD PACKAGING AND QUALITY CONTROL (LAB)

1. Determine the tin coating weight measurement.
2. Determine the continuity of tin coating (Ferricyanide paper test for porosity).
3. Test the thermal shock resistance of glass container.
4. Test for alkalinity of glass bottles.
5. Determine the bursting strength of different packaging materials.
6. Determine the tear resistance of different packaging materials
7. Evaluate various commercial samples of wheat atta for some quality parameters as
 1. specified in BIS standards.
 8. Determine the grease resistance of different packaging materials.
 9. Determine the WVTR of some packaging materials.
 10. Evaluate commercial jam sample for some quality parameters.
 11. Evaluate the given food sample using different sensory test methods.

Six Semester

BFT-601:FOOD LAWS AND REGULATORY ISSUES (Max. marks 80+20=100)

UNIT -I

Historical perspectives including necessity of Food Laws. Establishment of US Pure Food Law in early 1900s and of Food & Drug Administration to enforce safety of food products; Urbanisation of population and necessity of processed and preserved foods and the necessity of ensuring quality of food to prevent adulteration. *20 marks*

UNIT -II

Food Quality, Safety & Testing:Quality of Foods and Quality Standards like BIS; Agmark and other optional standards; the difference between mandatory and optional standards; enforcement of optional standards; Food Safety Systems: Quality systems standards including ISO; Auditing; Good Manufacturing Practice and HACCP. Various ways of testing the safety of foods; Detection of harmful chemicals and microbes in foods; Testing of ingredients and additives; using animals for evaluating safety; Clinical studies. Responsibility of agriculture, food industry & food supply sector;Standards of Weights & Measures, British Regulatory Consortium(BRC),American Institute of Bakers(AIB) and some provisions under these regarding food products such as requirements of labelling and giving information therein, size of packages etc. Important Issues of GM Foods, Fortification, Nutrition Information on Label, Organic Foods, Safety of Additives, Processes etc. affecting consumers and industry.*20 marks*

UNIT -III

Food Laws & Implementing Agencies-National:Prevention of Food Adulteration Act 1954 & Rules 1955 established in India to enforce safety and purity of food products; Various aspects of defining adulteration, taking samples of food for analysis by public analyst, prosecution for adulteration and punishment; Standards of various food products; FPO; Infant Milk Substitute Act; Laws relating to vegetable oils; Use of permitted additives like colours, preservatives, emulsifiers, stabilisers, antioxidants.Food Safety & Standards Act 2006 and the provisions therein; Integrated Food Law - Multi departmental - multilevel to single window control system, consumer protection Act.*20 marks*

UNIT -IV

International Scenario in Food Regulation USFDA, EFSA, UK, Canada, A & NZ, Japan, Malaysia, Singapore; Consumer Movements; Intellectual Property Rights and Trade Marks: Protection of investment and efforts in research and development by patenting; Criteria of patentability; National and international patent; Terms of patents; Copyright.*10 marks*

UNIT -V

International Agencies in Food Regulation:Food Codex Alimentarius: The necessity of harmonised Food Standards for international trade; various aspects and relation with domestic laws; Codex Nodal agency, FAO, WHO, WTO, TUV ,Consumer protection forums.*10 marks*

Books Recommended

1. Mehta, Rajesh and J. George “Food Safety Regulations, Concerns and Trade: The Developing Country Perspective”, Macmillan, 2005.
2. “The Prevention of Food Adulteration Act, 1954”, Commercial Law Publishers (India) Pvt. Ltd.
- 3.
4. Rees, Naomi and David Watson “International Standards for Food Safety”, Aspen Publication, 2000.
- 5.
6. Newslow, D.L. “The ISO 9000 Quality System: Applications in Food and Technology”, John Wiley & Sons, 2001.
- 7.
8. Hubbard, Merton R. “Statistical Quality Control for the Food Industry”, 3rd Edition, Springer, 2003.

BFT-602: ENVIRONMENTAL ISSUES IN FOOD INDUSTRY (Max. marks 80+20=100)

UNIT -I

Environment and Pollution: Components of environment; Environmental pollutions, its measurements and management; Air pollution and its control; Water pollution and its control; Xenobiotic compounds; Pesticides and pest management; processes; Solid wastes and management; Microorganisms as components of the environment; microorganisms as indicators of environmental pollution; bioorganic pollution; microbial toxicants and pollutants, and their bio-degradation; biodegradation of plastics, biofouling and biofilms; bioremediation. *20 marks*

UNIT -II

Control of Air Quality: Air duct design and room air distribution; air conditioning systems; clean-room air conditioning; important pollutants of air; properties of particulate matter and air pollution control methods; air quality in the processing plants, legal requirements. *10 marks*

UNIT -III

Waste Water Treatment: Waste water sources characteristics - standards for disposal of water, physical, chemical and biological characteristics of waste water; measurement of organic content in waste water; Physical unit operations in waste water treatment - screening; racks, mixing, flocculation, sedimentation, floatation, elutriation, vacuum filtration, incineration; chemical unit operations in waste water treatment - reaction kinetics; chemical precipitation, aeration and gas transfer process, rate of gas transfer, adsorption, disinfection; biological unit operations - aerobic and anaerobic. *20 marks*

UNIT -IV

Storage & Disposal of Waste: Types of waste generated; Non- degradable & biodegradable wastes, Solid waste storage and disposal methods- land-filling, burial, incineration, recycling; Biological treatment of food industry wastes, storage and disposal of liquid and gaseous waste; legal aspects related to storage and disposal; environmental laws; pests & their control. *15 marks*

UNIT -V

Utilization of Waste: Methods of utilizing wastes to make value added products- CASE STUDIES: Pectin, food colorants, antioxidants from fruit peels (citrus, mango, and pomegranate), lycopene from tomato peels, vegetable seed oils, biomolecules and enzymes from meat processing. Generation of biogas, SCP, microalgae, animal feeds, zero emission plants; recovery & recycling of materials. *15 marks*

Books Recommended:

1. Potter, Norman N. and J.H. Hotchkiss "Food Science", 5th Edition, CBS, 1996.
2. Moorthy, C.K. "Principles and Practices of Contamination Control and Clean rooms", Pharma Book Syndicate, 2003.
3. Roday, S. "Hygiene and Sanitation in Food Industry", Tata McGraw – Hill Publishing, 1999.
4. Wilson, C.L. "Microbial Food Contamination", 2nd Edition, CRC, 2008.

BFT-603: FOOD BIOTECHNOLOGY(Max. marks 80+20=100)

UNIT -I

Principles of food biotechnology: Basic principles and application of biotechnology in food industries with regard to production, processing regulatory aspect of modern biotechnology application in food industry in the context of environment protection of human and animals.

20 marks

UNIT -II

Fermentation technology: Fermentation media natural and synthetic media. Sterilization technique. Heat radiation and filtration method, fermenters types of fermentation immobilization enzyme and cell bioreactors. Process development: shake flask fermentation, upstream and downstream processing, distintegration of cells, separation, extraction, concentration and purification of products.*20 marks*

UNIT -III

Lactic acid bacteria- put a dash distribution, classification and physiology; antimutagenic, antimicrobial and health promoting effects; malo- lactic. Protective factors of lactic bacteria in food preservations. Yeasts and moulds associated fermented food. Technology for the production of sauerkraut, kimchi, bamboo shoot, rice beer, idli, dosa, yogurt, dahi, kefir, cheese miso, tempeh and salami, traditional fermented food of India, nutritional changes.

10 marks

UNIT -IV

Microbes in food Technology: microbial starters for industrial production; sources, propagation, preservation and use of starts. Improvement of starters by classical and molecular biological techniques. Microbial protein as food and feed: SCP and economics of SCP and microbial derived additive, flavours and odours, Pathogenic microbes- infections; bacterial toxins and mycotoxins sources, physiological effects; methods of prevention and control in foods.*10 marks*

UNIT -V

Transgenic: Basic concept and essential steps of the process, some examples of transgenic plants. Use of suitable promoters, Gene silencing and measures to overcome it. Commercial aspects of the technology. Genetic modification in Agriculture- transgenic plants, genetically modified foods, application, future application, ecological impact of transgenic plants. Genetically modified foods- ethical issues concerning GM foods; testing for GMO's; current guidelines for the production, release and movement of GMO's; labelling and traceability; trade related aspects; biosafety; risk assessment and risk management. Public perception of GM foods. IPR, GMO Acts-2004.

Organic foods, types of organic foods industry, history, application, future application.
20 marks

Books recommended

1. Bains W.1993.Biotechnology from A to Z. Oxford Unuiv.Press.
2. Joshi VK and Pandey A. 1999.Biotechnology: Food Fermentaion. Vols.I,II.Education Publ.
3. Knorr D.1982.Food Biotechnology.Marcel Dekker.
4. Lee BH.1996. Fundamentals of Food Biotechnology.VCH.
5. Perlman D.1977-1979. Annual Reports of Fermentation Processes.
6. Percott SC and Dunn CG.1959.Industrial Microbiology.McGraw Hill.
7. Ward. OP.1989.Fermentaion Biotechnology.Prentice Hall.

BFT-604:ENTERPRENERSHIP,BUSINESS MANAGEMENT ANDINTERNATIONAL TRADE(Max. marks 80+20=100)

UNIT-I

Element in Enterprise Management: Basic management concepts, personnel, production, materials, financing and marketing managements, problem solving and innovation, industrial and business law. Entrepreneurial motivation.Environmental analysis, project selection, project appraisal, modification/ finalization of project, collaborations, preparations for launching, trial run and test marketing.*15 marks*

UNIT-II

The concept of business, trade, industry, firm and management; functions ofmanagement; areas of management; concept and functions of marketing; scope ofmarketing management; marketing mix; marketing organizational structure; micro andmacro environments; consumer behaviour; consumerism; marketing research andmarketing information systems.*15 marks*

UNIT-III:

Market measurement- present and future demand; Market forecasting; marketsegmentation, targeting and positioning; Allocation of marketing resources; MarketingPlanning Process; Product policy and planning; Product-mix; product line; product lifecycle; New product development process; Branding, packaging, services decisions;Marketing channel decisions: Retailing, wholesaling and distribution; Pricing Decisions:Price determination and pricing policy of milk products in organized and unorganizedsectors of dairy industry.*15 marks*

UNIT-IV:

Promotion mix decisions, advertising: functions, objectives, and types;advertising budget and advertising message; Media Planning; Personal Selling; Publicity;Sales Promotion; Food and Dairy Products Marketing.*15 marks*

UNIT-V:

International Marketing and International Trade; Salient features ofInternational Marketing; Composition & direction of Indian exports; Internationalmarketing environment; Deciding which & how to enter international market; Exports-Direct exports, indirect exports,

Licensing, Joint Ventures, Direct investment & internationalization process; Deciding marketing Programme; Product, Promotion, Price, Distribution Channels; Deciding the Market Organization; World Trade Organization (WTO). 20 marks

Books Recommended:

1. Marketing Management - Philip Kotler
2. Marketing Management - Dr. P. K. Srivastava
3. Marketing Management - Dr. S. C. Jain
4. Cateora Philip R & Graham John L. 2001. *International Marketing*. 10th Ed. Tata McGraw Hill.
5. Keegan WJ. 1996. *Global Marketing Management*. 5th Ed. Prentice Hall of India.
6. Kotler Philip. *Marketing Management – Analysis, Planning, Implementation and Control*. Pearson Edu.
7. Stanton William J, Etzel Michael J & Walker Bruce J. 1996. *Fundamentals of Marketing*,
8. McGraw-Hill.
9. 8. Terpstra V & Sarathy R. 1997. *International Marketing*. 7th Ed. The Dryden Press.

BFT-605: Laboratory Course-XI (Max. marks 80+20=100)

1. Estimation of BOD (2 sample)
2. Microbial load and their relatives density in foods(bacteria, fungi, yeast)
3. Estimation of Lactic acid and Lactose.
4. Immobilization of Yeast cells
5. Studies of indigenous fermented foods and beverages of N.E Regions (eg. hawaijar, Soibum, Ngari, Yu, etc). Isolation and identification of Microorganism involved in Fermentation under controlled condition.

BFT -606 Project Work Max. marks (80+20=100)

Project work should be based on Food Processing Technology and laboratory works learned during the course. Student should be encouraged to work independently, however each student should be assigned to a faculty member of the Department. At the end of the Project work, each student should submit report in the form of dissertation to the Head of the Department within a date line fixed by the Head of the Department. The dissertation should be examined and evaluated by a committee of the faculty members.