KUVEMPU UNIVERSITY

M. Sc. Food Technology

Syllabus

for the Academic year

2026-27

About the Department

The Department of Postgraduate Studies and Research in Food Technology at Kuvempu University was founded in the academic year 2021-22 in the Chemical Science block. This significant achievement was made possible by the visionary leadership and tireless dedication of the Hon'ble Vice Chancellor, Prof. B. P. Veerabhadrappa, and the Registrar, Smt. Anuradha G. Later, the department established itself separately in the archaeology block of the Jnana Sahyadri campus, providing MSc. and PhD programs in food technology. The Department of Food Technology is committed to advancing research and innovation in the fields of food science, processing, and safety. It contributes significantly to bridging the gap between agricultural productivity and consumer demand by creating sustainable, nutritious, and high-quality food items.

Emphasizing multidisciplinary learning, the department combines ideas of nutrition, chemistry, microbiology, and engineering to provide students a complete awareness of the food system—from farm to fork. By means of a mix of theoretical education and hands-on training in contemporary laboratories, students equip themselves to fulfil the demands of modern food industry. The department takes an active role in research, industrial partnerships, and community engagement to tackle contemporary challenges including food security, waste minimization, and the creation of functional and fortified foods. Department graduates are adequately equipped for positions in food processing businesses, quality assurance, research and development, regulatory agencies, and academia.

The Department of Food Science supports the students to participate in different in-house research projects and present them at various platforms like national and international seminars and conferences, which help students to understand how products can be taken from the laboratory to the market. It also constantly exposes the students to industrial practices to understand the requirements of the industry. Under guidance of experienced professors, students work passionately on these projects. Knowing the opportunities of food technology, the department arranges industry visits, national seminars and conferences, and regular student training programs.

Objectives

- To equip talented young students with the requisite conceptual insight, skill, and attitude to enable them to provide research and educational inputs of the highest standards in rapidly growing food sectors.
- To contribute to the development of new technology and pave a way for research analysis and implementations and career development.
- To impart theoretical knowledge and practical skills that are mandatorily required to get employed in the food industry and national and international food research organizations and to motivate young minds to become entrepreneurs in the food industry.

- To make the next generation aware of food quality and safety and familiarize them with regulations governing food and food products.

Vision

- To advance innovation and sustainability in the food industry by equipping students with cutting-edge knowledge, research expertise, and practical skills to address global food security, safety, and nutrition challenges.
- To foster leaders who contribute to the development of healthier, safer, and more sustainable food systems worldwide.

Mission

- To provide high-quality education and research opportunities that empower students to develop innovative solutions in food processing, safety, and sustainability.
- To produce skilled professionals who contribute to the advancement of the global food industry through research, technological advancements, and responsible practices.

About the Course

Academic Program: M.Sc. Food Technology

Nature and duration: CBCS - Semester Scheme (4 Semesters)

Eligibility: B.Sc./B.Tech./BE in Life Sciences, Chemical Sciences, Food Technology, Food Science and Technology, Food Science, Food Science and Nutrition, Nutrition and Dietetics, Agriculture, Horticulture, Dairy Technology, Community Science (Home Science), Forestry, Fisheries, Agriculture Engineering, Processing and Food Engineering, Agricultural Biotechnology, Biotechnology and other allied agricultural sciences, and Pharmacy.

Intake: 42

Abbreviations:

1. FT : Food Technology
2. CBCS : Choice Based Credit System
3. L:T:P - (4:0:0)/(0:0:2) : Lecture (Theory): Tutorial: Practical

M.Sc. Food Technology (CBCS) Course Structure (2026-27 onwards)

Semester	Subject/Paper Code	Title of the Paper	Instruction Hrs./week	Marks			Credits	Examination duration (Hrs.)
				Examination	Internal Assessment	Total Marks		
SEMESTER-I		**THEORY PAPERS**						
	FT 1.1	Food Chemistry (HARD CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 1.2	Food Microbiology (HARD CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 1.3	Principles of Food Processing and Preservation Technology (HARD CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 1.4	Nutraceuticals and Functional Foods (SOFT CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 1.5	Technology of Fruit and Vegetable Processing (SOFT CORE)	**4**	**75**	**25**	**100**	**4**	**3**
		PRACTICAL PAPERS						
	FT 1.6	Food Chemistry	**4**	**40**	**10**	**50**	**2**	**3**
	FT 1.7	Food Microbiology	**4**	**40**	**10**	**50**	**2**	**3**
	FT 1.8	Principles of Food Processing and Preservation Technology	**4**	**40**	**10**	**50**	**2**	**3**
SEMESTER-II		**THEORY PAPERS**						
	FT 2.1	Bioanalytical Techniques (HARD CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 2.2	Food Biotechnology (HARD CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 2.3	Food Engineering (HARD CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 2.4	Nutrition and Therapeutic Foods (SOFT CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 2.5	Advances in Food Processing Technologies(SOFT CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 2.6	Food Packaging and Quality Assessment (Interdisciplinary – Elective paper)	**2**	**40**	**10**	**50**	**2**	**1.5**
		PRACTICAL PAPERS						
	FT 2.7	Bioanalytical Techniques	**4**	**40**	**10**	**50**	**2**	**3**
	FT 2.8	Food Biotechnology	**4**	**40**	**10**	**50**	**2**	**3**
	FT 2.9	Food Engineering	**4**	**40**	**10**	**50**	**2**	**3**
SEMESTER-III		**THEORY PAPERS**						
	FT 3.1	Food Preservatives, Packaging and Research Methodology (HARD CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 3.2	Dairy Technology (HARD CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 3.3	Processing Technology of Meat, Poultry and Fish (HARD CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 3.4	Post-Harvest Management (SOFT CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 3.5	Processing Technology of Spices and Plantation Crops (SOFT CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 3.6	Nutraceuticals (Interdisciplinary - Elective paper)	**2**	**40**	**10**	**50**	**2**	**1.5**
		PRACTICAL PAPERS						
	FT 3.7	Food Preservatives, Packaging and Research Methodology	**4**	**40**	**10**	**50**	**2**	**3**
	FT 3.8	Dairy Technology	**4**	**40**	**10**	**50**	**2**	**3**
	FT 3.9	Processing Technology of Meat, Poultry and Fish	**4**	**40**	**10**	**50**	**2**	**3**
SEMESTER-IV		**THEORY PAPERS & PROJECT WORK/DISSERTATION**						
	FT 4.1	Food Additives and Biostatistics (HARD CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 4.2	Waste Management, Food laws and Entrepreneurship (HARD CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 4.3	Bakery and Confectioneries Technology (HARD CORE)	**4**	**75**	**25**	**100**	**4**	**3**
	FT 4.4	Project Work/Dissertation	**6**	**100**	**50**	**150**	**6**	**3**
		PRACTICAL PAPERS & STUDY TOUR/FIELD VISIT						
	FT 4.5	Food Additives and Biostatistics	**4**	**40**	**10**	**50**	**2**	**3**
	FT 4.6	Waste Management, Food laws and Entrepreneurship	**4**	**40**	**10**	**50**	**2**	**3**
	FT 4.7	Bakery and Confectioneries Technology	**4**	**40**	**10**	**50**	**2**	**3**
		Study Tour/Field Visit	**---**	**---**	**---**	**---**	**---**	**---**
	Mandatory Credits: Communication Skill (Dept. of English)		**2**	**---**	**---**	**---**	**1**	**---**
	Mandatory Credits: Computer Application (Dept. of Computer Science)		**2**	**---**	**---**	**---**	**1**	**---**
	Mandatory Credits: Personality Development (Dept. of Business Administration/Commerce)		**2**	**---**	**---**	**---**	**1**	**---**
		Total Credits for the Course	**124**	**---**	**---**	**2350**	**94**	**---**

Note: 1. Each student must choose exactly **one soft core paper** out of **two available options** during the **1st, 2nd, and 3rd semesters**.

2. Three Mandatory Credits –mentioned as Pass/Satisfactory and not considered for final percentage calculation and they are offered any semester (1 to 4) by the respective department

I Semester

FOOD CHEMISTRY (Hard core)

Course code: FT 1.1 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: **16 hours**

Introduction: Water molecule structure, ice, liquid water and steam, water activity, Phase transition of water molecule. Physicochemical properties of water, role of water in sustaining life on Earth, pH and buffers. Dispersed System: surface chemistry, colloidal interaction, creaming foams and emulsion. **Carbohydrate**s: Introduction, classification, structure, sources, properties and functions of **a**. Monosaccharides- glucose and fructose, **b.** disaccharides- Maltose, Lactose and Sucrose, **c**. functional polysaccharides- Starch, glucans and dextrins **d.** structural polysaccharides- cellulose, hemicelluloses, pectin, gums, inulin and arabinoxylans. Sugar alcohols (sorbitol, xylitol and erythritol) and Sucralose. Modified starch and dietary fibre. Dietary requirements of carbohydrates. Enzymatic degradation of Carbohydrates-Amylases.

Unit 2: **16 hours**

Amino acids and Proteins: Amino acids, occurrence, structure, classification, physical & chemical properties. Peptides, polypeptide & their properties. Proteins- major source, classification, structure, properties, purification and denaturation of proteins. Physicochemical and functional properties of protein derived from milk, egg protein, meat and fish muscle. Protein in oil seeds and cereals. Modified proteins and their application in food industry. Dietary requirements of proteins, metabolic defects associated with Proteins, such as Kwashiorkor and Marasmus. Protein digestive enzymes- Plant proteases, Pepsin trypsin and Chymotrypsin.

Unit 3: **16 hours**

Lipids: General introduction, classification, physical and chemical properties, functions and Dietary requirements of food lipids- a. Fatty acids, b. Acylglycerols: c. Phospho and glycolipids, Lipoproteins, Diol lipids, higher alcohols, waxes and cutin. Refining of crude oil and fats, hydrogenation and winterization. Vegetable and animal fat- lard, butter, margarine, shortenings and low-fat spreads. Flavour changes in fats and oils, lipid oxidation, auto oxidation, factors affecting lipid oxidation and its biological significance. Metabolic defects such as cardio vascular disease associated with lipids. Lipases.

Unit 4: **16 hours**

Vitamins- General introduction, Physiological and biochemical role, functions and deficiency disorders and dietary requirements of Vitamin B complex, Vitamin C, Fat soluable Vitamins A, D, E and K. Vitamin like compounds choline, carnitine, inositol, lipoic acid, PABA, Coenzyme Q. **Minerals:** Classification of macro and micro nutrients along with their physiological and biochemical role, functions, sources, and deficiency diseases. Electrolytes

functions and its significance, recommended intake and sources. Role of trace elements in different food and effect of various processing treatments.

Course outcome

1. Enables to understand physicochemical properties of water, carbohydrates their functional properties and inborn error caused by carbohydrates.
2. Enables to study amino acids physicochemical properties, biological functions, interaction, modified protein, applications in food industry and their metabolic defects.
3. Enables to study enzymes, lipids flavour changes in fats and oils, enzyme biological significance and metabolic disorders.
4. Enables to understand vitamins and minerals and their physiological and biochemical functions, role in different food, and deficiency diseases.

Reference Books

1. Eskin NAM, Henderson HM and Townsed RJ (1971) Biochemistry of Foods, Academic Press, New York.
2. H.-D. Belitz, W. Grosch and P. Schieberle (2009) Food Chemistry, 4th Ed. Springer-Verlag. Berlin Heidelberg.
3. John W. Brady (2013) Introductory Food Chemistry, Cornell University Press, Ithaca, USA.
4. Lillian Hoagland Meyer (1974) Food Chemistry, The AVI Publishing Co Inc., Connecticut, MA, USA.
5. Meyer, L.H. (1987) Food Chemistry. CBS publishers and Distributors, New Delhi.

FOOD MICROBIOLOGY (Hard core)

Course code: FT 1.2 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: **18 hours**

Microbiology: Introduction, historical developments in food microbiology, prokaryotes and eukaryotes. **Classification of microorganisms** - a brief account (Yeast, Molds and Bacteria) **Microbiological Techniques** - Sterilization, Cultivation of Microorganisms, culture media and types of culture media, Nutritional requirements of microorganisms, Growth curve, Measurement of growth; Intrinsic and extrinsic factors influencing growth of microorganisms in foods. Isolation of microorganisms - serial dilutions, streak plate, pour plate & spread plate methods. **Staining Techniques** - Simple and differential, fluorescent, negative, Structural staining - capsule, spore, cell wall and reserved food material, Preservation of cultures.

Unit 2: **14 hours**

Thermal inactivation of microbes- Concept, determination & importance of Thermal Death Time, F, Z & D values. Food hygiene and sanitation: Contamination during handling, processing of food and its control. Biochemical changes caused by microorganisms. **Microbial spoilage and its effect on food**; Spoilage of different kinds of food- cereals, pulses, fruits and vegetables, meat, fish, egg, poultry and their processed products, milk and milk products, canned foods, and beverages.

Unit 3: **16 hours**

Determination of microorganisms and their products in food; Sampling plan, sample collection, transport and storage, sample preparation for analysis. **Culture dependent methods**- Direct microscopic observation, culture, enumeration and isolation methods; **Analytical methods for microbial metabolites**- microbial toxins and metabolites. **Fermented and Dairy Food Products:** Microorganisms involved in food fermentations. Starter cultures for fermented dairy products (*Streptococcus thermophillus, Lactobacillus bulgaricus*). Fermented milk products- Acidophilus and Bulgarian milk, yoghurt, cheese, Kefir, Koumiss; Fermented grains and vegetable products - Sauerkraut, Soy sauce, Tempeh, Miso, and Kimchi; Single cell protein, Role of microorganisms in beverages - tea and coffee fermentations. Vinegar Fermentation. Prebiotic and Probiotics in foods and its benefits.

Unit 4: **16 hours**

Food-borne diseases: Bacterial food-borne diseases - *Staphylococcal* intoxification, Botulism, salmonellosis, Shigellosis, enteropathogenic *Escherichia coli* diarrhoea, *Clostridium perfringens* gastroenteritis, *Bacillus cereus* gastroenteritis; Food-borne viral pathogens-Norwalk virus, norovirus, reovirus, rotavirus, astrovirus, adenovirus, parvovirus, hepatitis A virus; **Food-borne animal parasites**-protozoa: giardiasis, amebiasis, toxoplasmosis, cysticercosis/taeniasis; roundworms: trichinosis, anisakiasis; **Mycotoxins**

and mycotoxicosis-aflatoxicosis, deoxynivalenol mycotoxicosis, ergotism; indicator microorganisms and applications of hurdle technology for controlling microbial growth. **Foods microbiology and public health:** Indicators microorganisms; Quality assurance: Microbiological quality standards of food: Government regulatory practices and policies-FDA, EPA, HACCP, ISI and ISO.

Course outcome

1. Able to understand basics concepts of microbiology, historical developments and microbial technique
2. Able to know the techniques of preservation of foods, food hygiene and
3. sanitation.
4. Students can understand the pathogens of food spoilage and different molecular techniques used to characterize the pathogens.
5. Able to know the different food borne diseases caused by microorganisms and a brief on different regulatory practices and policies.

References Books

1. **Bacterial Pathogenesis A Molecular Approach**. 2nd Edition. 2001 by Abigail A. Salyers and Dixie D. Whitt. ASM Publications.
2. **Basic Food Microbiology**, Banwart, G.J. (1997). CBS Publishers.
3. **Food and Microbes** — Swagata Chatterjee Sarkar – Introductory book focusing on microbes in food and their roles (useful for basic concepts)
4. **Food Microbiology** — K. Vijaya Ramesh – 1st Edition (MJP Publishers; detailed and student-friendly)
5. **Food Microbiology** — W. C. Frazier & D. C. Westhoff – Classic reference widely used in Indian universities (often available in affordable editions)
6. **Food Microbiology** — W. M. Foster – 1st Edition (CBS Publishers; good comprehensive text suited for MSc syllabus)
7. **Food Microbiology**, Fundamentals and Frontiers, Doyle, P., Bonehat, L.R. and Mantville, T.J (2010): ASM Press, Washington DC.
8. **Fundamental Food Microbiology**, Bibek Ray (1996). CRC Press.
9. **Microbiology**; Pelczar, Chan and Krieg; Tata McGraw Hill, Delhi
10. **Modern Food Microbiology** — James M. Jay – 4th Edition (paperback; fundamental textbook on food microbiology)
11. **Modern Food Microbiology,** James M. Jay (2000). 5th Edition, CBS Publishers.
12. **Objective Food Microbiology** — Suresh Chandra, Ratnesh Kumar & Ruchi Verma – 1st Edition — Good for quick revision and MCQs (exam preparation)

PRINCIPLES OF FOOD PROCESSING & PRESERVATION TECHNOLOGY (Hard core)

Course code: FT 1.3 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: 16 hours

Introduction: Aim and objectives of preservation and processing of foods, characteristics of food components, primary sources of microorganisms found in foods, classification of food- based on perishability, based on pH, based on origin, based on nutrients they provide, causes of quality deterioration and spoilage of perishable foods, spoilage in canned foods. Historical development of food processing and Preservation. General principles of food preservation.

Unit 2: 16 hours

Low temperature Preservation of foods: Chilling temperatures**:** Considerations relating to storage of foods at chilling temperatures, low temperature applications in food preservation, controlled and modified atmosphere storage of foods. Freezing temperature: Preparation of foods for freezing, freezing process: slow and fast freezing of foods and its consequences, storage stability of frozen foods, effect of freezing on microorganisms. Effect of freezing rate on quality of food products and thawing of frozen foods.

Unit 3: 16 hours

High temperature preservation of foods: Basic concepts in thermal destruction of microorganisms D, Z, F, values, Heat resistance and thermophilism in microorganisms. Cooking, blanching, pasteurization and sterilization of foods. Assessing adequacy of thermal processing of foods. Canning and bottling: General aspects of canning and bottling, processing operations exhausting and sealing, retorting, ultra-high temperature processes, determination of thermal process time, processing equipment, canning and bottling of various food products.

Unit 4: 16 hours

Preservation by Drying and Dehydration: Principles, technological aspects and applications of drying and dehydration of foods. drying phenomenon, factors affecting rate of drying, methods of drying of various food products, type of driers and their suitability for different foods; intermediate moisture food processing. Principles, technological aspects and applications of evaporative concentration processes, Freeze concentration and membrane processes for food concentrations. Other techniques in preservation: Principles and applications of sugar and salt, antimicrobial agents, Sources of radiations, effect on microorganisms and different nutrients. Radiation units and doses for foods, dose requirements for radiation preservation of foods, safe limits, irradiation mechanism and survival curve, irradiation of packaging materials.

Course outcome

1. List and identify the factors responsible for food spoilage, quality and need for preservation.
2. Compare and contrast the different low temperature food preservation methods & discuss their principles
3. Compare and contrast the different high temperature food preservation methods & discuss their principles.
4. Able to identify & discuss the applications of dehydration, membrane-based separation & irradiation as methods of food preservation.

Reference Books

1. B. Sivasankar (2009) Food processing and preservation, Eastern economy edition, Prentice-Hall of India Pvt. Ltd.
2. Emerging Technologies for Food Processing by Da-Wen Sun
3. Food Processing: Principles and Applications (2nd ed.) by Sung Hee Park, Buddhi P. Lamsal, and V.M. Balasubramaniam (Editors)
4. Food Processing and Preservation Technology: Advances, Methods, and Applications by Goyal, Mishra, and Birwal
5. Food Processing Technology: Principles and Practice by P.J. Fellows
6. Fruit & Vegetable Preservation: Principles and Practices by R.P. Shrivastava and Sanjeev Kumar
7. Handbook of Research on Food Processing and Preservation Technologies, 5-volume set Editors: Megh R. Goyal, PhD, PE Preeti Birwal, PhD Monika Sharma, PhD
8. Introduction to Food Engineering (4th ed.) by R.P. Singh and D.R. Heldman
9. James M Jay (2012) Modern food microbiology, 5th Edn, CBS publishers and Distributors.
10. Norman N. Potter and Joseph H. Hotchkiss (2013) Food Science, CBS publishers and Distributors.
11. Osman Erkmen and T. Faruk Bozoglu (2016) Food Microbiology Principles in to Practice, John Wiley & Sons, Ltd, UK.

NUTRACEUTICALS AND FUNCTIONAL FOODS (Soft core)

Course code: FT 1.4 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: 16 hours

Nutraceuticals and functional Foods –Definition, concept, history and market; Evolution of nutraceuticals and functional foods market. Classification of nutraceuticals and functional foods. Relation of functional foods and nutraceutical (FFN) to foods and drugs. Free radical scavengers, Antioxidants, mechanism and biological role of antioxidant molecules, Antioxidant enzymes, selonoenzymes and selenocompounds, Antioxidants as radioprotectors.

Unit 2: 16 hours

Natural occurrence of certain phytochemicals- Classification of Phytochemicals, Nutraceutical activities and chemical properties of flavonoids: omega – 3 fatty acids, carotenoids, dietary fiber, phytoestrogens; glucosinolates; organosulphur compounds. Nutraceutical remedies for acute and chronic studies in human disorders. Isolation of phytochemicals from plant materials: Pre extraction preparation. Extractive methods for conventional and advance method stability studies. Advancement techniques in the isolation and purification of phytochemicals.

Unit 3: 16 hours

Prebiotics, probiotics and symbiotics- Probiotics: Definition, types and relevance; Usefulness in gastro intestinal health and other health benefits; development of a probiotic products; recent advances in probiotics; Challenges and regulatory issues related to probiotic products. Prebiotics: Prebiotic ingredients in foods; types of prebiotics and their effects on gut microbes; health benefits of prebiotics; recent development in prebiotics. Symbiotics. Anti- nutrients, Types of inhibitors present in various foods and their inactivation, general adverse effects and interactions of nutraceuticals.

Unit 4: 16 hours

Functional foods - Definition, development of functional foods, use of bioactive compounds in appropriate form with protective substances and activators; Effect of environmental condition and food matrix; Effects of processing conditions and storage; Food allergens, Research frontiers in functional, Nutrigenomics concept of personalized medicine.

Course outcome

1. Enable to acquire the knowledge on concept, history, evolution of nutraceuticals, anti-oxidant properties and its functional & therapeutic properties.
2. Able to learn about natural occurrence and classification, isolation techniques and stability studies of Phytochemicals/nutraceuticals
3. Learn about role of Probiotics, Prebiotics and Symbiotics as health benefits and their product development.
4. Able to gain knowledge on concept, development of functional foods, bioactive compounds and nutrigenomics concepts.

Reference books

1. Wildman, R.E.C., Handbook of Nutraceuticals and Functional Foods, CRC Press.
2. Otles, S., Probiotics and Prebiotics in Food, Nutrition and Health, CRC Press.
3. Ferguson, L.R., Nutrigenomics and Nutrigenetics in Functional Foods, CRC Press.
4. Saarela, M. (Ed.), Functional Foods: Concept to Product, Woodhead Publishing.

TECHNOLOGY OF FRUIT AND VEGETABLE PROCESSING
(Soft Core)

Course code: FT 1.5 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: 16 hours

Introduction: Current status of fruits and vegetables processing, classification and composition of fruits and vegetables and their nutritional significance. Pre-harvest factors influencing post-harvest physiology, post-harvest handling and precooling methods, post-harvest treatments, edible coatings, cold chain, and commercial cooling systems. Physical and chemical indices of fruit maturity, crop maturity and ripening. Biochemical changes during maturation, ripening, processing and storage. Methods of storage: refrigerated, controlled atmosphere and hypobaric storage. Modified atmosphere packaging- role of gases, and influence of MAP on microorganisms, advantages and disadvantages.

Unit 2: 16 hours

Pre-processing operations- washing, blanching, peeling, sorting and grading of raw materials. Minimal processing of fruits and vegetables, quality factors for processing, fruit product order (FPO). Processing of fruits and vegetables: Freezing of fruits and vegetables, methods, freezing injury. Dehydration of fruits and vegetables, dehydration methods, physical and chemical changes during drying. Canning of fruits and vegetables, syrups and brines for canning, types of cans, manufacturing of cans, lacquering, mechanical defects, spoilage in canned foods.

Unit 3: 16 hours

Processed products of fruits and vegetables: Fruit juices, beverages and concentrates, squashes, cordials, carbonated beverages, fruit juice powders, methods of production, preservation and packaging, physiological aspects of fruit juice production and methods of fruit juice clarification. Technology of soft drinks, mineral water, ingredients, and additives used in production of soft drinks. Manufacturing of carbonated and non-carbonated beverages, technology of carbonation, and application of CO_2 in juice preservation.

Unit 4: 16 hours

Jams, jellies, marmalades, preserves and candied products, role of pectin, theory of jelly formation, strength of pectin. Fermented fruits and vegetables products. Chutneys, sauces, pickles and tomato products. Fruits and vegetables by-product and their utilization. By-products of fruits and vegetables industry; peel, pomace, oil, pectin, alcohol, enzyme and their utilization. Technology of mushroom: production, processing and its processed products.

Course outcome

1. Identify different maturity indices and post-harvest changes in fruits and vegetables and explain their post-harvest treatments.
2. Understand pre- processing operations of fruits and vegetables.
3. Attain knowledge about the processed products of fruits and vegetables.
4. Understand the production and processing techniques of mushroom.

Reference Books

1. Jongen, W. (2002). Fruit and vegetable processing: Improving Quality: Woodhead Publishing, Boca raton.
2. Thompson, A. K. (1996). Post-harvest Technology of Fruit and Vegetables: Blackwell, Australia.
3. Thompson, A. K. (2003). Fruits and Vegetables- Harvesting, Handling and Storage: Blackwell, Oxford.
4. Verma, L. R. & Joshi, V. K. (2000). Post-harvest Technology of Fruits and Vegetables: Indus, New Delhi.
5. Srivastava, R. P. & Kumar, S. (2001). Fruit and Vegetable Preservation– Principles and Practices (3 ed.): International Book distributing Co., Lucknow (India).

FOOD CHEMISTRY LABORATORY

Course code: FT 1.6 Credit: 0:0:2
Contact Hours: 16 L Examination: 50M

1. Safety measures in the Laboratory
2. Qualitative Tests of Carbohydrate (Molisch's Test, Fehling's Test, Benedict Test, Iodine Test)
3. Quantitative Determination of Carbohydrate by Phenol Sulphuric acid method
4. Isolation of starch from given sample.
5. Determination of total sugar/reducing sugar in food.
6. Determination of iodine value/acid value/saponification value of oil
7. Test for detection of different oils (Baudouin test, Halphens test, hexabromide test)
8. Estimation of lysine content
9. Determination of ascorbic acid by dye method
10. Determination of phosphorus/estimation of calcium
11. Estimation of tannins from food
12. Determination of total carotenoids

Course outcome

1. Enables to understand Qualitative and quantitative test of carbohydrates and proteins.
2. Enables to study Determination of macro and micro nutrients.
3. Enables to study Determination of iodine value, acid value and saponification values of oil.
4. Enables to understand Determination and estimation of phytochemicals.

FOOD MICROBIOLOGY LABORATORY

Course code: FT 1.7 Credit: 0:0:4
Contact Hours: 16 L Examination: 50M

1. Good Microbiology laboratory practices: Laboratory safety (Dos and Don'ts), hazard from chemicals, handling of cultures and chemicals, disposal of chemicals and cultures.
2. Introduction to different Glass wares used in Microbiology Laboratory and handling of different instruments and Equipment's used for culture and Sterilization.
3. Preparation of basic liquid (Nutrient broth) and basic solid media (Nutrient Agar and Potato Dextrose Agar), selective, differential media and enriched media (MacConkey Agar and Blood Agar). for cultivation of bacteria and fungi.
4. Serial Dilution.
5. Pure culture techniques used for isolation and purification of microorganisms - Streak plate method / Pour plate method / Spread plate method.
6. Bacterial Identification by simple staining procedure.
7. Bacterial Identification by Gram's staining.
8. Lactophenol Cotton Blue staining preparation for fungi.
9. Culture preservation techniques (Agar slants, stabs).
10. Determination of bacterial growth by turbidity measurements and to plot bacterial growth curve.
11. Evaluation of microbiological quality of commonly consumed street foods.
12. Preservation of potato/onion by UV radiation.
13. Isolation of Yeast from starchy Food samples.
14. Isolation of and Enumeration of Molds from Food Sample.
15. Isolation of Bacteria from Food Sample
16. Microbial Examination of Cereal and Cereal Products (Bread)
17. Microbiological Examination of Fruits and Vegetables.
18. Quantitative Analysis of Milk by Standard Plate Count Method
19. Microbial Examination of Canned Foods
20. Detection of Bacterial Spoilage of Canned Food
21. Determination of Thermal Death Point (TDP) of microorganism
22. Determination of Thermal Death Time (TDT) of microorganism
23. Detection of Escherichia coli and Coliform

Course outcome

1. Good microbiology laboratory practices and introduction to different glasswares / instruments /equipment's used in microbiology laboratory
2. Preparation of different media and its application
3. Different culture techniques for the isolation of microorganisms.
4. Enumeration and characterization of the microorganisms and preservation techniques of different food.

PRINCIPLES OF FOOD PROCESSING & PRESERVATION TECHNOLOGY LABORATORY

Course code: FT 1.8 Credit: 0:0:4
Contact Hours: 16 L Examination: 50M

1. Preparation of Soya milk.
2. Determination of moisture in Food samples.
3. Sterilization Methods
4. Determination of Hydration properties of Texture Vegetable Protein (TVP)
5. Detection of adulterants in food stuffs.
6. Preparation of Marmalade.
7. Preparation of jam and jelly.
8. Estimation of reducing sugar by Fehling's procedure
9. Estimation of salt content in brine
10. Estimation of salt content in butter
11. Estimation of iodine in salt.
12. Estimation of peroxide value of oils and fats.
13. Estimation of free fatty acids in ghee and oil.
14. Determination of water sample.
15. Study of microwave heating of foods.
16. Concept of shelf life of different foods.
17. To study the concept of Asepsis and sterilization.
18. Determination of pH of different foods using pH meter.
19. Study quality characteristics of foods preserved by drying/dehydration/ freezing.
20. To perform blanching of different plant foods.

Course outcome

1. Use of theories, principles and calculation for chemical reagents preparation to conduct the experiments.
2. Design and enhance the practical approaches in estimation of carbohydrates, proteins and salt content.
3. Formulate and evaluate the experimental methods used in Food preservation experiments.

II semester

BIOANALYTICAL TECHNIQUES (Hard core)

Course code: FT 2.1 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: 16 hours

Introduction to Bioanalytical technique. Basic Concepts of chemistry. Concept of Molal, Molar and Normality of solution. Concept and importance of pH and buffer solution. **Dynamics of biomolecules:** Diffusion, Laws of diffusion, Active transport, Facilitated diffusion, Osmosis, Osmotic pressure, Osmoregulation, Viscosity and biological importance, Surface tension, Factors influencing surface tension, Biological importance. Calculation of the energy content of foods - energy conversion factors and its importance. **Classical method of analysis:** Sampling techniques and data analysis, Proximate analysis: Moisture, fat (FFA, IV, PV and RM), Protein, fiber, carbohydrates, ash, starch, reducing and non-sugar, vitamins, minerals, density, specific gravity and other concept in food.

Unit 2: 16 hours

Spectroscopy: An introduction to absorption spectroscopy, photometry, beer lamberts law UV, visible, NMR, mass & IR spectrophotometry theory and instrumentation; introduction to advanced Spectroscopy with Principles and applications.

Unit 3: 16 hours

Separation Techniques: Chromatography and its Principle; types of chromatography (Ion Exchange, Affinity chromatography, GC, HPLC), Instrumentation and its applications with respect to food analysis. Electrophoresis: General principles, Support media, Electrophoresis of Nucleic acids- Agarose Gel Electrophoresis. Electrophoresis for proteins – SDS PAGE, Native PAGE, Gradient gel electrophoresis, Isoelectric focusing.

Unit 4: 16 hours

Microscopic Techniques: Light Microscopy; Fluorescence microscopy, Atomic force microscope, Electron microscope, Scanning electron microscopy, Transmission Electron microscope. Application of microscope in analyzing biological/Food samples. **Centrifugation**: Principles of centrifugation and components of Centrifuge. Different types of centrifuge and its applications with reference to food.

Course outcome

1. Students will be able to understand and explain the basic concepts of sample, collection, and handling along with chemical, and biological properties of carbohydrates.
2. The principle and concept of analysis of various food will make students to capable of understanding the food components and adulterants in food.
3. Student will understand the fundamental of the various separation methods and its operating principles of the various column and channel separation techniques.
4. Student will able to Comprehend the knowledge gained on characteristics and properties of foods. Student will acquire skills to estimate the nutrient analysis by different methods for various nutrients.

Reference Books

1. Katoch R. Analytical techniques in biochemistry and molecular biology. Springer Science & Business Media; 2011.
2. Ramachandran VS, Beaudoin JJ. Handbook of analytical techniques in concrete science and technology: principles, techniques and applications. Elsevier; 2000.
3. Sadasivam S. Biochemical methods. New age international; 1996.
4. Thimmaiah SK, Thimmaiah SK. Standard methods of biochemical analysis. Kalyani publishers; 2004.
5. Thimmaiah SR. Pigments. Standard methods of biochemical analysis; 2009.

FOOD BIOTECHNOLOGY (Hard core)

Course code: FT 2.2 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: 16 hours

Introduction to Food Biotechnology: Chemical structure of nucleic acids, proteins; Chemistry and Biology of DNA; Types of DNA; DNA replication, The genetic material and its organization in prokaryotes and eukaryotes. Central dogma of life (Genetic code, Transcription and translation in prokaryotes and eukaryotes). DNA repair mechanism; modifying enzymes; recombinant DNA technology; mutation and polymorphism and their detection.

Unit 2: 16 hours

Fermentation Technology: Principles of fermentation and Historical Back ground. Microbial Strain Improvement. Natural and synthetic media; Media formulations, Media sterilization, batch and continuous media sterilization processes; Sterilization of fermenter. Configurations and functions of batch, fed batch and continuous fermenters. Fermenter devices, Fermented food products: Lactic acid fermentation. Ethanol fermentation. Vitamin B-12 fermentation. Soya sauce fermentation. Fermented Dairy products. Wine and Beer fermentation. Vinegar fermentation. Bread making by yeast. Indian traditional foods, pickles, fermented vegetables, Mushroom cultivation. Oriental fermented products. Probiotics.

Unit 3: 16 hours

Microbial recombinant technology: Introduction to Genetic engineering. Gene Cloning Vectors for Bacteria and Yeast. Polymerase Chain Reaction (PCR), DNA Fingerprinting, Molecular Markers and their applications. Gene Cloning Vectors for Plants and Animals. Preparation of Desired DNA, Introduction of Recombinant DNAs into Host Cells (Different Gene Transfer Methods), Gene. Cloning Strategies, Selection (Screening) of Recombinants, Expression of Cloned Genes.

Unit 4: 16 hours

Advance Food Biotechnology Applications: Starter cultures–types, designing and development, micro encapsulation and packaging, scopes and challenge; development and formulation of novel products such as probiotic foods. Classification and application in food industry Ethical issues concerning GM foods: Testing for GMOs, current guidelines for production, release and movement of GMOs, labelling and traceability, trade related aspects, bio-safety, risk assessment, risk management, public perception of GM foods.

Course outcome

1. Able to acquire the knowledge of basics concepts of cell, genetics and biotechnological concepts
2. Basic Concepts and design of fermentation/fermenter for the production of various products.
3. Apply the biotechnology in the field of Biosensors and uses and application of enzymes in food industries.
4. Apply the fundamental concepts of nanotechnology in Food industries

Reference Books

1. Advances in Food Biotechnology – *Rai V. Ravishankar (Ed.)* (Wiley-Blackwell)
2. Food Biotechnology (various editions) – *Foster or Anthony Pometto & Kalidas Shetty* (Suggested in syllabus references)
3. Genetically Modified Organisms in Food: Production, Safety, Regulation and Public Health – *Ronald Ross Watson & Victor R. Preedy*
4. GMO Food: A Reference Handbook – *David E. Newton*
5. Introduction to Food Biotechnology – *Perry Johnson-Green*

FOOD ENGINEERING
(Hard core)

Course code: FT 2.3 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: 16 hours

Food Engineering Fundamentals: Introduction to food engineering: scope and importance. Dimensions, units, and systems of measurement. Reaction kinetics in food system, phase transition and transformations in food systems. Physical properties of foods: density, specific volume, porosity, viscosity. Rheological behaviour of foods: Newtonian and non-Newtonian fluids, fluid flow, fluid statics, fluid dynamics and fluid flow applications. Thermal properties of foods: specific heat, thermal conductivity, thermal diffusivity. Material and energy balances in food processing systems. Thermal Processing: Death kinetics, thermal death curve, decimal reduction time. Z- Factor, heat penetration curve, process time calculations, mathematical curve, mathematical and graphical solutions.

Unit 2: 20 hours

Food Engineering Unit Operations: Size reduction: principles, equipment, and applications. Mixing and blending of food materials. Heat transfer operations: conduction, convection, radiation. Evaporation and concentration of liquid foods, Heat and mass balance, steam economy, heat recovery, efficiency, process calculations. Drying and dehydration: principles, drying curves, equipment. Refrigeration and freezing systems in food processing. Mass transfer operations in food processing. Separation processes in food engineering. Filtration theory and filtration equipment. Constant rate and constant pressure filtration. Centrifugation and sedimentation. Membrane separation processes. Microfiltration, ultrafiltration and reverse osmosis. Food fortification technologies. Stability of nutrients during processing. Encapsulation principles, Microcapsule design, release mechanisms and application.

Unit 3: 16 hours

Food Plant Design and Process Engineering: Introduction to food plant design and process engineering, Types of food processing plants and layouts. Food process flow diagrams and process descriptions. Material flow, product flow and personnel flow in food plants. Selection of food processing equipment. Equipment sizing and capacity calculations, Utilities in food processing plants. Steam generation, boilers and steam distribution, Refrigeration systems and cold storage design, Compressed air systems and electrical requirements. Material handling systems in food plants. Conveyors, elevators, pumps and piping systems, Design of piping systems for food processing, Valves, fittings and flow control devices, Process engineering calculations. Mass and energy balance applications in plant design. Heat transfer equipment in food plants. Process control basics and instrumentation, Automation and control in food processing industries. Process flow diagrams for food industries.

Unit 4: **12 hours**

Enzymes in Food Processing: Introduction to enzymes: classification, properties, and sources, Factors affecting enzyme activity and stability. Enzyme immobilization techniques and advantages. fermentative production of enzymes (amylases, proteases, cellulases, pectinases, xylanases, lipases) used in food industry and their downstream processing. Applications of enzymes in food processing: Enzymes in cereal processing and baking, Enzymes in dairy processing (cheese, lactose hydrolysis, texture improvement), Enzymes in fruit and vegetable processing (juice clarification, maceration), Enzymes in meat, fish, and brewing industries, Role of enzymes in improving yield, quality, and shelf life of foods.

Course outcome

1. Able to understand basics concepts of food energy laws related to size reduction and familiarise with principles of fluid flow and basic unit operation principles of several food processing methods
2. Knowledge of psychometric would enable the students to evaluate and optimize the food storage conditions in food processing plants, regarding enzymes and their enzyme applications in processed food, fermentation and fermenters would enable the students to pursue their career in fermented food making industries.
3. Ability to explain the enzyme kinetics and the effects of different parameters on enzymes.
4. Understand the application of reactors and explain how enzymes act as biological catalysts and how they interact with specific substrate molecules.

Reference Books

1. Gustavo, V. B-C., & Ibarz, A. (2002). Unit Operations in Food Engineering: CRC Press.
2. Heldman, R & Daryl, B (2007). Handbook of Food Engineering (2nd ed.): CRC Press
3. J.C. Batty and S.L. Folkman, ‘Food Engineering Fundamentals’, John Wiley and Sons, New York, U.S.A.
4. J.C. Harper, ‘Elements of Food Engineering’, AVI, Westport, U.S.A.
5. Lozano, J. E (2000). Trends in Food Engineering.
6. R.L. Earle, ‘Unit Operations in Food Processing’, Pergamon Press Oxford, U.K.
7. R.T. Toledo, ‘Fundamentals of Food Process Engineering’, CBS Publishers, New Delhi, India.
8. Rao, D.G (2014). Fundamentals of Food Engineering: PHI Learning, Delhi

9. Saravacos, G. D., & Maroulis, Z. B. (2011). Food Process Engineering Operations: CRC Press, Boca raton.
10. Singh, R. P., & Heldman, D. R (2014). Introduction to Food Engineering (5th ed.): Academic Press, New Delhi.
11. Smith, P.G (2011). Introduction to Food Process Engineering (2nd ed.): Springer, New York
12. Stavros Yanniotis (2008). Solving Problems In Food Engineering; Springer, New York
13. Toledo, R.T. (2007). Fundamentals of Food Process Engineering (3rd ed.): Springer, New York.

NUTRITION AND THERAPEUTIC FOODS (Soft core)

Course code: FT 2.4 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: 16 hours

Introduction to Nutrition: Concept of nutrition; relationship between nutrition and health; adequate and optimum nutrition; malnutrition; geriatric nutrition; **Recommended Dietary Allowances (RDA) –** formulation and dietary guideline references for men, women, and adults, including the adult composition unit. **Energy in Human Nutrition:** Concept of energy and its units; energy balance; assessment of energy requirements with reference to deficiency and excess; determination of energy in foods; basal and resting metabolism (BMR and RMR), their regulation, and specific dynamic action (SDA) of food; total energy requirement and its modification under normal physiological conditions and during stress. **Nutrition and Health Agencies:** Role of national and international agencies in promoting community nutrition and health, including UNICEF, FAO, WHO, CARE, National Institute of Nutrition (NIN), Central Food Technological Research Institute (CFTRI), and Indian Council of Medical Research (ICMR).

Unit 2: 16 hours

Growth monitoring and promotion: Somatic, physical, brain and mental development, puberty, menarche, prepubertal and pubertal changes. **Nutrition during pregnancy, lactation and Lactation period:** Pregnancy: Physiological adjustments, Nutritional requirements, Nutritional status of Indian pregnant women. Effect of malnutrition on outcome of pregnancy. Lactation: physiology of lactation, Factors affecting lactation, nutritional requirements. Effect of lactation on maternal malnutrition and fertility.

Unit 3: 16 hours

Growth development from Infancy, pre-school age to adulthood: Factors affecting growth and development; Importance of nutrition for ensuring growth and adequate development. Growth monitoring and promotion; Use of growth charts, standards and prevention of growth faltering. **Infancy:** Feeding pattern, compositional differences between human milk and milk substitute and their suitability for infant feeding, importance of breast feeding over artificial feeding, weaning practices, weaning and supplementary foods. **Preschool age:** Growth and development, nutritional requirements, special care in feeding them, nutritional problems specific to this age. **School age and adolescent children:** Growth and development, nutritional requirements, special care in feeding schoolers, nutritional problems specific to this age. **Nutritional requirements:** young adults, adult population and elderly people, common nutritional problems.

Unit 4: **16 hours**

Dietary planning and diet therapy: Weights and Measures. Nutritional Assessment. Nutritional care process. Nutritional intervention: Objectives of diet therapy, Therapeutic modification of the normal diet: diet prescription. **Routine Hospital diet** - regular diets, clear fluid diet, full fluid diet, soft diet, modifications of food and nutrient intake, Enteral nutrition, parenteral nutrition, Refeeding syndrome, Transitional feeding. **Medical and nutritional care record types and uses,** Format for medical and nutrition charting and documentation record. **Food- Drug Interaction:** Effect of Food on Drug Therapy. **An overview of digestion and absorption of food** – Role of enzymes in digestion, regulators of gastrointestinal activity, hormonal mechanisms, digestive process, absorptive mechanisms, digestion and absorption of nutrients, factors affecting digestion.

Course outcome

1. Acquire knowledge on concept of nutrition, health benefits, food formulations, energy balance and deficiency, BMR and RMR and its regulation.
2. Able to learn growth monitoring and promotion, Nutrition during pregnancy, lactation and lactation period.
3. Learn about growth development from infancy, pre-school age and adulthood.
4. Able to gain knowledge on concept concepts of dietary planning and diet therapy.

Reference Books

1. A Comprehensive Textbook of Applied Nutrition and Dietetics – Dharsan Sohi – 3rd Edition — Applied approach to nutrition science relevant to therapeutic foods and clinical settings.
2. Antia F.P. And Philip Abraham (2001) Clinical Nutrition and Dietetics, Oxford Publishing Company, New Dellhi.
3. Clinical Nutrition and Dietetics – F.P. Antia & Philip Abraham
4. 4th Edition (Oxford Publishing) — Traditional and widely used reference in clinical therapeutic nutrition.
5. Clinical Nutrition Handbook – Anita Jatana – 2022 Edition (Jaypee Brothers Medical Publishers) — Practical text focusing on clinical nutrition assessment and diet therapy.
6. Dietetics – B. Srilakshmi – Latest Edition (e.g., 9th Edition, New Age International) — Covers nutrition principles, therapeutic diets, life cycle nutrition and disease-specific dietary management.

7. Esther A. Winterfeldt, Margret L. Bogle,LeaL.Ebro.(2011). Dietetics: Practice& Future Trends. Third Edition. Jones and Barlet Publishers.UK.
8. Garrrow J.S, James W. P.T, Ralph A, (2000), Human Nutrition and Dietetics, 10th edition, Churchill Livingston, London.
9. Human Nutrition and Dietetics – Passmore & M.A. Eastwood – Edition varies — Strong foundational and clinical nutrition text.
10. Krause's Food, Nutrition & Diet Therapy – L. Kathleen Mahan & Sylvia Escott-Stump – 11th Edition (W.B. Saunders) — One of the most comprehensive global references on therapeutic nutrition and diet planning.
11. Normal and Therapeutic Nutrition – Robinson, Lawler, Chenoweth & Carwick – 17th Edition (Macmillan) — Covers normal nutrient requirements and therapeutic modifications.

ADVANCES IN FOOD PROCESSING TECHNOLOGIES
(Soft Core)

Course code: FT 2.5 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: **16 hours**

Membrane Technology: Pressure activated membrane processes: Microfiltration, Ultrafiltration, Nanofiltration, Reverse Osmosis and Electrodialysis and their industrial application. Membrane distillation. **Supercritical fluid extraction (SCFE):** Concept, properties of super critical fluids, extraction methods, application in food processing**. Microwave and Radio Frequency Processing:** Advantages of microwave and radio frequency processing, mechanism of heat generation, application in food processing, microwave blanching, sterilization and finish drying. **Hurdle technology:** Concept and principle, preservation techniques as hurdles and their principles, hurdle technology for foods.

Unit 2: **16 hours**

Recent Technologies in Food Processing: High Pressure Processing: Concept, equipment for HPP treatment, mechanism of microbial and enzyme inactivation and its application in food processing, effect on food constituents. Ultrasonic processing: Properties, types of equipment, and applications. Cryo-processing of foods. Nanotechnology: Principles and applications in foods. Irradiation: Source, Dose, Direct and indirect effects responsible for death/inactivation of microorganisms, Effect on foods, Technological challenges and limitations. Principle and application of high intensity light, pulsed electric field, ohmic heating, IR heating, inductive heating, cold plasma in food processing and preservation.

Unit 3: **16 hours**

Innovative Packaging Technologies: Active and intelligent packaging: Active packaging and intelligent packaging techniques, current use of novel packaging techniques. Oxygen, ethylene and other scavengers: Oxygen scavenging technology, selecting right types of oxygen scavengers; ethylene, carbon dioxide and other scavengers. Antimicrobial food packaging: Antimicrobial agents, constructing antimicrobial packaging systems, factors affecting the effectiveness of antimicrobial packaging. Non-migratory Bioactive Polymers (NMBP): Advantages of NMBP; inherently bioactive synthetic polymers: types and application; polymers with immobilized bioactive compounds and their applications.

Unit 4: **16 hours**

Time temperature labels and indicators (TTIs): Defining and classifying TTIs, Application of TTIs to monitor shelf life. Self heating/rehydrating packages. Freshness indicator in packaging: Compounds indicating the quality of packaged food products, freshness indicators, pathogen indicators, other methods for spoilage detection. Green Plastics for Food Packaging: Problems of plastic packaging wastes, range of biopolymers,

developing novel biodegradable materials. Edible Films and Coatings: Properties, types, sources, applications, advantages, disadvantages, theories of plasticization, challenges and opportunities.

Course outcome

1. Students would be able to analyze the advanced technologies of food processing and describe their principles, applications, and potential in modern food processing.
2. Students would be able understand the advanced packaging technologies involved in food processing.
3. Students can understand innovative packaging technologies and their application.

References Books

1. Gould GW, 2000. New Methods of Food Preservation, CRC Press
2. Barbosa-Canovas, 2002. Novel Food Processing Technologies, CRC Press
3. Sun DW, 2015. Emerging Technologies for Food Processing, Elsevier Ltd.
4. Nema PK, Kaur BP and Mujumdar AS, 2018. Drying Technologies for Foods: Fundamentals and Applications, CRC Press.
5. Ahvenainen R, 2001. Novel Food Packaging Techniques, CRC Press
6. Han J and Han J, 2005. Innovations in Food Packaging, Academic Press
7. Yam K and Lee D, 2012. Emerging Food Packaging Technologies, Woodhead Publishing.

FOOD PACKAGING AND QUALITY ASSESSMENT (ELECTIVE)

Course code: FT 2.6 Credit: 2:0:0
Contact Hours: 32 L Internal Assessment: 10M Examination: 40M

Unit 1: **11 hours**

Food Packaging Technology: Introduction, Packaging operation, package functions and design, Deteriorative changes in foodstuff and packaging methods for prevention, shelf life of packaged foodstuff, methods to extend shelf- life. Principle in the development of protective packaging. Food packaging materials: Properties, primary and secondary packaging materials, Use of biodegradable packaging and active packaging materials.

Unit 2: **11 Hours**

Process of packaging: Material handling, filling, air removal, sealing, retorting, Modified atmosphere packaging, vacuum and gas packaging. Package sterilization techniques, cushioning, unitizing, palletizing, stacking and containerization. Evaluation of packaging materials and package performance, packaging equipments. Food Labelling and Bar coding. Food Safety and standards (Packaging and Labelling) regulation.

Unit 3: **10 hours**

Food safety, Quality and Assurance: Quality assessment of food materials on the basis of sensory evaluation, Physical, chemical microbiological methods, **Role of QC and QA:** Definition, Concepts and functions in food industries. GMP, GHP, HACCP (Principles, implementation), Total quality management system, Difference between TQM and ISO 9000, TQM process in Small scale enterprises.

Course outcome

1. The students would become familiar with various novel packaging techniques and can provide their technical skills in the food package manufacturing industry.
2. Students can analyze and select appropriate packaging materials and methods and evaluate packaging performance, equipment, and regulatory requirements related to food labeling and standards.

Reference Books

1. Amihud Kramer, Bernard A. Twigg, 2017: Quality control for the food industry, Fundamentals & Applications, Volume 1, 3rd Edition, Medtech Scientific International Ltd., Kolkata.
2. Dev raj, Rakesh Sharma and V K Joshi, 2011: Quality control for value addition in food processing, Newindia publishing agency, Pitam Pura, New Delhi.

3. Marcus Karel, Owen R. Fennema, Daryl B. Lund: Physical principles of food preservation. New York, Basel Dekker, 1975.

BIOANALYTICAL TECHNIQUES LABORATORY

Course code: FT 2.7 Credit: 0:0:4
Contact Hours: 16 L Examination: 50M

1. Concept of solution preparation (Normality, Molarity).
2. Preparation of various buffer solutions.
3. Concept of diffusion and osmosis.
4. Verification of Beer-lambarts law.
5. Importance of sampling and techniques of sampling.
6. Determination of starch and pectic substances using different methods.
7. Estimation of nucleic acid using UV-visible spectrophotometer.
8. Estimation of protein using UV-visible spectrophotometer
9. Separation techniques: Paper/thin chromatography for pigments.
10. Sedimentation Co-efficient of different biomolecules.
11. Estimation of antinutritional factors.
12. Proximate analysis of Green leafy vegetable.
13. Determination of food adulterations/additives
14. Rheological properties of foods.

Course outcome

1. Pupil will Acquire knowledge on Standard solutions and the various buffer solutions.
2. Student will able to Perform quantitative, qualitative analysis and interpret analytical results of food.
3. Learner will acquire competences to use different instruments like calorimeter, UV-Visible Spectrophotometer, Chromatographic separation, HPLC, Gas chromatographic analyzer, Rheology.
4. Acquire skills to estimate the nutrient analysis by different methods for various nutrients.

FOOD BIOTECHNOLOGY LABORATORY

Course code: FT 2.8 Credit: 0:0:4
Contact Hours: 16 L Examination: 50M

1. Isolation of genomic DNA (plant / animal/ microbial sources – any one).
2. Production of different kinds of wine in the Laboratory (Demonstration)
3. Microbial production (demonstration) and quantitative estimation of citric acid
4. Estimation of unfermented sugar in the fermented sample.
5. Estimation of percentage of alcohol in the fermented sample
6. Estimation of citric acid by titrimetric method.
7. Determination of acidity of milk by titrimetric method.
8. Mushroom cultivation.
9. Single cell production
10. Visit to different industries (Mushroom, Spirulina, Honey, Jam and Jellies)
11. Visit to Beverages Industries/Cool drinks industries

Course outcome

1. Use of theories, principles and calculation for chemical reagents preparation to conduct the experiments.
2. Design and enhance the practical approaches in plant biotechnology.
3. Design and enhance the practical approaches in estimation of sugar, alcohol and citric acid.
4. Design and enhance the practical approaches in synthesis of nanomaterials and applications.

FOOD ENGINEERING LABORATORY

Course code: FT 2.9 Credit: 0:0:4
Contact Hours: 16 L Examination: 50M

1. Determination of Relative Viscosity and Absolute Viscosity of Sample Using Ostwald Viscometer
2. Determination of Surface Tension of given liquid using Stalagmometer
3. Psychrometry in Food Industries.
4. Determination of Cooking properties of Parboiled and Raw rice
5. Determination of average size of flour by Sieve analysis
6. Determination of rehydration ratio of dehydrated foods
7. Food Extruders.
8. Evaporators used in Food Industries
9. Identification of Enzymes in different sources
10. Isolation of enzymes from different sources
11. Determination of α-Amylase enzyme activity
12. Effect of a) pH b) temperature on activity of Amylase enzymes
13. Effect of substrate concentration on enzyme activity
14. Immobilization of amylase by entrapment method
15. SDS – PAGE
16. Food plant design and visit to food processing plants
17. Determination of moisture content (hot-air oven method)
18. Particle size distribution and sieve analysis
19. Rheological properties of food materials
20. Driers used in Food industries- Fluidized bed driers, Spray driers
21. Clarification of juices using enzymes
22. Heat transfer analysis in food processing

Course outcome

1. Use of food engineering theories, principles and calculation for chemical reagents preparation to conduct the experiments.
2. Design and enhance the practical approaches infiltration, drying, food dehydration techniques and encapsulation procedures.
3. Formulate and evaluate the experimental methods used in the productions of enzymes (amylases, proteases, celluloses, pectinases, lipases) experiments,
4. Experiments designed on role of enzymes, flavours in food processing industry, and be able to apply the scientific method to the processes of experimentation.

III semester

FOOD PRESERVATIVES, PACKAGING AND RESEARCH METHODOLOGY (Hard core)

Course code: FT 3.1 Credit: 4:0:0

Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: 16 hours

Food Preservatives: Introduction to Food Preservatives: Definition and importance of food preservation. Types of Food Preservatives Natural preservatives: Salt, sugar, vinegar, alcohol, citric acid, ascorbic acid, Chemical preservatives: Benzoates, sorbates, propionates, sulphites, nitrites and nitrates, Antioxidants: BHA, BHT, TBHQ, sodium erythorbate, antimicrobial agents and chelating agents. Mechanism of action of preservatives, Role of preservatives in shelf-life extension. Applications of preservatives in different food products. **Harmful Effects of Food Preservatives:** Toxicological concepts: ADI, NOAEL, chronic vs acute toxicity. Health effects of major preservatives: Benzoic acid and benzoates, Sulphur dioxide and sulphites, Nitrites and nitrates, BHA, BHT and synthetic antioxidants, Parabens and sodium dehydroacetate. Allergic reactions, carcinogenicity, mutagenicity and metabolic effects. Impact on children, pregnant women and sensitive population.

Unit 2: 16 hours

Food Packaging Technology: Introduction to food packaging: Definition, objectives, functions and roles of food packaging, Packaging design and development, Packaging environment, Factors influencing the selection of packaging. Packaging materials and their properties: Paper: pulping, fibrillation and beating, types of papers, paper boards, corrugated fibre board, Glass: composition, properties, types of closures, methods of bottle making; Metals: types of cans, tin and aluminium based cans, lacquers; Plastics: Polyethylene, polypropylene, polyester, polyamides, polycarbonates and vinyl polymers used in packaging, their chemical structure and properties. Manufacture of flexible films: Blown film extrusion, cast film extrusion, film orientation process, co-extrusion process, conversion process. Container manufacture - sheet thermoforming, injection moulding. Different forms of packaging: Rigid, semi rigid and flexible, Liquid and powder filling machines; bottling machines, Form fill seal and multilayer aseptic packaging machines, vacuum packs unit, shrink pack unit, tetra-pack unit.

Unit 3: 16 hours

Testing of packaging materials: Mechanical properties such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, bond strength, heat seal strength, Cobb's value, their methods of testing and evaluation. Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement, prediction of shelf life of foods using different packaging materials. Transport worthiness tests: Drop test, vibration test, compression strength and rolling test. Migration from packaging materials: Overall and specific migration, physical

process, partition coefficient and sorption process, determination of migration, food simulants, flavour adsorption and sorption, packaging flavour interaction, factors affecting flavour absorption, role of food matrix, flavour modifications and food quality. Recent trends in food packaging: Vacuum packaging, controlled atmospheric packaging (CAP), modified atmospheric packaging (MAP), gas packing, bioplastics in food packaging, aseptic packaging, retort pouch packaging, microwave packaging, biodegradable packaging, active packaging, intelligent packaging, smart packaging, edible packaging, shrink and stretch packaging. **Role of packaging in food marketing:** aesthetic and graphic design; Coding and marking; nutrition labelling, Traceability: RFID tag, bar coding, QR code. Packaging Laws and regulations: safety aspects of packaging materials, Environmental & Economic issues, recycling and waste disposal

Unit 4: **16 hours**

Research Methodology: Meaning, objectives and scope of research. Motivation and importance of research in food technology. Characteristics of scientific research. Criteria of good research. Types of research. Scientific thinking and research process. Identification and selection of research problems. Sources of research problems in food science and technology. Defining, stating and evaluating a research problem. Review of literature: purpose, need and significance. Sources of scientific literature. Organization and application of literature review. Research hypothesis: concept, definitions and importance. Nature, functions and types of hypotheses. Research approaches. Qualitative research methods. Quantitative research methods. Criteria for selection of appropriate research approach. Research design and experimental planning. Sampling techniques and sampling design. Measurement and data collection methods. Data analysis. Interpretation of research data. Referencing and citation methods. Scientific writing and publication practices. Dissertation and thesis writing. Research ethics and plagiarism. Importance of plagiarism checking tools.

Course outcome

1. The knowledge of advance techniques in food processing preservation would help the students to develop novel food products with improved quality characteristics.
2. Knowledge of harmful food preservatives would make the students acquainted with the scientific and technical know-how use, reduce or eliminate food preservatives
3. during different types of food production.
4. The students would become familiar with various novel packaging techniques and can provide their technical skills in the food package manufacturing industry.
5. The students would be able to use statistical tools during prediction and solve the problems arising in food industries.

Reference Books:

1. Ahvenainen, R. (Ed.) 2003, Novel Food Packaging Techniques, CRC Press.
2. Coles, R. & Kirwan, M. (2011). Food and Beverage Packaging Technology (2nd ed.): Wiley Blackwell, UK.
3. Eiri Board of Consultants. (2007). Food Packaging Technology: Engineers India Research Institute, New Delhi.
4. Han, J.H. (Ed.) 2005, Innovations in Food Packaging, Elsevier Academic Press.
5. Mahadeviah M & Gowramma RV. 1996. Food Packaging Materials, Tata McGraw Hill. 2. Gowariker, V.R., Viswanatahan, N. V, Sreedhar, J. 1986, Polymer Science, New Age International (P) Ltd, New Delhi.
6. Robertson, G. L. (2006). Food Packaging: Principles and Practice (2nd ed.): CRC Press, Boca raton. 10. Piringer, O. P. & Baner, A. L. (2000). Plastic Packaging Materials for Food: Wiley-VCH, Weinheim
7. Rooney, M.L. (1995). Active Food Packaging: Blackie Academic & Professional, Glasgow, UK.
8. Yam, K. L, Lee, D. S. (Ed.), 2012, Emerging Food Packaging Technologies: Principles and Practice, Woodhead Publishing Ltd.

DAIRY TECHNOLOGY (Hard core)

Course code: FT 3.2 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: 16 hours

Evolution and scope of dairying: Indian and global perspectives, Dairy education and research in India, Global dairy industry scenario: production, trade, and future trends, Milk: definition, sources, and factors affecting composition, Physico-chemical properties of milk: pH, buffering capacity, redox potential, Optical, rheological, and interfacial properties, Milk constituents: Proteins (casein micelles, whey proteins), Milk fat and fat globule membrane, Lactose, minerals, enzymes, and bioactive components, Gel formation and coagulation phenomena.

Unit 2: 16 hours

Dairy microbiology: enumeration of bacteria, yeasts, and molds, Milk quality standards and safety regulations, Thermal processing principles and kinetics, D-value, Z-value, F_0-value, Q_{10} concept, Thermization and lactoperoxidase system, Pasteurization (LTLT, HTST, ESL milk), UHT processing: direct and indirect systems, modern UHT plant design, Bactofugation and homogenization, Non-thermal processing technologies, Packaging of milk and milk products: materials, functions, and shelf-life.

Unit 3: 16 hours

Special milks: toned, double toned, recombined, fortified and functional milks, Fermented dairy products: dahi, yoghurt, lassi, acidophilus milk, Starter cultures and probiotics, Fat-rich dairy products: cream, butter, ghee, Condensed and dried dairy products, Cheese: classification, manufacture of cheddar, cottage and processed cheese, Frozen dairy products: ice cream manufacturing methods, Indigenous dairy products: paneer, khoa and khoa-based sweets, Defects in milk and milk products, Marketing strategies for dairy products in India.

Unit 4: 16 hours

Hygienic design of dairy plant buildings and equipment: Cleaning-in-Place (CIP) and sanitation practices, Preventive maintenance and plant hygiene, Dairy plant waste disposal and effluent treatment, Whey utilization and sustainable dairy practices, Membrane technologies: MF, UF, NF, RO, Conventional and emerging dairy pathogens, Biosensor-based detection of contaminants, Digital traceability and quality monitoring systems, Types and applications of starter cultures and DVS cultures.

Course outcome

1. Able to know the Dairy Education & Research in India and properties of the milk.
2. Able to understand the techniques involved in processing, quality assurance of milk and packaging of milk.

3. Students are able to know different types of milk, milk products and marketing strategies in India.
4. Able to know the sanitary aspects of dairy plant.

Reference Books

1. Bylund G. Dairy processing handbook. Tetra Pak Processing Systems AB; 2003.
2. De, Sukumar. Outlines of dairy technology. 16 edition; 2009.
3. Jenness R & Patton S. Principles of Dairy Chemistry. John Wiley & Sons. 1969.
4. Robinson RK. Modern dairy technology: Volume 2 advances in milk products. Springer Science & Business Media; 2012.
5. Walstra P & Jenness R. Dairy Chemistry and Physics. John & Wiley. 1984.

PROCESSING TECHNOLOGY OF MEAT, POULTRY AND FISH
(Hard core)

Course code: FT 3.3 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: **16 hours**

Meat: Sources of meat and meat products in India, its importance in national economy. Selection of animals for slaughtering, ante-mortem inspection, grading and safety protocols. Effect of feed, breed and management on meat production and quality. Chemical composition and muscle structure, post-mortem muscle chemistry; meat colour and flavors; meat microbiology and safety. Modern abattoirs/ meat plants, typical layout and features, stunning methods; Slaughtering of animals and poultry. Steps in slaughtering and dressing; offal handling and inspection; operational factors affecting meat quality: Rigor mortis, pH changes, colour changes, effects of processing on meat tenderization. Meat quality evaluation, inspection, grading of meat. Mechanical deboning, Meat plant sanitation and safety, By-product utilization.

Unit 2: **16 hours**

Chilling and freezing of carcass and meat/poultry; factors responsible for effective chilling and freezing, importance of cold chain facilities, quality changes during chilling and freezing, cold shortening, ripening, DFD and PSE, Factors affecting post-mortem changes - properties and shelf-life of meat. Processing of meat – pickling, curing and smoking; thermal and non-thermal processing. methods of preservation – retort processing, different dehydration techniques, high pressure processing, hurdle processing and irradiation. Restructured and designed meat products. Intermediate moisture and dried meat products; meat plant hygiene – GMP and HACCP; Packaging of meat products.

Unit 3: **16 Hours**

Poultry: Classification, composition, preservation methods and processing. Poultry industry in India, measuring the yields and quality characteristics of poultry products, microbiology of poultry meat, spoilage factors; Layout and design of poultry processing plants, Plant sanitation; Poultry meat processing operations, equipment used – Defeathering, bleeding, scalding; Packaging of poultry products, refrigerated storage of poultry meat and by-products. Structure, composition, nutritive value and functional properties of eggs and its preservation by different methods. Processing of egg products. Factors affecting egg quality and measures of egg quality. Packaging of eggs, egg products, Whole egg powder, Egg yolk products, their manufacture, packaging and storage.

Unit 4: **16 Hours**

Fish: Types of fish, composition, structure, post-mortem changes in fish. Handling of fresh water fish. Canning, smoking, freezing and dehydration of fish. Preparation of fish products,

fish sausage and home makings. Commercially important marine products from India; product export and its sustenance; basic biochemistry and microbiology; preservation of postharvest fish freshness; transportation in refrigerated vehicles; deodorization of transport systems; design of refrigerated and insulated trucks; grading and preservation of shell fish; pickling and preparation of fish protein concentrate, fish oil and other byproducts. Alternative Protein: Lab grown/cultivated meat.

Course outcome

1. Understand the present and future scenario of meat, poultry and fish products in India and abroad.
2. Students will have learnt about chemistry, various processing and preservation methods used for meat, fish, poultry and eggs.
3. Understand and identify the specific processing technologies used for meat, fish and poultry products.
4. Understand the safety standards in relation to meat, poultry and fish products.

Reference Books:

1. Bremner H. 2002. Safety and Quality Issues in Fish Processing. Publishing, CRC Press, Boca Raton, New York.
2. Fidel Toldrá. 2010. Handbook of Meat Processing. Blackwell Publishing, USA.
3. Hui YH. 2001. Meat Science and Applications. Marcel Dekker. 32
4. Kerry, Kerry & Ledward. 2002. Meat Processing, Wood head Publishing, CRC Press, Boca Raton, New York.
5. Lawrie, R.A. 2006. Meat Science, 7th Edn. Pergamon Press, Oxford UK.
6. Legarreta IG & Hui Y.H. 2010. Handbook of Poultry Science and Technology, Wiley Publications.
7. Mead G. 2004. Poultry Meat Processing and Quality, Wood head Publishing, CRC Press, Boca Raton, New York.
8. Pearson A. M and Dutson T. R. 1995. HACCP in Meat, Poultry, and Fish Processing. Springer Science + Business Media Dordrecht, U.K.
9. Pearson AM & Gillett TA. 1996. Processed Meat. 3rd Ed. Chapman & Hall.
10. Stadelman WJ &Cotterill OJ. 2002. Egg Science and Technology. 4th Ed. CBS publications, New Delhi.
11. Stadelmen, W.J. and Cotterill, O.J., 1995. Egg. Science and Technology. Fourth Edition. by CRC Press.

POST HARVEST MANAGEMENT (Soft core)

Course code: FT 3.4 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: 16 hours

Postharvest Management of fruits and vegetables: Importance and scope of postharvest management of fruits and vegetables, post-harvest losses, pathological disorders in fruits and vegetables-types, symptoms, control measures. Role of plant growth regulators in postharvest management. Pre- harvest factors influencing postharvest life of crops. Browning: - enzymic browning non enzymic browning, its prevention. General steps in processing of fruits and vegetables. Methods of storage-precooling, pre storage treatments, low temperature storage, controlled atmosphere storage, hypobaric storage, irradiation and low-cost storage structures, Advanced technologies for post-harvest management of fruits and vegetables.

Unit 2: 16 hours

Postharvest Management of Cereals: Introduction to post harvest technology of cereals; need, scope and importance. Introduction to various post-harvest operations. **Rice:** structure and composition, parboiling of rice, milling of rice, product and byproducts of rice milling, Value addition of rice: processed, fermented and extruded products. **Wheat**: structure and composition, production, varieties and their quality. Cleaning, conditioning and milling of wheat. Malting of cereals, detection of gluten. **Oat:** structure, composition, nutritive value, preparation of oat meal and oat flakes. **Sorghum:** structure, composition, processing and milling of sorghum and its uses. Food grain storage: principles and parameters affecting during storage. Fumigation-principles, properties and applications. Rodenticides for rats and mice. **Millet:** processing and food uses. **Pseudocereals:** origin, production and processing.

Unit 3: 16 hours

Postharvest Management of Pulses and Oilseeds: Introduction, post-harvest losses and prevention. Structure and composition of pulses, toxic constituents in pulses, Harvesting, pre drying, threshing, drying, processing of pulses- soaking, germination, decortications, cooking and fermentation. Milling of pulses, Dry milling, Wet milling, Improved milling method. Marketing of pulses-quality standards, packing, adulteration. **Oilseeds:** Introduction, Applications of oilseeds and oil seed meals. nutritional factors of oil seeds and legumes, cooking characteristics, processing methods. Extraction of oil and refining, Fats and oils: Properties, manufacture, uses in food systems. Byproducts of pulse and oil milling and their value addition. Rancidity- types, mechanism and prevention.

Unit 4: 16 hours

Postharvest Management of Spices: Introduction, classification of spices, Production and

processing of black pepper, cardamom, ginger, turmeric, chilli, clove, cinnamon and their value addition. Production and processing of minor spices - ajwain, coriander, cumin, fenugreek, garlic, mustard, mace and nutmeg, onion, saffron, tamarind, mint, vanilla, asafoetida. Extraction techniques for spice oil and oleoresins. Spices and spice blends, antioxidant activity of spices, microbiological aspects and sterilization of spices, storage of spices and spice extractives. quality control; fumigation and irradiation of spices.

Course outcome

1. The students would be acquainted with the post harvesting processing of the fruits and vegetables.
2. The students would be acquainted with knowledge of processing and milling technologies of cereals.
3. The students would get opportunity to render their services in processing and quality control aspects of oil and oil products processing industries.
4. The students would be acquainted with knowledge of Spice production and processing technologies.

Reference Books

1. Edible oil Technology by A. P. Bhatnagar and Daljit Singh.
2. Food Quality Control: History, Present and Future. In book: Scientific, Health and Social Aspects of the Food Industry. By: Nnemeka Ihegwuagu and Martins O Emeje (2012)
3. Fruit and Vegetable Preservation: Principle and Practices by R.P. Srivastava and Sanjeev Kumar.
4. Handbook of Cereal Science and Technology. Kulp K & Ponte GJ. (2000) 2nd Ed. Marcel Dekker.
5. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Crops by N Kumar
6. Minor Spices and Condiments: Crop Management and Post Harvest Technology by J.S. Pruthi.
7. Oil seed Processing Technology by Shukla, Shrivastva and Gupta
8. Post-Harvest Technology of Fruits and Vegetables by A.K. Thompson
9. Postharvest: An Introduction to the Physiology and Handling of fruit and vegetables, Wills, R. B. H. (1996)

PROCESSING TECHNOLOGY OF SPICES AND PLANTATION CROPS (Soft Core)

Course code: FT 3.5 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: 16 hours

Introduction to Spices and Herbs: Status and scope of spice processing industries in India; spices, herbs and seasonings: classification on the basis of origin and physical characteristics. **Major spices:** Post-harvest technology; processed products of ginger, chilli, turmeric, onion, garlic, pepper and cardamom. **Minor spices,** herbs and leafy vegetables: all spice, sweet basil, caraway seed, cassia, cinnamon, clove, coriander, cumin, dill seed, nutmeg, mint, rose merry, saffron, sage. Spice quality evaluation, criteria for assessment of spice quality. Effect of processing on spice quality, contamination of spices with micro-organisms and insects. Spice Essential Oils: methods of extraction, isolation, and encapsulation; Spice Oleoresins: method of extraction, isolation, separation equipment.

Unit 2: 16 hours

Cocoa Processing: Cocoa, chemistry of the cocoa bean, analysis of cocoa beans, processing of raw bean, changes taking place during fermentation of cocoa beans. Processing of cocoa beans: cleaning, roasting, alkalization, cracking and fanning; nib grinding for cocoa liquor; cocoa butter and cocoa powder; chemical changes during various stages of processing. Chocolate Manufacture: Types of chocolates, ingredients, chemistry of chocolate manufacture. Mixing, refining, conching, tempering, moulding, etc. to obtain chocolate slabs and chocolate bars. Dark, milk and white chocolate and their manufacturing processes. Quality evaluation, packaging and storage of chocolates.

Unit 3: 16 hours

Tea: Occurrence, chemistry of constituents; harvesting; types of tea - green, oolong and CTC; chemistry and technology of CTC tea; manufacturing process for green tea and black tea manufacture; instant tea manufacture; quality evaluation and grading of tea. **Coffee:** Occurrence, chemical constituents; harvesting, fermentation of coffee beans; changes taking place during fermentation; drying; roasting; process flow sheet for the manufacture of coffee powder; instant coffee technology; chicory chemistry; quality grading of coffee, standards and specifications of coffee products, de-caffeinated coffee and coffee brew concentrate.

Unit 4: 16 hours

Introduction to quality attributes of food: Appearance, flavour, textural factors and additional quality factors. Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami. Gustation & Taste perception: Structure and physiology of taste organs- tongue, papillae, taste buds, salivary glands. Mechanism of taste perception, Factors affecting taste

quality & evaluation methods foe sensory analysis, Estimation of colour of food by visual /instrumental means.

Course outcome

1. Summarize the chemistry and processing steps of tea, coffee, cocoa and their products and evaluate the processing parameters.
2. Understand the exact maturity indices and optimal harvesting methods to maximize the yield of active compounds.
3. Analyze the defects in chocolate and propose corrective measures.
4. Understand the quality attributes and sensory evaluation of foods.

Reference Books

1. Banerjee B. 2002. Tea Production and Processing. Oxford Univ. Press.
2. Minifie BW. 1999. Chocolate, Cocoa and Confectionery Technology. 3rd Ed. Aspen Publ.
3. NIIR. 2004. Handbook on Spices. National Institute of Industrial Research Board, Asia Pacific Business Press Inc.
4. A Chakraverty et al., Handbook of Postharvest Technology, Marcel Dekker (2003).
5. DA Patil, Spices and Condiments: Origin, History and Applications. Astral Publishing House (2013).
6. JG Woodroof *et al.,* Hand Book of Sugars for Processors, Chemists and Technologists. AVI Publication (1973).

NUTRACEUTICALS (ELECTIVE)

Course code: FT 3.6 Credit: 2:0:0
Contact Hours: 32 L Internal Assessment: 10M Examination: 40M

Unit 1: 12 hours

Introduction to Nutraceuticals and Phytonutrient: Definition, concept, history and market; Classification of nutraceuticals Functional foods, pre and probiotics. Free radical scavengers, biological role of Antioxidant molecules. Mechanism and biological role of antioxidant molecules. Antioxidant enymes, selenoenymes and seleno-compounds. Antioxidants as radioprotectors.

Unit 2: 10 hours

Natural occurrence of certain phytochemicals- Classification of Phytochemicals, and flavonoids: omega – 3 fatty acids, carotenoids, dietary fiber, phytoestrogens; glucosinates; organosulphur compounds. Therapeutic properties, significance relevance of nutraceuticals in the management of diseases and disorders. Nutraceutical remedies for acute and chronic studies in human disorders.

Unit 3: 10 hours

Isolation of phytochemicals from plant materials: Care in handling and storage of raw materials with minimal damage to sensitive bioactive compounds; Extractive methods for maximum recovery and minimal recovery and minimal destruction of active material; stability studies. Anti-nutrients, Types of inhibitors present in various foods and their inactivation, safety data, general adverse effects and interactions of nutraceuticals.

Course outcome

1. Enable to acquire the knowledge on concept, history, evolution of nutraceuticals, anti-oxidant properties and its functional & therapeutic properties.
2. Able to learn about natural occurrence and classification of phytochemicals/ nutraceuticals and its role in disease management.
3. Able to gain knowledge of isolation techniques and stability studies of phytochemicals/nutraceuticals and concept of anti-nutrients.

Reference Books

1. Brian Lockwood (2007). Neutraceuticals. Pharmaceutical Press, USA.
2. Shaidi F and Marian Nazck (2007). Phenolics in Food and Nutraceuticals. CRC Press, Florida.
3. Wildman, Robert (2007). Nutraceuticals and Functional Foods, second edition. Taylor and Francis Group.

FOOD PRESERVATIVES, PACKAGING AND RESEARCH METHODOLOGY LABORATORY

Course code: FT 3.7 Credit: 0:0:4
Contact Hours: 16 L Examination: 50M

1. Determination of Grammage and Density of Packaging materials
2. Identification of Corrugated Fibre Boards (CFB)
3. Determination of water absorption capacity of Packaging material by Cobb's method
4. Determination of overall migration of constituents of Packaging materials
5. Identification of Plastic films
6. Nomenclature and types of Glass containers
7. Types of Cartons
8. Types of Caps, closures and finishes
9. Determination of Acidity and pH
10. Estimation of Benzoic acid
11. Preservation by high sugar concentration – preparation of jam and jelly
12. Evaluation of Packaging materials
13. Identification of Bags and Pouches
14. Packaging laws and regulations
15. Determination of wax from wax paper
16. Testing of lacquered tin plate sheets
17. Determination of equilibrium moisture content

Course outcome

1. Use of theories, principles and calculation for chemical reagents preparation to conduct the experiments.
2. Design and enhance the practical approaches in estimation of carbohydrates, proteins and salt content.
3. Formulate and evaluate the experimental methods used in Food preservation experiments.
4. Gain proficiency in basic laboratory techniques in both chemistry and biology and be able to apply the scientific method to the processes of experimentation.

DAIRY TECHNOLOGY LABORATORY

Course code: FT 3.8 Credit: 0:0:4
Contact Hours: 16 L Examination: 50M

1. Experiment on platform test of milk.
2. Chemical analysis of milk products.
3. Isolation and identification of probiotic cultures in curds and milk,
4. Preparation of Khoa and khoa based sweets.
5. Conventional and rapid techniques for Microbiological quality evaluation of raw and pasteurized milk and other dairy products.
6. Estimation of lactose in milk by colorimetric methods.
7. Determination of moisture in skim milk powder.
8. Iodine value and saponification value of ghee
9. Preparation of Paneer/Ghee/Cream/butter/Cheese.
10. Preparation of ice creams.
11. Sensory evaluation of milk and milk products.
12. Dairy industry management and project feasibility, plan layout, cost benefit analysis through visit to dairy plant.

Course outcome

1. Design the experiments for the quality analysis of the milk
2. Isolation of probiotics and other microorganism from the milk.
3. Different chemical analysis of the milk.
4. Dairy industry management and project feasibility, plan layout, cost benefit analysis.

PROCESSING TECHNOLOGY OF MEAT, POULTRY AND FISH LABORATORY

Course code: FT 3.9 Credit: 0:0:4
Contact Hours: 16 L Examination: 50M

1. Slaughtering and dressing of meat animals;
2. Study of post-mortem changes;
3. Meat cutting and handling; evaluation of meat quality;
4. Preservation by dehydration, freezing, canning, curing, smoking and pickling of fish and meat;
5. Shelf-life studies on processed meat products;
6. Evaluation of quality of eggs;
7. Preservation of shell eggs;
8. Estimation of meat: bone ratios;
9. Preparation of meat products- barbecued sausages, loaves, burger, fish finger;
10. Application of meat testing kits for quality evaluation.
11. Visit to meat processing plants / modern abattoir

Course outcome

1. Design and enhance the practical approaches in spoilage and preservation methods of eggs.
2. Understanding the biochemical changes during different slaughtering operation of meat products.
3. Design and enhance the practical approaches in estimation of proteins and detection of soya bean in meat.
4. Formulate and enhance the practical approaches in preparation, processing and preservation methods of meat.

IV Semester

FOOD ADDITIVES AND BIOSTATISTICS (Hard core)

Course code: FT 4.1 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: **14 hours**

Introduction: General classification, types, functions, legal aspects, risks and benefits. International numbering system for food additives. **Preservatives:** General mechanism of action; basis of selection; classes; Chemical preservatives: characteristics, antimicrobial spectrum, mechanism of action, regulations, application in food. **Antioxidants:** Characteristics, types/classes/groups, sources, functions, role of free radicals in human body, mechanism of action, application in food, limits and synergistic effects of antioxidants.

Unit 2: **18 hours**

Flavouring agents: Flavour functions, selection, sources, natural and synthetic flavouring, extractions methods, application in food. Stability of flavours during processing, Flavour composites, Flavour emulsions, essential oils, oleoresins. **Sweeteners**: classification/types, characteristics, applications in food. Limits and toxicology of non-nutritive sweeteners. **Emulsifiers and Stabilizers:** Characteristics, functions, types, mechanism of emulsion formation, mechanisms of emulsion stabilization and destabilization, application in food. **Hydrocolloids:** Definition, function, sources, application in food. Starch, protein, lipids, fibres, oligosaccharides, nutraceuticals and enzymes as functional ingredients; their modification, specifications and applications in foods.

Unit 3: **18 hours**

Colouring agents: classification, properties, functions, sources of natural and synthetic colours, extraction, applications in food, levels of use, misbranded colours, colour stabilization. Humectants, clarifying agents, gelling agents, fat replacers, leavening agents, bleaching and maturing agents, chelating agents, anti-caking agents, acidity regulators: definition, sources, functions and their application in food processing. Toxicology and safety evaluation of food additives, food additives generally recognized as safe (GRAS), tolerance levels and toxic levels in foods-LD 50 values of food additives. Toxicants generated during food processing such as nitrosamines, acrylamide, benzene, dioxins and furans; Methods for elimination of natural and derived toxins in foods.

Unit 4: **14 hours**

Biostatistics: Basic Statistical Concepts: Introduction to basic statistical concepts, such as mean, median, mode, standard deviation, descriptive statistics and hypothesis testing. Data collection, Classification and Tabulation of data, Graphical representation: Bar diagrams, Pie diagrams, and Radar analysis. Histogram, Frequency curve and frequency polygon. Tests of significance: t – test, z – test, X^2 tests for goodness of heterogeneity and independence of

attributes, F – test. Computer applications: Computer applications for documents preparation and presenting, spreads sheets and Principles of experimental designs: randomized block and Latin designs and analysis of variance (ANOVA).

Court outcomes

1. Students will understand the chemical and technological properties of relevant food additives used as food improvement.
2. Students learnt the knowledge of the food additives, the reasons of their use in foods and toxicological evaluation.
3. Students will acquire competence in the proper use of additives in safe food production.
4. Students identify the importance of data collection & its role in determining scope of Bio-statistics. Interpret statistical results correctly and effectively.

Reference Books

1. Antioxidants: Technological, Toxicological and Health Perspective, Madhavi DL, Deshpande SS & Salunkhe DK, (1996) Marcel Dekker.
2. Encyclopaedia of Food and Colour Additives, George A B. (1996) CRC Press.
3. Food Additives Data Book, Smith J & Shum LH, (2011) Wiley-Blackwell.
4. Food additives, Branen A L, Davidson PM & Salminen S. (2001) Marcel Dekker.
5. Food Polysaccharides and Their Applications, Stephen AM, (2006) CRC Press.
6. Food Proteins: Processing Applications, Nakai S & Modler H W (2000) Wiley VCH.
7. Manual of Methods of Analysis of Foods: Food Additives by FSSAI.
8. Natural Food Additives, Ingredients and Flavorings, Baines D and Seal R, (2012) Woodhead Publishing.

WASTE MANAGEMENT, FOOD LAWS AND ENTREPRENEURSHIP (Hard core)

Course code: FT 4.2 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: 16 hours

Fundamentals of Waste Management: Definition, classification, characteristics and sources of food waste, Global food waste statistics and SDG goals (UN Sustainable Development Goals), Environmental and economic impacts of food waste**. Types of Food Processing Wastes:** Cereals and millets processing wastes**,** Legumes and oilseed industry by-products**,** Fruits and vegetable processing wastes**,** Dairy, meat, sugar, beverage and fermentation industry wastes**,** Agro-industrial waste streams. **Waste Valorization & By-product Utilization:** Circular bioeconomy concepts**,** Recovery of bioactive compounds**,** Nutraceuticals, functional ingredients and feed applications**,** Biopolymers, packaging materials and bioenergy production**,** Industrial symbiosis and zero-waste processing. **Solid Waste Management:** Segregation, storage, handling and transportation**,** Composting, vermicomposting and anaerobic digestion**,** Biogas, biofuel and biomass utilization. **Wastewater Characteristics & Treatment:** Physical, chemical and biological parameters**,** Industrial effluent treatment (primary, secondary, tertiary)**,** Membrane technologies and advanced oxidation processes**,** Sustainable water reuse and resource recovery.

Unit 2: 16 hours

Food Quality, Safety & Assurance Systems: Sensory analysis (descriptive, consumer testing, AI-assisted sensory tools)**,** Physical, chemical and microbiological quality testing**,** Rapid testing technologies (PCR, biosensors, NIR, spectroscopy). **Quality Control (QC) & Quality Assurance (QA):** Concepts, functions and industrial implementation**,** Documentation and traceability systems**,** Risk-based quality management. **Food Safety Management Systems:** GMP, GHP, GLP**,** HACCP principles, hazard analysis and implementation**,** ISO 22000 and FSMS integration**,** Digital food safety monitoring and traceability. **Total Quality Management (TQM):** Concepts and tools**,** Six Sigma, Lean manufacturing**,** Difference between TQM, ISO 9000, ISO 22000**,** Application in SMEs and food start-ups.

Unit 3: 16 hours

Global Food Laws, Standards & Regulatory Affairs: Food Safety and Standards Act (FSSA)**,** FSSAI regulations: Food product standards**,** Additives, contaminants, toxins and residues**,** Food fortification standards**,** Labelling and packaging regulations. **International Food Regulations:** Codex Alimentarius and its role**,** US FDA, EFSA, WHO food regulations**,** WTO–SPS and TBT agreements**,** Global food trade regulations. **Food Certification & Standards:** AGMARK, BIS**,** ISO 22000, ISO 9001**,** BRCGS, IFS, SQF, Global GAP**,** Halal, Kosher certification. **Regulatory Compliance & Risk Management:**

Food recall procedures, Traceability systems, Import/export food compliance, Emerging areas, Novel foods, Plant-based and lab-grown foods, Functional foods and nutraceutical regulation.

Unit-4: 16 hours

Food Entrepreneurship, Innovation & Business Management: Evolution and theories of entrepreneurship, Characteristics and competencies of entrepreneurs, Start-up ecosystem in food sector, Agri-food innovation models. **Food Start-ups & Small Enterprises:** Definition, structure and policy support, MSME schemes, incubation centres, Relationship between small and large industries. **Production & Operations Management:** Investment analysis and feasibility study, Plant location and layout design, Product and process design, Automation and Industry 4.0 in food manufacturing. Quality control tools and techniques. **Marketing & Branding:** Food marketing concepts, Consumer behaviour and market research, Digital marketing, e-commerce and supply chains, Branding, packaging and value addition. **Human Resource Management:** Manpower planning and skill development, Recruitment, training and performance evaluation, Food industry leadership skills. **Financial & Business Planning:** Business model canvas, Funding sources and venture capital, Costing, pricing and break-even analysis, Export opportunities and global trade.

Course outcomes:

1. Students will understand the conventional and advanced waste management methods.
2. The students would be enabled to develop food quality and safety management systems in food industries.
3. Students learnt the knowledge of national and international food safety laws and standards.

Reference Books

1. Amihud Kramer, Bernard A. Twigg, 2017: Quality control for the food industry, Fundamentals & Applications, Volume 1, 3rd Edition, Medtech Scientific International Ltd., Kolkata.
2. Dev raj, Rakesh Sharma and V K Joshi, 2011: Quality control for value addition in food processing, New india publishing agency, Pitam Pura, New Delhi.
3. Inteaz Alli. 2004. Food Quality Assurance: Principlesand Practices. CRC Press, Boca Raton, FL, USA.
4. Ronald H. Schmidt and Gary E. Rodrick. 2003. Food Safety Handbook. John Wiley & Sons, Inc., Hoboken. New Jersey, USA.R.E.
5. S S Khanka, 2012. Entrepreneurial Development, S. Chand Publishing, New Delhi.

BAKERY AND CONFECTIONARIES TECHNOLOGY (Hard core)

Course code: FT 4.3 Credit: 4:0:0
Contact Hours: 64 L Internal Assessment: 25M Examination: 75M

Unit 1: 16 hours

Bakery Equipment: Introduction to utensils and equipment used in bakery unit and their uses small equipment, big equipment's and oven. Bulk handling of ingredients, Dough mixing and mixers, dividing, rounding, sheeting, and laminating, fermentation enclosures and brew equipment. Ovens and Slicers, Packaging materials and equipment. Raw materials required for bread making and their functional properties. Essential ingredients: Flour, yeast, water, salt. Other ingredients: Sugar, colour, flavor, fat, milk and milk powder and bread improvers. Functions of various raw materials used in baking industries Materials of Baking. Leaveners and yeast foods, shortenings, emulsifiers and antioxidants, Sweeteners, water and salt, Ingredients from milk and eggs. Fruits, vegetables, and nuts, Spices, flavors and colors.

Unit 2: 16 hours

Bread Manufacturing Process: Straight dough fermentation, Sponge and dough, Accelerated processing. Chorley wood bread process, Dough retarding and freezing, Stages in processing of bread and bread making methods and advantages and disadvantages of various methods of bread-making. Characteristics of good bread: Internal characters; external characters. Bread defects/faults and remedies. Spoilage of bread Causes, detection and prevention **Biscuits and Cookies**: Production of cakes and cookies/biscuits. Types of biscuit dough's –Developed dough, short dough's, semi-sweet, enzyme modified dough's and batters –importance of the consistency of the dough. Cake making: Ingredients and their function structure builders. Tenderizers, moisteners and flavor enhancers – Selection and preparation of mould, Temperature and time required for different type of cake, problems of baking.

Unit 3: 16 hours

Confectioneries: Introduction Principles of Confectionery Manufacture. Raw Material and their role. Types of Confectionery Products and Technology for their Manufacture. Quality Parameters of Confectionery Products. Nutrient and other Losses in Confectionery Products. ingredients- sugar from cane, Gur, khandasari sugar, raw sugar, refined sugar, white sugar, beet sugar, forms of sugar, liquid sweeteners, reactions of sugar and sugar-based confectioneries. Classification of confectionary. Importance of sugar confectionery and flour confectioner. Fondants. spoilage of confectionery products. Sanitation and safety. Good manufacturing practices (GMP) in baking and confectionery industries.

Unit 4: **16 hours**

Confectionery processing; Cocoa beans, chocolate liquor, cocoa butter, cocoa bean processing and chocolate manufacturing plant operations. Sugar Glasses in the chemistry of boiled sweets: Formulation and manufacture of boiled sweets. Grained sugar products: fondant, fudge, chocolate covered liqueur sweets. Toffees and Caramels: Cooking types, processing and toffee as an ingredient of other products. Chewing gum: Ingredients and preparation, gelled products. Aerated products: Marshmallows and Nougats. Lozenges: Ingredients and manufacturing. Indian Confectionery: Confectionery manufacturing practices and confectionery as a source of energy

Course outcome

1. Students get the knowledge of handling the equipment used in bakery units by studying bakery equipment.
2. Students can acquire the knowledge of essential ingredients and functional properties of bread making.
3. Students get the information of making process of different confectioneries and chocolate products, bread making, biscuits and cookies making etc.
4. Bakery and Confectionery course envisage providing students with knowledge of the basic functioning of the bakery industry.

Reference Books

1. Cauvain, Stanley P, and Yound, Linda S., “Technology of Bread Making”, Second Edition Aspen publication, Maryland, 2005.
2. Manley, Duncan., “Biscuit Doughs Manual 2”, Woodhead Publishing Ltd., England. 2009
3. Matz, Samuel A., “Bakery Technology and Engineering”, Third Edition, Chapman & Hall, London,
4. Pomeranz. Y. “Modern Cereal Science and Technology”. MVCH Publications, New York.2003.
5. Samuel A., Matz., “Equipment for Bakers”, Pan Tech International Publication, 2009.

PROJECT WORK / DISSERTATION

Course code: FT 4.4 Internal Assessment: 50M Examination: 100M

Course outcome

1. Development of research orientation and aptitude in the students enabling them to pursue for higher research studies.
2. Hands on practical training on using various instruments and other statistical tools will enhance the knowledge and technical experience of the students.
3. Enhancement of logical reasoning, analytical power and independent thinking to hypothesis for research problem and find its solutions.
4. Report writing, presentation and publication of results will provide platform to be interactive with the scientific community.

FOOD ADDITIVES AND BIOSTATISTICS LABORATORY

Course code: FT 4.5 Credit: 0:0:4
Contact Hours: 16 L Examination: 50M

1. Evaluation of GRAS aspect of food additives
2. Estimation of food additives:
   a. Sulphur dioxide
   b. Ascorbic acid
   c. Sodium chloride
   d. EDTA
   e. Monosodium glutamate
   f. Artificial sweetener - Saccharin, aspartame
   g. Colour – Curcumin, annatto
3. Detection of synthetic colours - sunset yellow, tartrazine
4. Role and mode of action of clarifying agents in fruit juices
5. Role and mode of action of chelating agents in fruit juices
6. Demonstration of food additive analysis by HPLC
7. TLC detection of emulsifiers in various food products
8. Determination of nitrates and nitrites in food
9. Problems to understand various biostatistical concepts like
   a. Calculations related to basic biostatistics
   b. Chi square
   c. One-way and two-way ANOVA
   d. Correlation aspects.

Course outcomes

1. Students will understand the chemical and technological properties of relevant food additives used as food improvement.
2. Students learnt the knowledge of the food additives, the reasons of their use in foods and toxicological evaluation.
3. Students identify the importance of data collection & its role in determining scope of Bio-statistics. Interpret statistical results correctly and effectively.

WASTE MANAGEMENT, FOOD LAWS AND ENTREPRENEURSHIP LABORATORY

Course code: FT 4.6 Credit: 0:0:4
Contact Hours: 16 L Examination: 50M

1. Estimation of acidity in water samples.
2. Estimation of hardness of water by EDTA method.
3. Estimation of temporary and permanent hardness of water.
4. Determination of Dissolved oxygen by Winkler's method.
5. Estimation of dissolved carbon dioxide in water samples.
6. Determination of Dissolved chloride by Mohr's method.
7. Detection of Cyanogens in food samples.
8. Extraction and Detection of Aflatoxin from crops.
9. Quality inspection of various food stuffs- cereals, pulses, spices and condiments.
10. Determination of BOD in water samples.
11. Determination of COD in water samples.
12. Preparation of FSMS plan for liquid pasteurisation of milk.
13. Preparation of FSMS plan for liquid edible oil processing.

Course outcomes

1. Understand the chemical properties of water can be studied perfectly by doing standard experiments.
2. Students acquire the different practical techniques of preparation of samples and analytical methods.
3. Understand and identify the specific toxic substances present in food staffs.
4. Students will be acquainted with techniques involved in preparation of FSMS plan.

BAKERY AND CONFECTIONARIES TECHNOLOGY LABORATORY

Course code: FT 4.7 Credit: 0:0:4
Contact Hours: 16 L Examination: 50 M

1. Study of ingredients (major and minor): Characteristics of flour, yeast, shortening, sugar, egg and salts.
2. Determination of flour colour/dullness by flour colour grader.
3. Determination of effect of ingredients.
4. Experiment on leavening action of baking powder, sodium-bicarbonate and ammonium-bi-carbonate.
5. Estimation of gluten content (atta and maida)
6. Estimation of water absorption power (atta and maida)
7. Determination of yeast-ferment test and dough rising capacity
8. Preparation of bread and its evaluation.
9. Preparation of biscuits –different types
10. Preparation of cookies-different types
11. Preparation toffees.
12. Preparation sugar boiled confectionary.
13. Preparation of chocolates, fruit drops.
14. Preparation of fruit toffees candies and preserve
15. Studies of flour and dough characteristics
16. determination of acidity of flour by water extract method
17. Effect of additives on baking quality.

Course outcome

1. Understand the chemical properties of flour can be studied perfectly by doing standard experiments.
2. Students acquire the different practical techniques of preparation of verities of bakery and confectionary products.
3. Understand and identify the specific processing technologies used bakery and confectionary industry.
4. Students will be acquainted with techniques involved in advanced baking and confectionery.

First/Second/Third/Fourth Semester M.Sc. Degree Examination

January/July 2025

(*CBCS Scheme*)

FOOD TECHNOLOGY

Paper – FT 1.1: FOOD CHEMISTRY (HARD CORE/SOFT CORE)

Time: 3 Hrs] ***[Max. Marks: 75***

Note: *i) Answer any **FIVE** questions from **Part – A**, any **THREE** questions from **Part - B** and any **FIVE** full questions from **Part - C***

ii) Marks are indicated at the right side

PART – A

I. Answer any FIVE of the following questions: **5 x 2 = 10**

1.

a)

b)

c)

d)

e)

f)

g)

PART – B

II. Answer any THREE of the following questions: **3 x 5 = 15**

2.

3.

4.

5.

PART – C

III. Answer any FIVE of the following questions: **5 x 10 = 50**

6. a)

b)

7. a)

b)

8. a)

b)

9. a)
   b)
10. a)
    b)
11. a)
    b)
12. a)
    b)

Second/Third Semester M.Sc. Degree Examination

July/January 2025

(*CBCS Scheme*)

FOOD TECHNOLOGY

Paper – FT 3.5: NUTRACEUTICALS (Elective)

Time: 1 1/2 Hrs.] ***[Max. Marks: 40***

Note: *i) Answer any **FIVE** questions from **Part – A**, any **THREE** questions from **Part - B***

ii) Marks are indicated at the right side

PART – A

I. Answer any FIVE of the following questions: **5 x 2 = 10**

1.

a)

b)

c)

d)

e)

f)

g)

PART – B

II. Answer any THREE of the following questions: **3 x 10 = 30**

2. a)

b)

3. a)

b)

4. a)

b)

5. a)

b)
