DAVANGERE UNIVERSITY

CURRICULUM
for the Academic year 2020 – 2021 onwards

M. Sc. Food Technology

Department of Studies in Food Technology
Shivagangotri, Davangere University, Davanagere-577007

About Food Technology Department

The journey of Department of Food Technology started in the year 2005,in single room under the leadership of EminentProfessor Dr. Basavaraj Madhusudan and the supporting teaching staff from Biochemistry.He contributed for preparation of the course materials for education and research in basic food science and technology. In addition, the "Research Centre for Nanoscience and Technology (RCNT)"was inaugurated by Prof. K. Chidananda Gowda (former Vice Chancellor), Prof B. Bakkappa (former Director of P.G. Centre) and Shri. Mohan Amberkar (former Member of Syndicate) on September 24th 2005. This offered students an educational opportunity to work with a unique blend of applications in Food and Drug Nanotechnology. The Centre was later moved to new premises and officially opened on November16, 2006 by Shri. Ramachandra Gowda (former Minister for Science &Technology, Government of Karnataka) and the then Vice-Chancellor Prof. B.S. Sherigara,Kuvempu University, Shimoga, India.

In the year 2009 theP.G. Centre of Kuvempu University became fully functional Post Graduate Department of studies and Research in Food Technology under newly established Davangere University.

At present, the department isexpanded with the greater facilities under the Chairmanship of Professor H. S. RavikumarPatil.Along with the Chairman,the department has specializedeleven young and energetic permanent facultieswho relatively act as a catalyst to build a stronger department andto trigger up talented youngsters'imagination.

The Food Technology Department has successfully establishedRCNT center and managing efficiently to integrate with many projects related to nanoscience and food applications. Currently, department is looking towards a megaproject on establishment ofPilot Food Plant.

DEPARTMENT VISION

To be a leading Food Technology department that imparts quality technical education with strong research component, to develop solutions in the field of food& nutrition, health and environment.

DEPARTMENT MISSION

To provide quality technical education in a conducive learning environment to produce professionals, researchers with a zeal for lifelong learning and a commitment to society.

Programme Specific Objectives (PSOs)

PO1: Apply the knowledge of science, engineering fundamentals, and mathematical concepts to the solution in the field of food technology.

PO2: Identify, formulate, review research literature, and analyze complex Food Technology/applications problems and Design solutions for complex problems and design system components or processes that meet the specified needs with appropriate consideration for the food sustainability.

PO3: Acquire the practical knowledge and demonstrate the ability to design, conduct/troubleshoot experiments and analyze data in the field of food technology

PO4: Understand the impact of the professional food technology solutions in societal and environmental contexts, and apply ethical principles and commit to professional ethics and responsibilities.

PO5: Communicate effectively and write effective reports and design documentation, make effective presentations.

PO6: Recognize the need for, and have the preparation and ability to engage in independent/as an entrepreneur and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

1. To have thorough grounding in Biology, Chemistry and Mathematics.
2. To be proficient in the principles and practices of advanced Food Technological/biological sciences.
3. To apply Food technology principles to biological systems to address the societal problems.

M.Sc. Food Technology (CBCS) Course Structure (2020-21 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	**4**	**70**	**30**	**100**	**4**	**3**
	FT 1.2	Food Microbiology	**4**	**70**	**30**	**100**	**4**	**3**
	FT 1.3	Principles of food processing and preservation Technology	**4**	**70**	**30**	**100**	**4**	**3**
	FT 1.4	Nutraceuticals and Functional Foods	**4**	**70**	**30**	**100**	**4**	**3**
		PRACTICAL PAPERS						
	FT 1.5	Food Chemistry	**4**	**40**	**10**	**50**	**2**	**3**
	FT 1.6	Food Microbiology	**4**	**40**	**10**	**50**	**2**	**3**
	FT 1.7	Principles of food processing and preservation Technology	**4**	**40**	**10**	**50**	**2**	**3**
	FT 1.8	Nutraceuticals and Functional Foods	**4**	**40**	**10**	**50**	**2**	**3**
	Mandatory Credits: English Language, Communication Skill		**2**	**---**	**---**	**---**	**2**	**---**
SEMESTER-II		**THEORY PAPERS**						
	FT 2.1	Bioanalytical Techniques	**4**	**70**	**30**	**100**	**4**	**3**
	FT 2.2	Food Biotechnology	**4**	**70**	**30**	**100**	**4**	**3**
	FT 2.3	Nutrition and Therapeutic Foods	**4**	**70**	**30**	**100**	**4**	**3**
	FT 2.4	Food Engineering	**4**	**70**	**30**	**100**	**4**	**3**
		PRACTICAL PAPERS						
	FT 2.5	Bioanalytical Techniques	**4**	**40**	**10**	**50**	**2**	**3**
	FT 2.6	Food Biotechnology	**4**	**40**	**10**	**50**	**2**	**3**
	FT 2.7	Nutrition and Therapeutic Foods	**4**	**40**	**10**	**50**	**2**	**3**
	FT 2.8	Food Engineering	**4**	**40**	**10**	**50**	**2**	**3**
	Mandatory Credits: Computer Skill		**2**	**---**	**---**	**---**	**2**	**---**
SEMESTER-III		**THEORY PAPERS**						
	FT 3.1	Food preservatives, packaging and Research Methodology.	**4**	**70**	**30**	**100**	**4**	**3**
	FT 3.2	Dairy Technology	**4**	**70**	**30**	**100**	**4**	**3**
	FT 3.3	Processing technology of Meat, Poultry and Fish	**4**	**70**	**30**	**100**	**4**	**3**
	FT 3.4	Post-Harvest management	**4**	**70**	**30**	**100**	**4**	**3**
	FT 3.5	Nutraceuticals (Interdisciplinary-Elective paper)	**2**	**40**	**10**	**50**	**2**	**2**
		PRACTICAL PAPERS						
	FT 3.6	Food preservatives, packaging and Research Methodology.	**4**	**40**	**10**	**50**	**2**	**3**
	FT 3.7	Dairy Technology	**4**	**40**	**10**	**50**	**2**	**3**
	FT 3.8	Processing technology of Meat, Poultry and Fish	**4**	**40**	**10**	**50**	**2**	**3**
	FT 3.9	Post-Harvest management	**4**	**40**	**10**	**50**	**2**	**3**
SEMESTER-IV		**THEORY PAPERS & PROJECT WORK/DISSERTATION**						
	FT 4.1	Food additives and Biostatistics	**4**	**70**	**30**	**100**	**4**	**3**
	FT 4.2	Waste management, Food laws and entrepreneurship	**4**	**70**	**30**	**100**	**4**	**3**
	FT 4.3	Bakery and Confectioneries Technology	**4**	**70**	**30**	**100**	**4**	**3**
	FT 4.4	Project Work/Dissertation	**6**	**70**	**30**	**100**	**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: Personality Development		**2**	**---**	**---**	**---**	**2**	**---**
	Total Credits for the Course		**134**	**---**	**---**	**2400**	**104**	**---**

I SEMESTER

FOOD CHEMISTRY	
Course Code :FT 1.1 Credit:4:0:0 Contact Hours: 64 L Internal Assessment: 30 M Examination: 70 M Course Coordinator(s): Dr. Gayatri Vaidya	
UNIT-I	
Introduction: Physicochemical properties of water, water weak interactions in Aqueous Systems, ionization of water, weak acids, and weak bases, buffering against pH changes in biological systems, water as a reactant, The fitness of the aqueous environment for living organisms water activity and its influences on food quality and stability. Role of water in food. **Carbohydrate**: Introduction, classification, structure, sources, properties and functions of carbohydrates, functional properties of sugars, starch, cellulose, glucans, hemicelluloses, gums, pectin substances, polysaccharides, Modified starch and dietary fibre.Dietary requirements of carbohydrates, inborn errors of carbohydrates.	**16 hours**
UNIT-II	
Amino acids and Proteins: Amino acids, occurrence, structure, classification, physical & chemical properties**.** Peptides, polypeptide, proteins & their properties, major source of proteins, classification, structure, properties, purification and denaturation of proteins, physicochemical and functional properties of protein derived from milk, egg protein, meat protein, fish muscle protein, oil seed protein and cereal protein. Protein- protein interaction, Protein-lipid interaction, protein-lipid complexes and protein-carbohydrate complexes. Modified proteins and application in food industry. Dietary requirements of proteins, metabolic defects such as Kwashiorkor associated with proteins.	**16 hours**
UNIT-III	
Enzymes and Lipids: General introduction to Enzymes, classification and functions of Enzymes and its activity in different food systems, factors affecting rate of enzymatic action, commercial availability, immobilization of enzymes, importance of enzymes in food processing. **Lipids:** General introduction, classification, physical and chemical properties, functions and Dietary requirements of food lipids, refining of crude oil and fats, hydrogenation, winterizationshortenings and low fat spreads. Vegetable and animal fat, margarine, lard, butter. Flavour changes in fats and oils, lipid oxidation, auto oxidation, factors affecting lipid oxidation and its biological significance, metabolic defects such as cardiovascular disease associated with lipids.	**16 hours**
UNIT-IV	
Vitamins and Minerals: Physiological and biochemical role of fat and water soluble vitamins, functions and sources. Vitamin C, Vitamin B complex, Iron and Folic acid. Requirements and recommended allowances. Deficiency diseases. **Minerals:** Classification of macro and micro nutrients along with their physiological and biochemical role. Role of trace elements in different food, effect of various processing treatments, functions, sources, and deficiency diseases. Electrolytes functions and its significance, recommended intake and sources.	**16 hours**

Reference Books

Sl. No.	Text Books
1	Lillian Hoagland Meyer(1974) Food Chemistry, The AVI Publishing Co Inc., Connecticut, MA, USA
2	Eskin NAM, Henderson HM and Townsed RJ(1971)Biochemistry of Foods, Academic Press, New York
3	John W. Brady(2013) Introductory Food Chemistry, Cornell University Press, Ithaca, USA
4	H.-D. Belitz, W. Grosch and P. Schieberle (2009) Food Chemistry, 4th Ed. Springer-Verlag. Berlin Heidelberg
5	Meyer, L.H.(1987) Food Chemistry. CBS publishers and Distributors, New Delhi.

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.

FOOD MICROBIOLOGY

Course Code : FT 1.2 Credit :4:0:0

Contact Hours : 64 L Internal Assessment: 30 M Examination: 70 M

Course Coordinator(s): Dr. Sadashiva S.O

UNIT-I	
Microbiology: Introduction, historical developments in food microbiology; prokaryotes and eukaryotes; classification of microorganisms - a brief account (Yeast, Mould and Bacteria); **Microbiological Techniques -** Sterilization, Cultivation of Microorganisms, culture media and types of culture media, Nutritional requirements of microorganisms, Growth curve,Measurement of growth; 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.	**16 hours**
UNIT-II	
Preservation of Foods: General principles involved in food preservation; low temperature preservation; lethal effects of chilling, freezing and thawing; high temperature preservation. Heat resistance of microorganism, heat penetration and thermal processing; Pasteurization, canning and dehydration; chemical preservation and its toxic effects; irradiations; 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.	**16 hours**
UNIT-III	
Food spoilage: Determination of microorganisms and their products in food; sample preparation for analysis; Culture dependent methods- Direct microscopic observation, culture, enumeration and isolation methods; Chemical and Physical methods - Chemical, immunological and nucleic acid based methods; Methods to assess microbial diversity, Merits and demerits of culture dependent and culture independent methods; Molecular analysis of bacterial community - Culture independent techniques - Denaturing Gradient Gel Electrophoresis (DGGE), Terminal Restriction Fragment Length Polymorphism (T-RFLP), Analytical methods for microbial metabolites- microbial toxins and metabolites.	**16 hours**
UNIT-IV	
Food borne diseases: Bacterial food borne diseases - Staphylococcal intoxification, Botulism, Salmonellosis, Shigellosis, Enteropathogenic *Escherichia coli* Diarrhoea, *Clostridium perfringens* gastroenteritis, *Bacillus cereus* Gastroenteritics; 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; Roundworm - Trichinosis, Anisakiasis; Mycotoxins- Aflatoxicosis, Deoxyni valenol Mycotoxicosis, Ergotism; **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, applications of hurdle technology for controlling microbial growth.	**16 hours**

Reference Books

Sl. No.	Text Books
1	Food Microbiology, Fundamentals and Frontiers, Doyle, P., Bonehat, L.R. and Mantville, T.J (2010): ASM Press, Washington DC.
2	Bacterial Pathogenesis A Molecular Approach. 2nd Edition. 2001 by Abigail A. Salyers and Dixie D. Whitt. ASM Publications.
3	Basic Food Microbiology, Banwart, G.J. (1997). CBS Publishers.
4	Fundamental Food Microbiology, Bibek Ray (1996). CRC Press.
5	Microbiology; Pelczar, Chan and Krieg; Tata McGraw Hill, Delhi
6	Modern Food Microbiology, James M. Jay (2000). 5th Edition, CBS Publishers.

Course Outcomes

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 sanitation.
3	Students can understand the pathogens of food spoilage and different molecular techniques used to characterize the pathogens.
4	Able to know the different food borne diseases caused by microorganisms and a brief on different regulatory practices and policies.

PRINCIPLES OF FOOD PROCESSING & PRESERVATION TECHNOLOGY

Course Code : FT 1.3Credit :4:0:0

Contact Hours : 64 L Internal Assessment: 30 M Examination: 70 M

Course Coordinator(s): Dr. Sharath S

UNIT-I	
Introduction: Aim and objectives of preservation and processing of foods, characteristics of food components, primary sources of microorganisms found in foods, deterioration of food quality, causes of quality deterioration and spoilage of perishable foods, definition of shelf life, perishable foods, semi perishable foods, shelf stable foods. spoilage in canned foods. Classification of food based on pH, Food infection, Historical development of food processing and preservation.	**16 hours**
UNIT-II	
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 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.	and **16 hours**
UNIT-III	
High temperature preservation of foods: Basic concepts in thermal destruction of microorganisms D, Z, F, values, Heat resistance and thermophilisms in microorganisms. Cooking, blanching, pasteurization and sterilization of foods. Assessing adequacy of thermal processing of foods, general process of canning 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.	**16 hours**
UNIT-IV	
Preservation by 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.	**16 hours**

Reference Books

Sl. No.	Text Books
1	Osman Erkmen and T. Faruk Bozoglu (2016) Food Microbiology Principles in to Practice, John Wiley & Sons, Ltd, UK.
2	Norman N. Potter and Joseph H. Hotchkiss (2013) Food Science, CBS publishers and Distributors.
3	James M Jay (2012) Modern food microbiology, 5th Edn, CBS publishers and Distributors.
4	B. Sivasankar (2009) Food processing and preservation, Eastern economy edition, Prentice-Hall of India Pvt. Ltd.
5	John M DeMan (2013) Principles of Food Chemistry, 3rd Edition, Springer Verlag

Course Outcomes:

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.

NUTRACEUTICALS AND FUNCTIONAL FOODS

Course Code : FT 1.4 Credit:4:0:0

Contact Hours: 64 L Internal Assessment: 30 M Examination: 70 M

Course Coordinator(s): Dr. Shankar J

UNIT-I	
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. Therapeutic properties, significance and relevance of nutraceuticals and functional foods in the management of diseases and disorders. Free radical scavengers, Antioxidants, mechanism and biological role of antioxidant molecules, Antioxidant enzymes, selonoenzymes and selenocompounds, Antioxidants as radioprotectors.	**16 hours**
UNIT-II	
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: 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. Advancement techniques in the isolation and purification of phytochemicals.	**16 hours**
UNIT-III	
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.	**16 hours**
UNIT-IV	
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; Development of biomarkers to indicate efficacy of functional ingredients; Research frontiers in functional foods; Nutrigenomics concept of personalized medicine.	**16 hours**

Reference Books

Sl. No.	Text 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.
4	Gibson GR & William CM (2000). Functional Foods - Concept to Product.
5	Goldberg I (1994). Functional Foods: Designer Foods, Pharma Foods.
6	Cupp J & Tracy TS (2003). Dietary Supplements: Toxicology and Clinical Pharmacology. Humana Press.
7	Saarela M (2011) Functional Foods: Concept to Product. 2nd edition. Oxford, Cambridge. Woodhead Publishing Ltd Bagchi D.
8	Brigelius-Flohé, J &Joost HG. (2006). Nutritional Genomics: Impact on Health and Disease. Wiley VCH.

Course Outcomes:

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.

FOOD CHEMISTRY LABORATORY		
Course Code : FT 1.5		Credit:
0:0:2Contact Hour: 16 L	Internal Assessment: 10 M	Examination: 10 M
Course Coordinator(s): Dr. Gayatri Vaidya		

1. Safety measures in the Laboratory
2. Qualitative Tests of Carbohydrate (Molisch's Test, Fehling's Test, Benedict Test, Iodine Test, etc.)
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 Outcomes:

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 1.6 Credit : 0:0:2
Contact Hours	: 16 L Internal Assessment: 10 M Examination: 40 M
Course Coordinator(s):	Dr. Sadashiva S.O

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. Pure culture techniques used for isolation and purification of microorganisms - Streak plate method / Pour plate method / Spread plate method.
5. Different staining methods to study morphological and structural characteristics of bacteria and fungi. - Gram Staining / Fungal staining (Lacto-phenol cotton blue) / Spore staining / Flagella staining / Capsule staining / Negative staining.
6. Culture preservation techniques (Agar slants, stabs and glycerol stocks).
7. Study the effect of salt, pH and temperature on microbial growth.
8. Determination of bacterial growth by turbidity measurements and to plot bacterial growth curve.
9. Detection and enumeration of pathogenic and indicator organisms in food; MPN of coli forms;
10. Evaluation of microbiological quality of commonly consumed street foods.
11. Extraction and detection of afla toxin for infected foods.
12. Preservation of potato/onion by UV radiation

Course Outcomes:

1	Good microbiology laboratory practices and introduction to different glass wares/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 1.7 Credit	: 0:0:2	
Contact Hours	: 16 L	Internal Assessment: 10 M	Examination: 40 M
Course Coordinator(s): Dr. Sharath S			

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 adultrance in food stuffs.
6. Preparation of Marmalade.
7. Estimation of reducing sugar by Fehling's procedure
8. Estimation of salt content in brine
9. Estimation of salt content in butter
10. Concept of shelf life of different foods
11. To study the concept of Asepsis and sterilization
12. Determination of pH of different foods using pH meter.
13. Study quality characteristics of foods preserved by drying/dehydration/ freezing.
14. To perform blanching of different plant foods.

Course Outcomes:

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.

NUTRACEUTICALS AND FUNCTIONAL FOODS LABORATORY			
Course Code	: FT 1.8	Credit	: 0:0:2
Contact Hours	: 16 L	Internal Assessment: 10 M	Examination: 40 M
Course Coordinator(s): Dr. Shankar J			

1. Determination of anti-oxidant activity by DPPH/ABTS/FRAP method
2. Estimation of ascorbic acid of by DNPH method
3. Estimation/Determination of total polyphenols in biological samples.
4. Estimation/Determination of total flavonoids
5. Estimation/Determination Tannins in biological samples.
6. Estimation of caffeine in tea and coffee
7. TF and TR value of tea and total solids.
8. Determination of Capsaicin content in chillies,
9. Determination Curcumin content of turmeric.
10. Isolation and culture of probiotics/Lactic acid bacteria (LAB) bacteria and its beneficiary effects.
11. Biochemical tests for probiotics bacteria.
12. Overview of probiotic products for health benefits
13. Determination of anti-nutrients in food/food materials.

Course Outcomes:

1	Acquire the knowledge on principal concept in determining anti-oxidant properties of nutraceuticals by different methods.
2	Learn about isolation/determination of different naturally occurring Phytochemicals.
3	Able to learn isolation of probiotic (LAB) bacteria, biochemical tests and its health benefits.
4	Gain proficiency in determining anti-nutrients in food materials.

II SEMESTER

BIOANALYTICAL TECHNIQUES AND BIOSTASTICS		
Course Code : FT 2.1		Credit:4:0:0
Contact Hours: 64 L	Internal Assessment: 30 M	Examination: 70 M
Course Coordinator(s): Dr. Paramesha M		

UNIT-I	
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. **Spectroscopy:** An introduction to absorption spectroscopy, photometry, beer lamberts law UV, visible, NMR, mass & IR spectrophotometry theory and instrumentation; introduction to advancedSpectroscopy with Principles and applications.	**16 hours**
UNIT-II	
Microscopic Techniques: Light Microscopy; Fluorescence microscopy, Atomic force microscope, Electron microscope, Scanning electron microscopy, Transmission Electron microsope. 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.	**16 hours**
UNIT-III	
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.	**16 hours**
UNIT-IV	
Advancedtechniques for food 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. **Rheology**: introduction and rheological parameters (like viscosity-concept of stress and strain, Newtonian and non-Newtonian fluids, pseudo plastic, dialatnat, plasticity, thixotropic and rhopexy, thixotropic and rheopexy, laminar and turbulent flow). Factors affecting rheological parameters, Rheological instruments for fluids and applications. Enzymes involved in food industries, Radio isotopes and applications of Radioisotopes in food industries and its advantages and disadvantages.	**16 hours**

Reference Books

Sl. No.	Text Books
1.	Thimmaiah SK, Thimmaiah SK. Standard methods of biochemical analysis. Kalyani publishers; 2004.
2.	Sadasivam S. Biochemical methods. New age international; 1996.
3.	Ramachandran VS, Beaudoin JJ. Handbook of analytical techniques in concrete science and technology: principles, techniques and applications. Elsevier; 2000.
4.	Thimmaiah SR. Pigments. Standard methods of biochemical analysis; 2009.
5.	Katoch R. Analytical techniques in biochemistry and molecular biology. Springer Science & Business Media; 2011.

Course Outcomes:

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 separations 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.

FOOD BIOTECHNOLOGY			
Course Code	: FT 2.2Credit	:4:0:0	
Contact Hours	: 64 L	Internal Assessment: 30 M	Examination: 70 M
Course Coordinator(s):	Dr. Sharath S		

UNIT-I	
Introduction to Food Biotechnology: Chemical nature of the genetic material, properties and functions of the genetic material, organization of the genetic material in bacteria, eukaryotes and viruses Chemical nature of the genetic material, properties and functions of the genetic material, Transcription and translation: RNA synthesis, types of RNA, genetic code; Recombinant DNA technology: Restriction enzymes. Plant cell and tissue cultivation. Micropropagation and Applications of micropropagation. Protoplast fusion. Recombinant DNA techniques.	**16 hours**
UNIT-II	
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, fedbatch and continuous fermenters. Fermenter devices: baffles, impellers, foam separators, sparger, culture vessel, cooling and heating devices. Mass transfer in reactors: Transport phenomena in fermentation- Gas- liquid exchange and mass transfer, oxygen transfer, critical oxygen concentration, Cell disintegration- physical, chemical and enzymatic methods. Microbiological fermentation Products:- Alcohol- Ethanol, Alcoholic beverage – Wine & Beer, Organic acids – Citric acid.	**16 hours**
UNIT-III	
Food Biotechnology Applications: Biosensors: Classification and application in food industry Application of biotechnology in food, Extraction- solvent, two phase, liquid extraction, whole broth and aqueous multiphase extraction. Purification – chromatography, concentration , ultra-filtration, reverse osmosis, drying and crystallization. Immobilization of enzymes: Arresting of cell in insoluble matrix, immobilized cell systems, large scale cell immobilization, uses and applications in industries. 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, IPR.	**16 hours**
UNIT-IV	
Nano-Biotechnology: Nanoparticles and types of Nanoparticles. Preparation of Nanoparticles: Chemical method and biological method. Characterization of NanoparticlesPrinciples of DSC, AFM, STM, TEM, XRD and FTIR. Applications ofNanotechnology: Nanotechnology in pharmaceutics, cosmetology and agriculture, precision farming, smart delivery system and nanotechnology in food industry, food packaging, food safety and food processing. Nanotoxicology.	**16 hours**

Reference books

Sl. No.	Text Books
1	B.D. Singh. 2014. Biotechnology - Expanding Horizons. Kalyani Publishers, New Delhi.
2	James D. Watson. 2013. Molecular Biology of the Gene, 7th Ed. Benjamin Cummings, San Francisco, USA.
3	Oliver Brandenberg, Zephaniah Dhlamini, Alessandra Sensi, Kakoli Ghosh and Andrea Sonnino 2011.
4	Ashok Agarwal and Pradeep Parihar. 2005. Industrial Microbiology: Fundamentals and Applications. Agrobios India, Jodhpur.
5	Bharatbhushan (2010). Handbook of Nanotechnology. Springer Publications.

Course Outcomes

1	Able to aquire 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 Foo industries

NUTRITION AND THERAPEUTIC FOODS		
Course Code: FT 2.3		Credit: 4:0:0Contact Hours: 64 L M
Internal Assessment: 30 M		Examination: 70 M
Course Coordinator(s): Dr. Shankar J		

UNIT-I	
Introduction: Concept of Nutrition, Relation of nutrition to health, Adequate nutrition, optimum nutrition, malnutrition, geriatric nutrition, RDA-formulation and dietary guidelines reference, men, women and adult composition unit. Energy in human nutrition: Idea of energy and its unit, energy balance, assessment of energy requirements – deficiency and excess, determination of energy in food, Basal and resting metabolism (BMR and RMR) and its regulation and S.DA. Total energy requirement and it's modification under normal physiological and other stress conditions. National and International agencies involved in promoting Nutrition and health status of a community – UNICEF, FAO, WHO, CARE, NIN, CFTRI, ICMR, etc.	**16 hours**
UNIT-II	
Growth monitoring and promotion: Somatic, physical, brain and mental development, puberty, menarch, prepubertal and pubertal changes. 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. **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.	**16 hours**
UNIT-III	
Growth development from Infancy, pre-school age to adulthood: Infancy: Growth and development, nutritional requirements. 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 preschoolers, nutritional problems specific to this age. Nutritional requirements Young adults, adult population and elderly people, nutritional problems common to this age and special needs.	**16 hours**
UNIT-IV	

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.	**16 hours**

References

Sl. No.	Text Books
1	Mahan, L.K. and Escott-Stump, S. (2008): Krause's Food Nutrition and DietTherapy,12th, Edition, W-13 Saunders Ltd., Canada.
2	Garrrow J.S, James W. P.T, Ralph A, (2000), Human Nutrition and Dietetics, 10th edition, Churchill Livingston, London.
3	Antia F.P. And Philip Abraham (2001) Clinical Nutrition and Dietetics, Oxford Publishing Company, New Dellhi.
4	Williams, S.R. (2003): Nutrition and Diet Therapy, 7th Edition, Times Mirror/Mosby Collage Publishing
5	Esther A. Winterfeldt, Margret L. Bogle,LeaL.Ebro.(2011).Dietetics: Practice& Future Trends.ThirdEdition.Jones and Barlet Publishers.UK.

Course Outcomes

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.

FOOD ENGINEERING AND ENZYMES IN FOOD PROCESSING		
Course Code: FT 2.4	Credit: 4:0:0Contact Hours: 64 L	
Internal Assessment: 30 M	Examination: 70 M	
Course Coordinator(s): Dr. Ravikumar Patil H.S and Dr. Santosh Kumar S.R		

UNIT-I	
Food Engineering: Introduction, reaction kinetics in food system, phase transition and transformations in food systems. Size reduction process: Principles, theories and laws, energy considerations, equipment. Unit operation in food engineering, mass and energy balance, fluid flow, fluid statics, fluid dynamics and fluid flow applications. Mixing and forming:Theory and applications, mixing indices, equipment for solid and liquid. Fluid flow, laminar, turbulent and transitional ranges velocity distribution profiles, basic equations, and thermal velocity calculations. Size reduction process and classification-mixing, kneading and blending. Thermal Processing:Death kinetics, thermal death curve, decimal reduction time. Z- Factor, heat penetration curve, process time calculations, mathematical curve, mathematical and graphical solutions. Evaporation: Heat and mass balance, steam economy, heat recovery, efficiency, process calculations. Engineering aspects of radiation processing.	**16 hours**
UNIT-II	
Food plant design: General consideration in designing the plant. Food dehydration: Constant and falling rate periods, drying rate calculations. Chilling, refrigeration and freezing: Theories, characteristic curve, cooling rate calculations. Separation processes: Filtration and centrifugation, theories and mathematical descriptions, constant rate and constant pressure filtration, equipment. Mechanical sieving, centrifugation, sedimentation. Membrane Technology: Microfiltration, Reverse osmosis and ultrafiltration. Fortification: Advances in fortification technology, synthetic nutrients, techniques of food fortification and stability of nutrients in relation to processing. Encapsulations: design and structure of microcapsules, release rate and mechanism. Techniques of micro encapsulation, advantages and application of encapsulation.	**16 hours**
UNIT-III	
Enzymes classification, properties, characterization, kinetics and immobilization; fermentative production of enzymes (amylases, proteases, cellulases, pectinases, xylanases, lipases) used in food industry and their downstream processing. Enzymes for starch, protein and lipid modification with suitable examples. Enzymes as processing aids: Role of enzymes in Dairy processing (cheese making and whey processing). Role of enzymes in meat processing and fish processing.	**16 hours**
UNIT-IV	
Role of enzymes in Brewing, Baking (fungal -amylase for bread making; maltogenic -amylases for anti-staling; xylanses and pentosanases as dough conditioners; lipases or dough conditioning; oxidases as replacers of chemical oxidants; synergistic effect of enzymes); Role of enzymes in the production of flavours (enzyme-aided extraction of plant materials for production of flavours, production of flavour enhancers such as nucleotides, MSG; flavours from hydrolyzed vegetable/animal protein)	**16 hours**

References

Sl. No.	Text Books
1	Batty, J.C. and Folkman, S.L. (1983). Food Engineering Fundamentals. John wiley and Sons, New York.
2	Fennema O.R. Ed. (1985). Principles of Food Science: Part-II Physical Principles of food Preservation. Marcel Dekker, New York.
3	Smith, P.G. "Introduction to Food Process Engineering", Springer, 2005.
4	Rao, M.A. Rizvi, S.S.H. and Datta, A.K. "Engineering Properties of Food", 3rd Edition, Taylor & Francis, 2005Whitehurst,R.J. & Van-Oort,M., (2010), Enzymes in Food technology, Second edition, Blackwell Publishing Ltd
5	Aehle, W. (2007) Enzymes in Industry: Production and application. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim
	Rastall,R (2007) Novel enzyme technology for food applications Woodhead Publishing Limited, Abington Hall, Abington, Cambridge CB21 6AH, England

Course Outcomes:

1	Able to understand basics concepts of food energy laws related to size reduction and Familiarize 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.Understand the application of reactors and Explain how enzymes act as biological catalysts and how they interact with specific substrate molecules
4	The enzymes are biological catalysts that catalyze the biochemical and molecular reaction which is necessary for maintenance and production of many food products.

BIOANALYTICAL TECHNIQUES LABORATORY			
Course Code	: FT 2.5	Credit	: 0:0:2
Contact Hours	: 16 L	Internal Assessment: 10 M	Examination: 40 M
Course Coordinator(s): Dr. Paramesha M			

1. Concept of solution preparation (Normality, Molarity etc.).
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 Outcomes:

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 chromate-graphic analyzer , Rheology.
4	Acquire skills to estimate the nutrient analysis by different methods for various nutrients.

FOOD BIOTECHNOLOGY LABORATORY			
Course Code	: FT 2.6 Credit	: 0:0:2	
Contact Hours	: 16 L	Internal Assessment: 10 M	Examination: 40 M
Course Coordinator(s):	Dr. Sharath R		

1. Preparation of Plant tissue culture media.
2. Micropropagation of Plant tissue culture.
3. Preparation of synthetic seeds.
4. Callus culture.
5. Isolation of genomic DNA (plant / animal/ microbial sources – any one).
6. Synthesis of ZnO nanomaterials by using combustion method.
7. Production of different kinds of wine in the Laboratory (Demonstration) 8.Microbial production (demonstration) and quantitative estimation of citric acid
9. Estimation of unfermented sugar in the fermented sample.
10. Estimation of percentage of alcohol in the fermented sample
11. Estimation of citric acid by titrimetric method.
12. Determination of acidity of milk by titrimetric method.
13. Mushroom cultivation.
14. Single cell production.

Course Outcomes

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.

NUTRITION AND THERAPEUTIC FOODS LABORATORY

Course Code: FT 2.7 Credit: 0:0:2Contact Hours: 16 L Internal Assessment: 10 M Examination: 40 M

Course Coordinator(s): Shankar J

1. Estimation of blood and urine glucose
2. Estimation of haemoglobin and iron
3. Estimation of total protein, serum albumin and globulin
4. Estimation of phosphorus in urine
5. Estimation of ascorbic acid in urine
6. Abnormal constituents in urine
7. Estimation of cholesterol
8. Estimation of urea in urine
9. Estimation of creatinine in urine
10. Estimation of nitrogen in urine
11. Diet Planning for various deficiency conditions:
    - •Protein energy malnutrition
    - •Vitamin A deficiency
    - •Iron deficiency anaemia
    - •Osteoporosis
12. Diet plan for Diabetes and Cardio vascular diseases.

Course Outcomes:

1	Develop skills on determining glucose level in blood and urine.
2	Learn about isolation/determination of different naturally occurring Phytochemicals.
3	Gain proficiency in designing diet plan for osteoporosis, protein, Vitamin, Iron deficiency.
4	Learn on diet plan for diabetes and cardio vascular diseases.

FOOD ENGINEERING AND ENZYMES IN FOOD PROCESSING LABORATORY		
Course Code: FT 2.8	Credit: 0:0:2Contact Hours: 16 L	Internal Assessment: 10 M Examination: 40 M
Course Coordinator(s): Dr. Ravikumar Patil H.S and Dr. Santosh Kumar S.R		

1. Application of psychometric charts in food engineering.
2. Study of equipment's used in food process.
3. Food plant design and visit to food processing plants.
4. Determination specific activity of enzymes
5. Effect of pH & temperature on enzymes
6. Separation of enzymes - SDS Page
7. Effect of inhibitors on the activity of enzymes
8. Immobilization of enzyme by entrapment and comparison with free enzyme
9. Enzymes in meat tenderization
10. Extraction of alkaline phosphatase from liver.
11. Extraction of lipase from plants
12. Estimation of lipase activity

Course Outcomes:

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

Course Code : FT 3.1
Credit:4:0:0Contact Hours: 64 L Internal Assessment: 30 M
Examination: 70 M
Course Coordinator(s): Dr. Veeresh S.J

UNIT-I	
Basic ConsiderationsPreservatives: Aims and objectives of preservation & processing of foods, Characteristics of tissues and non-tissues foods, Degree of perishability of unmodified foods, Causes of quality deterioration and spoilage of perishable foods, intermediate moisture foods, wastage of foods. **Natural Food Preservatives:** salt, sugar, alcohol, vinegar, Coffee powder and soup are dehydrated and freeze-dried for preservation, citrus food preservatives like citrus acid and ascorbic acid. **Chemical Food Preservative:** Benzoates (such as sodium benzoate, benzoic acid), Nitrites (such as sodium nitrite), Sulphites (such as sulphur dioxide), Sorbates (such as sodium sorbate, potassium sorbate, **Artificial Preservatives:** Types of Artificial Preservatives Food, Antimicrobial agents, Antioxidants, Chelating agents.	**16 hours**
UNIT-II	
Harmful Food Preservatives: Benzoates, Butylates, BHA (butylated hydroxyanisole), Caramel, Preservatives Food Additives,Sulfites, Sodium Nitrite, Propionic Acid ,Sorbic Acid, Benzoic Acid, **Antioxidants:** Sodium Erythorbate, Erythorbic Acid, Sodium Diacetate, Sodium Succinate, Grape Seed Extract, Pine Bark Extract, Apple Extract Tea Proplyphenols, Succinic Acid and Ascorbic Acid and food preservatives like Parabens and Sodium Dehydro Acetate, Methods Of Food Preservation,Side Effects of Harmful Food Preservatives.	**16 hours**
UNIT-III	
Food Packaging Technology: Introduction, Packaging operation, packagefunctions 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. **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.	**16 hours**
UNIT-IV	

Research Methodology:Introduction: Definitions and Objectives of Research, Motivation in Research, General Characteristics of Research, Criteria of Good Research and Types of Research. **The Research Problem:** Scientific Thinking and Research Problem. Selecting the Problem and Sources of the Problem. Defining, Statement and Evaluation of a Problem. **The Review of Literature**: Meaning and Need of Review of Literature. Objectives, Sources and Functions of Literature. **The Research Hypotheses**: Meaning, Definitions, Nature, Functions, Importance of Hypothesis and Kinds of Hypothesis. **The Research Approach**: Research	**16 hours**
Design. Qualitative and Quantitative Research. Criteria for Selecting a Research Approach. **Sampling**: Measurement, Sampling, Data Analysis and Interpretation of Data, Reference and citation. Publication, dissertation and Thesis writing. Importance of Plagiarism check.	

Reference Books

Sl. No.	Text Books
1	Marcus Karel, Owen R. Fennema, Daryl B. Lund: Physical principles of food preservation. New York, Basel Dekker, 1975.
2	Marczyk G, DeMatteo D, Festinger D. Essentials of research design and methodology. John Wiley; 2017 Dec 18.
3	Savin-Baden M, Howell-Major C. Qualititative Research: The Essential Guide To Theory And Practice. Qualitative Research: The Essential Guide to Theory and Practice. Routledge. 2013.
4	Kumar R. Research methodology: A step-by-step guide for beginners. Sage Publications Limited; 2019.
5	Gordon L. Robertson. 2010. Food Packaging and Shelf Life –A Practical Guide. CRC Press, Boca Raton, FL, USA.
6	Msagati, Titus A. M. (2012). The Chemistry of Food Additives and Preservatives.

Course Outcomes:

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 during different types of food production.
3	The students would become familiar with various novel packaging techniques and can provide their technical skills in the food package manufacturing industry.
4	The students would be able to use statistical tools during prediction and solve the problems arising in food industries.

DAIRY TECHNOLOGY

Course Code : FT 3.2
Credit:4:0:0Contact Hours: 64 L Internal Assessment: 30 M
Examination: 70 M
Course Coordinator(s): Dr. Paramesha M and Dr. Sadashiva S.O

UNIT-I	
Introduction to Dairy Technology and Milk properties, Nutritive components and microbiology of Milk: Genesis of Dairying, Dairy Education Research in India, Milk industry scenario past, present and future India and Context. Milk - Definition, sources, and composition of milk, factors effecting composition of milk, physiochemical properties of milk, grading of milk- definition and types **16 hours** of grades, collection (options for collection and its preservation), transportation and marketing of milk and milk products. Dairy farms in India and world, management of dairy farms and animals. Solution properties of milk, acidity, redox potential, flavour, density, optical properties and viscosity, basic aspects of surface phenomenon, brief information related to the milk components Lactose; Salts; lipids; proteins; enzymes and other components, Characteristics of fat globules in milk, Gel formation and properties.	& Global
UNIT-II	
Processing and quality assurance : Enumeration of Microorganisms in assessment of milk-bacteria, yeast and molds. Current awareness on quality and safety of dairy foods. Bactofugation: Principles and thermal processing of milk, kinetics of microbial destruction , thermal death curve, Arrhenius equation. Terminologies used in thermal processing, D-value, Z-value, Q10-value and F0value. Significance of thermization, lactoperoxidase system, pasteurization (LTLT & HTST concept), vaporization and sterilization and UHT processing of milk- relevance of UHT-processing, description of UHT plants, direct and indirect, upstream and downstream homogenisaiton and third generation UHT plants. **Packaging of milk and milk products:** Definition and Purpose of packaging.	**16 hours**
UNIT-III	
Milk and milk products: Special Milks and fermented milk products: Toned, Double toned, Recombined milk, Preparation of buttermilk, Acidophilus milk, Yoghurt, Dahi, and Lassi. **Fat Rich Dairy Products:** Cream, Butter and Ghee. **Condensed and Dried Milks:** sweetened condensed skim milk, Evaporated milk, **hours** whole milk powder and skim milk powder. **Cheese:** varieties, Preparation cheddar and cottage cheese and processed cheese. **Frozen Dairy Products** : Methods of manufacture of Ice cream. **Indigeneous Milk Products/Sweets :** and khoa based sweets, Paneer and paneer based products. Defects and their of milk and milk products and its Marketing strategies in India.	**16** of Khoa control
UNIT-IV	
Sanitary aspects: of dairy plant building, equipment and their maintenance. Disposal of dairy plant waste. Application of membrane technology in dairy industry. Principles of enumeration of conventional and emerging pathogens in dairy production and biosensor based techniques for monitoring microbial and non-microbial contaminants in dairy industry. Types and utility of starter cultures and DVS.	**16 hours**

Reference Books

Sl. no	**TEXT BOOK**
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.	Walstra P & Jenness R. Dairy Chemistry and Physics. John & Wiley. 1984.
5.	Robinson RK. Modern dairy technology: Volume 2 advances in milk products. Springer Science & Business Media; 2012.

Course Outcomes:

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.

PROCESSING TECHNOLOGY OF MEAT, POULTRY AND FISH	
Course Code : FT 3.3Credit : 4:0:0 Contact Hours : 64 L Internal Assessment: 30 M Examination: 70 M Course Coordinator(s): Dr. Venkatesh and Dr. Ravikumar Patil H.S	
UNIT-I	
Introduction– Sources, Importance and Status of meat, poultry and fishery industry in India. Its present scenario in national and international economy. Research and development activities on meat, poultry and fishery products. Per capita consumption of meat, poultry and fish. Safety standards in meat, poultry, fish Industry – GMP, EUhygienic regulations. HACCP/ISO/MFPO/Kosher/Halal. FSSAI guidelines on FSMS compliance for meat and meat products.	**16 hours**
UNIT-II	
Meat and meat Processing – Abattoir, Ante-mortem inspection of meat animals, evaluation of animal carcasses, composition of meat, slaughtering, post-mortem changes in meat, post-mortem glycolysis, rigor mortis, factors affecting postmortem changes in meat, colour texture, WHC, PSE, DFD condition and shelf life. Mechanical deboning, grading and aging. Byproducts from meat industries and their utilization. Preservation of meat and meat products – Electrical stimulation, chilling, cold shortening, thaw rigor, freezing, Cured, smoked, comminuted and canned products. Nutritive value and packaging of meat.	**16 hours**
UNIT-III	
Poultry and products – types poultry, factors affecting poultry farming, chemical composition and nutritive value of poultry meat, methods of stunning, slaughter, pre- and post-slaughter, scalding and dressing. Utilization of poultry industry byproducts. Nutritive value of egg and their preservation – Structure, composition, nutritive value and functional properties of egg. Factors affecting egg quality and their measurements. Microbial spoilage and preservation methods of eggs.	**16 hours**
UNIT-IV	
Fishery techniques and preservation – Fishing practices, fishery economics and marketing. Sanitary and Phyto-sanitary requirements for maintenance of fish quality, quality management of fish and fishery products. Fish handling, grading, chilling, freezing, canning and packaging. Factors affecting quality of fresh fish. Nutrient composition of fish - proteins, carbohydrates, lipids and fatty acid profiles, vitamins and minerals. Post-mortem changes in fish muscle. Fish storage and deodorization. Microbial contamination of fish and methods of preservation. Utilization of fish waste such as fish ensilage, compost, sauces, protein hydrolysates, fish meal etc.	**16 hours**

Reference Books

Sl. No.	Text Books
1	Alan, H. V. and Jane, P. S (1995). Meat and Meat Products: Technology, Chemistry and Microbiology: Champan & Hill, London.
2	Carmen, R. O. and George, J. M (1997). Poultry Meat and Egg Production: CBS Publications, New Delhi.
3	Lawrie, R. A (1998). Lawrie's Meat Science (6 ed.): Woodhead Publications, Cambridge.
4	Sharma, B. D (1999) Meat and Meat Products Technology Including Poultry Products Technology. Jaypee Brothers Medical Publishers Pvt. Ltd, New Delhi.
5	Sharma, B. D. and Kinshuki Sharma (2011) Outlines of Meat Science and Technology. Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.
6	Vikas Nanda (2014) Meat, Egg and Poultry Science & Technology. I.K. International Publishing House Pvt. Ltd., New Delhi.

Course Outcomes:

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.

POST HARVEST MANAGEMENT	
Course Code : FT 3.4Credit : 4:0:0 Contact Hours : 64 L Internal Assessment: 30 M Examination: 70 M Course Coordinator(s): Dr. Sharadadevi Kallimai	
UNIT-I	
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, post-harvest treatment to increase shelf life, controlled and modified atmosphere storage. general steps in processing of fruits and vegetables. Advancement technologies for post-harvest management of fruits and vegetables	**16 hours**
UNIT-II	
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, product and by products of rice, milling of rice. Wheat production, varieties and their quality. Wheat- structure and composition, 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.	**16 hours**
UNIT-III	
Postharvest Management of Pulses and Oilseeds : Introduction, post-harvest losses and prevention. Harvesting- pre drying, threshing, drying, Structure and composition of pulses, toxic constituents in pulses, 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. Rancidity- types, mechanism and prevention.	**16 hours**
UNIT-IV	

Spices: Spice production, processing, black pepper, green pepper, white pepper, oleoresin and volatile. Cardamom, ginger, chilies, turmeric powder, oleoresin and volatiles. Minor spices - ajwain, coriander, cumin, cinnamon, fenugreek, garlic, mustard, mace and nutmeg, onion, saffron, tamarind, cloves, mint, vanilla, asafetida and of spices. Spices and spice blends: Soluble spices, Spice substitutes for salt in sodium restricted diet, antioxidant activity of spices, microbiological aspects and sterilization of spices, storage of spices and spice extractives. Enzymatic synthesis of flavour identicals; quality control; fumigation and irradiation of spices.	**16 hours**

Reference Books

Sl. No.	Text Books
1	Preservation of Fruits and Vegetables–Girdhari Lal, Siddhapa and Tondon, ICAR, New Delhi.
2	Hand Book of Analysis and Quality Control of Fruits & Vegetable Products–S. Ranganna Tata McGraw Hill, New Delhi.
3	Commercial Vegetable Processing–Wood Roof &Lue
4	Commercial Fruit & Veg. Processing–W.V. Cruses.
5	Post harvest Technology of cereals ,pulses and oil seeds by A.Chakraverthy,third edition.
6	Rice Chemistry and Technology by B.O. Juliano
7	Durum Wheat Chemistry and Technology by G.Fabriani and C. Lintas

Course Outcomes

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.

NUTRACEUTICALS (ELECTIVE)	
Course Code: FT 3.5 Credit: 2:0:0Contact Hours: 32 L Internal Assessment: 10 M Examination: 50 M Course Coordinator(s): Dr. Shankar J	
UNIT-I	
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.	**12 hours**
UNIT-II	
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.	**10 hours**
UNIT-III	
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.	**10 hours**

Reference Books

Sl. No.	Text Books
1	Brian Lockwood (2007). Neutraceuticals. Pharmaceutical Press, USA.
2	Wildman, Robert (2007). Nutraceuticals and Functional Foods, second edition. Taylor and Francis Group.
3	Shaidi F and Marian Nazck (2007). Phenolics in Food and Nutraceuticals. CRC Press, Florida.

Course Outcomes:

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.

FOOD PRESERVATIVES, PACKAGING AND RESEARCH METHODOLOGY LABORATORY
Course Code : FT 3.6Credit : 0:0:2
Contact Hours : 16 L Internal Assessment: 10 M Examination: 40 M
Course Coordinator(s): Dr. Veeresh S.J

1. Identification of different types of packaging material. Physical properties of packaging films.Designing of packaging material for foods.Uniformity and amount of wax determination. Chemical resistance of packaging material. WVTR of different packaging material
2. Shelf life studies of packaged food. Grease resistance of packaging material
3. Puncture resistance of corrugated boxes. Packaging of fresh foods I) Fruits & Vegetables II) Meat.
4. Determination of tin coating weight & porosity
5. Determination of continuity of lacquer coating.
6. Determination of tensile strength and heat seal strength of packaging material
7. Determination of water absorption of paperboard and CFB. To conduct drop test.
8. Survey of preserved foods available in the local markets to study methods of preservation, preservatives used, shelf life, cost and form of availability
9. Preservation of food by traditional methods.
10. Drying of cereals and pulses –product preparation.
11. Drying and dehydration of vegetables, fruits, flesh food. Freezing of fruits, vegetables and flesh foods.
12. Preservation of foods by sugar-Jam, Jelly, Marmalade, Cordial, Squash, Fruit bars, Fruit Preserves-Tuity Fruity (Papaya), Petha (White Pumpkin) Ginger Murabha (Ginger), Glazed fruits. Preservation of foods by salt and acid-Vathal, Vadagam, Tomato ketchup and Squash, Pickles-Lemon, Mango, Mixed vegetable, Garlic.
13. Preservation by fermentation- Wine, Vinegar.

COURSE OUTCOMES

1	Students will be acquainted with the industrial techniques used to preserve and

	process foods, extend their shelf-life and improve their palatability characteristics.
2	Students will be familiarized with advances in food processing techniques.
3	Students will be acquainted with the principles, methods, and materials used for safe packaging of foods.
4	Students will be familiarized with national and international specifications for food preservation.

DAIRY TECHNOLOGY LABORATORY			
Course Code	: FT 3.7	Credit : 0:0:2	
Contact Hours	: 16 L	Internal Assessment: 10 M	Dr. Paramesha
Course Coordinator(s):	M and Dr. Sadashiva S.O	Examination: 40 M	

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 Milk.
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 OUTCOMES

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 3.8	Credit	: 0:0:2
Contact Hours	: 16 L	Internal Assessment: 10 M	Examination: 40 M
Course Coordinator(s): Dr. Venkatesh& Dr. Ravikumar Patil H.S			

1. Evaluation of egg.
2. Isolation of albumin from egg.
3. Isolation of lecithin from egg yolk.
4. Study of slaughtering operation of meat animals.
5. Preservation of meat by pickling.
6. Detection of soya bean in meat product by urease method.
7. Preparation of Sausages.
8. Analysis of gelatin.
9. Estimation of tyrosine value in meat.
10. Estimation of trimethylamine and total volatile basic nitrogen.
11. Protein estimation by Lowry's method.
12. Estimation of quality and grading of eggs.
13. Determination of Extract Release Volume and water holding capacity.
14. Preparation of fish oil.

COURSE OUTCOMES

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.

POST HARVEST MANAGEMENT LABORATORY		
Course Code : FT 3.9		Credit: 0:0:2Contact Hours : 16 L
Internal Assessment: 10 M	Examination: 40 M	
Course Coordinator(s): Dr. Shardadevi Kallimani		

1. Study of different types of browning reactions: enzymatic and non-enzymatic.
2. Sensory evaluation of prepared products in the laboratory.
3. To study the concept of gluten formation of various flours.
4. To study malting and germination.
5. To study dextrinization in foods.
6. Identification of pigments in fruits and vegetables and influence of pH on them.
7. Estimation of gluten content.
8. Determination of ash content in food stuff
9. Determination of acidity in wheat flour by water extract method
10. Determination of moisture content in flour
11. Preparation of health benefits of fermented cereals and pulses based products
12. Preparation of butter biscuits.
13. Role of ingredients in the preparation of cake.

COURSE OUTCOMES

1	Students will get experimental knowledge of how to determine the moisture content of different kinds of flour.
2	With the knowledge of preparation of fermented cereals, pulses based products, which are very much beneficial human health students can acquire jobs in various food industries.
3	Students can get the information about sensory evaluation of products which are prepared by them. This information is very helpful for them in fast food industries.
4	The students would be acquainted with knowledge of health benefits of fermented cereals and pulses.

IV SEMESTER

FOOD ADDITIVES AND BIOSTATISTICS	
Course Code : FT 4.1Credit : 4:0:0 Contact Hours : 64 L Internal Assessment: 30 M Examination: 70 M Course Coordinator(s): Dr. Santosh Kumar S.R	
UNIT-I	
Food additives: Definitions, classification and function. Role of Food Additives in food preparation and uses in processed food products. Chemical, technological and toxicological aspects of food additives, pH controllers, salts and chelating/sequestering agents, leavening agents, antioxidants, emulsifying and stabilizing agents, anti-caking agents, thickeners, firming agents, Proteins, starches and lipids as functional ingredient; isolation, modification, specifications, functional properties and applications in foods.	**16 hours**
UNIT-II	
Health and safety aspects of food additives: Present status of various food additives. Controversial food additives Saccharin, history, function, aspartame, nitrite and nitrate compounds, nitrosamines. Additives to improve acceptability, permitted food colors, natural and artificial sweeteners composition, uses, emulsifiers, enzymes, fat replacers, gelling agents, leavening agents, stabilizers, surfactants, tenderizers, texturizers, thickeners, vitamins, nutraceuticals, essential oils and oleoresins viscosity modifiers, whipping agents.	**16 hours**
UNIT-III	
Food Flavors and Food adulteration: Types of flavours, flavoring constituents, stability of flavours during food processing, analysis of flavours, extraction techniques of flavours, flavours emulsions; flavours Spices and flavors in food industries. Food adulteration, definition, reasons for food adulteration, methods of adulteration, and methods of detection. Normal food adulterants in coffee, tea leaves, edible oil, milk, cereals, spice powders. Adverse effects of food adulterants.	**16 hours**
UNIT-IV	

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 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).	**16 hours**

Reference Books

Sl. No.	Text Books
1	Branen, A.L., Davidson PM & Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker.
2	Gerorge, A.B. 1996. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
3	Gerorge, A.B. 2004. Fenaroli's Handbook of Flavor Ingredients. 5th Ed. CRC Press.
4	Madhavi, D.L., Deshpande, S.S & Salunkhe, D.K. 1996. Food Antioxidants: Technological, toxicological and Health Perspective. Marcel Dekker
5	Mahindru, S N (2000) Food Additives- Characteristics Detection and Estimation. Tata Mc Graw Hill Publishing Co. Ltd.

Course Outcomes:

1	Students will understands 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.

WASTE MANAGEMENT, FOOD LAWS AND ENTREPRENEURSHIP			
Course Code	: FT 4.2	Credit	: 4:0:0
Contact Hours	: 64 L	Internal Assessment: 30 M	Examination: 70 M
Course Coordinator(s): Dr. Veeresh S.J			

UNIT-I	Hours
Waste management: Definition, Classification, nature, disposal practices, impacts on environment and economy; Types of food processing wastes; Types, availability and utilization of by-products of cereals, legumes and oilseeds, fruits and vegetables processing industries, sugar and agro based industries waste. Solid waste management. Waste water characteristics and treatment methods.	**16 hours**
UNIT-I	
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.	**16 hours**
UNIT-III	
Food Statutes and Standards: National and International food laws, Mandatory and voluntary food laws. Food Safety and Standards Act, FSSAI, FSS Rules and regulations (Food product standards and Food Additives, contaminats, toxins and residues, Fortification of Foods), Duties and responsibilities of Food Safety Authorities. Agricultural Marketing and Grading Standards (AGMARK), Role of CODEX in food safety and standards, Food Safety Management Systems, International Featured Standards, BRC, AQAP.	**16 hours**

UNIT-IV	
Entrepreneur: Evolution of concept of Entrepreneur, Characteristics of an Entrepreneur, Distinction between an Entrepreneur and manager, Types of Entrepreneur, Concept of Entrepreneurship, Start-Up: Small enterprises, Definition, characteristics, relationship between small and large units, objectives and scope. **Production and operation management:** Investment analysis, Plant location, plant layout, product design, production design, quality control (Importance and Methods). Marketing Management: Marketing concepts and problems. Human resource management: manpower planning, Job requirements, Recruitment.	**16 hours**

Reference Books

Sl. No.	Text 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	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.

Course Outcomes:

1	Students will understands 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.
4	The knowledge regarding various standards and regulatory provisions would be beneficial for the students while pursuing their own entrepreneurship in food processing sector or while finding jobs in standard making organizations.

BAKERY AND CONFECTIONARIES TECHNOLOGY

Course Code : FT 4.3Credit : 4:0:0

Contact Hours : 64 L Internal Assessment: 30 M Examination: 70 M

Course Coordinator(s): Dr. Shardadevi Kallimani

UNIT-I	
Bakery Equipment: Introduction to utensils and equipments used in bakery unit and their uses small equipments, big equipments 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 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 and, water and salt, Ingredients from milk and eggs. Fruits, vegetables, and nuts, Spices, flavors and colors. Preservation methods.	and **16 hours**
UNIT-II	
Confectioneries and chocolate products: introduction, ingredients- sugar from cane, guar, khandasari sugar, raw sugar, refined sugar, white sugar, beet sugar, forms of sugar, liquid sweeteners, reactions of sugar and sugar based confectioneries. Importance of sugar confectionery and flour confectioner. Types of confectionery products-chocolate boiled sweets caramels toffees. Fondants. spoilage of confectionery products. Good manufacturing practices (GMP) in baking and confectionery industries. Sanitation and safety.	**16 hours**
UNIT-III	
confectioneryprocessing; 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 and liquorice. Aerated products: Marshmallows and Nougats. Lozenges: Ingredients and manufacturing. Indian Confectionery: Confectionery manufacturing practices	**16 hours**

and confectionery as a source of energy.	
UNIT-IV	
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.	**16 hours**

Reference Books

Sl. No.	Text Books
1	Matz, Samuel A., "Bakery Technology and Engineering", Third Edition, Chapman & Hall, London,
2	Cauvain, Stanley P, and Yound, Linda S., " Technology of Bread Making", Second Edition Aspen publication, Maryland, 2005.
3	Pomeranz. Y. "Modern Cereal Science and Technology". MVCH Publications, New York.2003.
4	Samuel A., Matz., " Equipment for Bakers", Pan TechInternational Publication, 2009.
5	Manley, Duncan., " Biscuit Doughs Manual 2", Woodhead Publishing Ltd., England. 2009

COURSE OUTCOMES

1	Students get the knowledge of handling the equipments used in bakery units by studying Bakery equipments.
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 envisages providing students with knowledge of the basic functioning of the Bakery industry.

PROJECT WORK / DISSERTATION
Course Code : FT 4.4 Course Coordinator(s): Dr. Sharath S, Dr. Shankar J, Dr. Paramesha M

Course Outcomes:

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: 0:0:2Contact Hours : 16 L
Internal Assessment: 10 M	Examination: 40 M	
Course Coordinator(s): Dr. Santosh Kumar S.R		

1. Estimation of tannins in relation to astringency.
2. Determination and estimation of food additives:
    a. Nitrites
    b. Boric acid
    c. Sorbic acid
    d. Sulphur dioxide
    e. MSG and sodium chloride
3. Determination and estimation natural and artificial food colours.
4. Determination and estimation of adulterants in foods: honey, fats & oils, spices (turmeric and red chilly powder).
5. Estimation of trypsin inhibitor in foods.
6. Texture analysis of foods by texturometer (Demonstration)
7. Problems to understand various biostastical concepts like
    a. Calculations related basic biostatistics
    b. Chi square
    c. One-way and two-way annova,
    d. Correlation aspects etc.

COURSE OUTCOMES

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.

WASTE MANAGEMENT, FOOD LAWS AND ENTREPRENEURSHIP LABORATORY

Course Code : FT 4.6 Credit: 0:0:2

Contact Hours : 16 L Internal Assessment: 10 M Examination: 40 M

Course Coordinator(s): Dr. Veeresh S.J

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 etc.
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 4.7Credit : 0:0:2 Contact Hours : 16 L Internal Assessment: 10 M Examination: 40 M Course Coordinator(s): Dr. Sharadadevi Kallimani

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

COURSE OUTCOMES

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.

I Semester M.Sc. Examination,

December, 2020 (2020-21
CBCS; New Syllabus)
FOOD TECHNOLOGY
20BOCA01:

Time: 3 Hours Max. Marks: 70

Note: *Answer Part-**A**, **four** questions from Part-**B** and **four full** questions from Part-**C***

PART – A

1. Answer **any five** of the following**:** **(2×5 = 10)**

a)

b)

c)

d)

e)

f)

g**)**

PART – B

(5×4 = 20)

2.

3.

4.

5.

6.

7.

PART – C

8. **(10×4 = 40)**

9.

10.

11.

12.

13.

***