ROYAL GLOBAL UNIVERSITY
GUWAHATI

ROYAL SCHOOL OF BIO-SCIENCES
(RSBSC)

Department of Food Technology

SYLLABUS
&
COURSE STRUCTURE

M.Sc. in Food Technology

W.E.F. 2025-2026

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M.Sc. in FOOD TECHNOLOGY UNDER CBCS

1. Preamble

The discipline of Food Technology has transcended boundaries and has incorporated diversified subjects to make it one of the most sought-after subjects to be pursued for UG/PG/ PhD degrees. Human beings are able to survive due to innovations in development of agriculture and its products. The M.Sc. programme in Food Technology is conceived with the idea of development of Human Resource for engagement in the society and food industries. The manpower generated through the programme may be engaged in the ever-increasing food industries and also for designing and development of entrepreneurial ventures.

The major objective of the programme is as follows:

- Impart theoretical and practical knowledge in the area of modern biology to enable them to work in industries, research organizations etc.
- To develop healthy citizens who are competent in their chosen fields.
- To instil confidence in the students for overall development of their professional expertise and traits.
- To instil the values of ethics and integrity.
- To enable graduates to become future leaders and innovators.

The two year degree course is for students who wish to broaden their knowledge about modern food science and technology and its relation to the development of society. Students who wish to make a change in the society and contribute to its improvement are highly welcome.

2. Introduction:

Food Technology is one of the multidisciplinary branches of Life Science, which amalgamates technology with food science to understand various food processing and their applications in human welfare. Thus, knowledge of Food Technology, helps in bridging the gap from labs to market driven research. Food Technology has its applications in almost every field, touching practically every human activity. The applied aspect of Food Technology is well established with its applications in Industry, Agriculture, Health and Environment. Food Technology requires a trained and skilled workforce to establish both the industry and research sectors. As a novel and rapidly expanding field, it demands continuous advancements in infrastructure and technology. With a strong global and local focus on developing new technological applications, the Food Technology sector in research and industry is poised to drive the next major revolution worldwide.

3.Aim of the Post Graduate Degree Programme in Food Technology:

The aim of the postgraduate degree in Food Technology is to equip students with knowledge and a thorough understanding of the fundamental concepts in the field. Students are expected to enhance their skills

in handling laboratory instruments and gain insight into the principles and mechanisms underlying their operation. A well-structured teaching-learning process will facilitate the development of knowledge, understanding, and technical expertise in Food Technology. Practical skills will be acquired through laboratory work, while presentation and articulation skills will be honed through seminars and internship experiences. Additionally, students will receive mentorship and guidance through research projects in their final year of study.

4. Career Opportunities:

Various scopes of career opportunities in Food Technology are as follows.

- Food Biochemists
- Food Microbiologists
- Food Quality Control Managers
- Food Inspector
- Nutritionists
- Dieticians
- Production Manager
- Academics

Students can also pursue higher studies such as Ph.D. programme in Food Technology or other areas in biological sciences.

DEPARTMENT OF FOOD TECHNOLOGY

VISION

To create food technologist who have strong ethics, integrity and preparedness to tackle any emerging global problem.

MISSION

- **Impart quality education to students and make them globally competitive food technologist.**
- **To incorporate confidence in the students to prepare themselves for solutions to emerging globally threatening problems.**
- **To provide state of the art academic and laboratory facilities.**

5. Post -Graduate Attributes:

Table: 7: The Learning Outcomes Descriptors and Post Graduate Attributes

Sl.no.	**Post Graduate Attribute**	**The Learning Outcomes Descriptors** ***(The post graduates should be able to demonstrate the capability to:)***
PGA1	Disciplinary Knowledge	Acquire knowledge and coherent understanding of the chosen disciplinary/interdisciplinary areas of study.
PGA 2	Complex problem solving	Solve different kinds of problems in familiar and non-familiar contexts and apply the learning to real-life situations.
PGA 3	Analytical & Critical thinking	Apply analytical thought including the analysis and evaluation of policies, and practices. Able to identify relevant assumptions or implications. Identify logical flaws and gaps in the arguments of others. Analyse and synthesize data from a variety of sources, draw valid conclusions and support them with evidence and examples.
PGA 4	Creativity	Create, perform, or think in different and diverse ways about the same objects or scenarios and deal with problems and situations that do not have simple solutions. Think 'out of the box' and generate solutions to complex problems in unfamiliar contexts by adopting innovative, imaginative, lateral thinking, interpersonal skills, and emotional intelligence.
PGA 5	Communication Skills	Listen carefully, read texts and research papers analytically, and present complex information in a clear and concise manner to different groups/audiences. Express thoughts and ideas effectively in writing and orally and communicate with others using appropriate media.

PGA 6	Research-related skills	Develop a keen sense of observation, inquiry, and capability for asking relevant/ appropriate questions. Should acquire the ability to problematize, synthesize and articulate issues and design research proposals, define problems, formulate appropriate and relevant research questions, formulate hypotheses, test hypotheses using quantitative and qualitative data, establish hypotheses, make inferences based on the analysis and interpretation of data, and predict cause-and-effect relationships. Should develop the ability to acquire the understanding of basic research ethics and skills in practicing/doing ethics in the field/ in personal research work.
PGA 7	Collaboration	Work effectively and respectfully with diverse teams in the interests of a common cause and work efficiently as a member of a team.
PGA 8	Leadership readiness/qualities	Plan the tasks of a team or an organization, setting direction by formulating an inspiring vision and building a team that can help achieve the vision.
PGA 9	Digital and technological skills	Use ICT in a variety of learning and work situations. Access, evaluate, and use a variety of relevant information sources and use appropriate software for analysis of data.
PGA 10	Environmental awareness and action	Mitigate the effects of environmental degradation, climate change, and pollution. Should develop the technique of effective waste management, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living.

6. Programme Learning Outcomes relating to M.Sc. degree programme in Food Technology

Students post graduating with the degree M.Sc. (Food technology) will be able to achieve the following:

PLO1: Knowledge of Food Technology: Students are able to demonstrate comprehensive knowledge and understanding of one or more disciplines such as chemistry, bio-chemistry, mathematics, statistics, microbiology, engineering, management; regulations with support of different allied subjects of Life Science; Physical Science

PLO2: Develop the ability to solve complex problems Develop: Identify, formulate, review research literature, and analyze complex. Design solutions for complexproblems and develop system components or processes that meet the specified needs with appropriate consideration for the food sustainability

PLO3: **Develop Critical thinking and analytical reasoning ability:** Recognize the need for lifelong learning and preparedness, logical reasoning, and ability to engage independently or as an entrepreneur while distinguishing and analyzing various aspects of real-life problems within the broader context of technological advancements.

PLO4: Develop the ability to create: Recognize new skills, ideas and technologies and its implementation in new product developments**.**

PLO5: Communication Skills: Communicate effectively, write effective reports, design documentation and make effective presentation through seminars and project dissertations

PLO6: Develop Research related skills: Acquire the practical knowledge and demonstrate the ability to design, conduct/troubleshoot experiments and analyze data in the field of food technology

PLO7: Develop the skills for collaborative work and team building: Work effectively with food industries, laboratories and production processing team to build the technical and practical learning aspects.

PLO8: **Develop Leadership qualities:** Work effectively with a team and building capabilities and leadership qualities for achieving the vision**.**

PLO9: Develop Digital and technological skills: The completion of this programme will enable the learner to use appropriate software to apply for bulk scale industrial production of technology-based food products

PLO10: Develop Environmental awareness and imbibe skills for addressing the problems: Examining the role of health consciousness, environmental awareness and intention on purchase of organic food

CREDIT DISTRIBUTION

SEMESTER	CREDITS
I	20
II	20
III	20
IV	20
	TOTAL CREDITS = 80

Assessment and Evaluation:

Scheme of Evaluation

The following suggestive table indicates the distribution of marks for various components in a semester

	Component of Evaluation	Marks	Frequency	Code	Weightage (%)
A	**Continuous Evaluation**				
i	Analysis/Class test	Combination of any two from (i) to (iv) with 10 marks each, (v) will be of 15 marks	1-3	C	45%
ii	Home Assignment		1-3	H	
iii	Project		1	P	
iv	Seminar		1-2	S	
v	Viva-Voce/Presentation		1-2	V	
vi	Midterm examination	MSE shall be of 10 marks	1-3	Q/CT	
vii	Attendance	Attendance shall be of 5 marks	100%	A	5%
B	**Semester End Examination**		1	SEE	50%
	Project				**100%**

1st SEMESTER				
COURSE CODE	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
FTC154C101	Food Biochemistry and Nutrition	500	4	4-0-0
FTC154C102	Food Preservation and Processing	500	4	4-0-0
FTC154C103	Food Microbiology	500	4	4-0-0
FTC154C104	Cereals, Legumes and Oilseeds Processing Technology	500	4	4-0-0
FTC154C115	Practical on Biochemistry and Nutrition	500	4	0-0-8
TOTAL CREDIT FOR 1st SEMESTER			**20**	
2nd SEMESTER				
COURSE CODE	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
FTC154C201	Spices and Plantation Crop Technology	500	4	4-0-0
FTC154C202	Instrumental Techniques in Food Analysis	500	4	4-0-0
FTC154C203	Food Safety, Quality Control, and Management Systems	500	4	4-0-0
FTC154C204	Meat, Poultry, Freshwater, and Marine Food Technology	500	4	4-0-0
FTC154C215	Practical on Spices and Plantation Crop Technology	500	4	0-0-8
TOTAL CREDIT FOR 2nd SEMESTER			**20**	
TOTAL CREDIT FOR 1st YEAR = 40				
3rd SEMESTER				
COURSE CODE	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
FTC154C301	Food Plant Design and Layout	500	4	4-0-0
FTC154C302	Research Methodology and Statistics	500	4	4-0-0
FTC154C303	Nutraceuticals and Health Foods	500	4	4-0-0
FTC154C314	Practical on Food Plant Design and Layout	500	4	0-0-8
FTC154C315	Practical on Research Methodology and Statistics	500	4	0-0-8

	TOTAL CREDIT FOR 3rd SEMESTER		**20**	
OR 3rd SEMESTER **(For students with 3rd and 4th Semester Research)**				
FTC154R321	RESEARCH PROJECT – PHASE I	500	20	
4th SEMESTER				
COURSE CODE	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
FTC154R421	Dissertation (Students with research in 4th Sem)	500	20	
(for 'coursework only' in lieu of Research)				
FTC154C401	Food Additives, Adulteration, and Toxicology	500	4	4-0-0
FTC154C402	Recent Trends in Food Product Development	500	4	4-0-0
FTC154C421	Dissertation-2 [One year PG (coursework + research)]	500	12	
TOTAL CREDIT FOR 4th SEMESTER = 20				
OR 4th SEMESTER **(For students with 3rd and 4th semester Research)**				
FTC154R421	RESEARCH PROJECT -PHASE 2	500	20	
TOTAL CREDIT FOR 2nd YEAR = 40				

SYLLABUS (1ST SEMESTER)

Subject Name: Food Biochemistry and Nutrition	**Scheme of Evaluation: (T)**
Subject Code: FTC154C101	**Credit Units: 4-0-0-4**

Course Objective: The course is designed to acquaint students with the chemical constituents of food, their interactions during cooking, and evaluation of taste characteristics of food.

Course Outcome:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the food groups and nutrient composition, flavoured components and their sensory evaluation.	**BT 1**
CO 2	**Understand** the functions and properties of carbohydrates, RDA and various metabolic pathways.	**BT 2**
CO 3	**Apply** the basic knowledge about proteins, their structure, functions and metabolic pathways	**BT 3**
CO 4	**Analyse** the composition of fats, oil and lipids with their functions, structure, properties, deficiencies, RDA and metabolic pathways.	**BT 4**
CO 5	**Evaluate** the functions and significance of vitamins and minerals, RDA and their effects in deficiencies and excess**.**	**BT 5**

Detailed Syllabus:

Modules	**Topics / Course content**	**Periods**
I	**FOOD AND ITS CONSTITUENTS:** Food and Nutrients - Definition, Classification, and Functions, Role of Water in Food and Human Health, Pigments, Phytonutrients, Antioxidants, Flavour Components – Definition, Classification, and Functions, Sensory Evaluation of foods – Organoleptic Analysis, Methods and Tests of Sensory Evaluation, Organizing Sensory Evaluation, Computer-Aided Sensory Evaluations, Anti-nutritional Factors in Foods, Digestion, Absorption, and Transport of Foods and Nutrients	**12**
II	**CARBOHYDRATES:** Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions, Deficiencies and Excess, Recommended Dietary Allowances, Metabolic Pathways - Glycolysis, Gluconeogenesis, Glycogenesis,	**12**

	Glycogenolysis, Citric Acid Cycle, Browning Reactions in Foods, Resistant Starches and Dietary Fibre – Definition, Sources and Functions	
III	**PROTEINS AND AMINO ACIDS:** Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions, Deficiencies and Excess, Recommended Dietary Allowances Metabolic Pathways - Transamination, Deamination, Decarboxylation, Urea Cycle, Stress and Anti-freeze Proteins; Protein Isolates and Concentrates, Denaturation of Proteins, Evaluation of Protein Quality	**12**
IV	**LIPIDS, FATS AND OILS**: Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions, Deficiencies and Excess, Recommended Dietary Allowances, Metabolic Pathways - Fatty Acid Oxidation, Biosynthesis of Fatty Acids, Synthesis and Functions of Cholesterol; Ketogenesis, Rancidity of Fats, Emulsions **VITAMINS AND MINERALS:** Classification, Functions, Dietary Sources, Deficiencies and Excess, Recommended Dietary Allowances	**12**
Total		**48**
Pedagogy: Lectures, Assignments, Seminars		

Text Books:

1. Agarwal A and Udipi SA. 2014. Textbook of Human Nutrition. Jaypee Brothers Medical Publishers (P) Ltd.
2. Bamji MS, Krishnaswamy K, and Brahmam GNV. 2009. Textbook of Human Nutrition. Third Edition. Oxford and IBH Publishing Co. Pvt. Ltd.
3. Belitz H.-D, Grosch W, and Schieberle P. 2009. Food Chemistry. Fourth Edition. Springer.

Reference Books:

1. Civille GV and Carr BT. 2016. Sensory Evaluation Techniques. Fifth Edition. CRC Press.
2. Damodaran S and Parkin K. 2017. Fennema's Food Chemistry. Fifth Edition. CRC Press.
3. Lawless HT and Heymann H. 2010. Sensory Evaluation of Food. Second Edition. Springer

Subject Name: Food Preservation and Processing	**Scheme of Evaluation: (T)**
Subject Code: FTC154C102	**Credit Units: 4-0-0-4**

Course Objective: The course is designed to understand the industrial techniques used to preserve and process foods, extend their shelf-life and improve their palatability characteristics.

Course Outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the principles of Food Preservations, their importance in food industry and various traditional and industrial methods of food preservation.	**BT 1**
CO 2	**Understanding** the different techniques of Food Preservation and their significance in food industry.	**BT 2**
CO 3	**Apply** the knowledge of low temperature techniques of food preservation and the methods of non-thermal processing used for different preservation.	**BT 3**
CO 4	**Analyse** the different food processing techniques, novel food processing, their parameters, advantages and disadvantages	**BT 4**
CO 5	**Evaluate** the different food processing industry globally and their techniques used in food preservation.	**BT 5**

Detailed Syllabus:

Modules	**Topics / Course content**	**Periods**
I	**INTRODUCTION TO FOOD PRESERVATION:** Principles of Food Preservation, Water Activity and its significance in food preservation, Overview of the Traditional Methods of Food Preservation, Natural and Chemical Food Preservatives – types, permissible limits, safety aspects, Psychrometric Charts	**12**
II	**THERMAL PRESERVATION:** Blanching, Pasteurization, Sterilization, Canning, Extrusion Cooking 2.2 Baking, Roasting, Grilling 2.3 Dehydration, Concentration, Evaporation, Intermediate Moisture Foods	**12**
III	**PRESERVATION BY THE USE OF LOW TEMPERATURES:** Refrigeration, Freezing, Lyophilisation, Cryogenic Freezing, Dehydrofreezing, Freeze Concentration, IQF	**12**

	NON-THERMAL PRESERVATION: Microwave Processing, Hurdle Technology, Irradiation, Pulsed Electric Field Electroporation, Modified Atmosphere, Biopreservation, High-Pressure Food Preservation, Membrane Technology, Cold Plasma Technology, Enzymes and Microbes in Food Preservation	
IV	**FOOD PROCESSING :**Definition and Difference between Food Processing and Food Preservation; Functions, Benefits and Drawbacks of Food Processing , Primary Processing Techniques – dicing, slicing, mincing, macerating, liquefaction, emulsification, Novel Food Processing – mushrooms, algae, leaf protein concentrates, protein from petroleum yeast, food analogues, edible insects , Performance Parameters for Food Processing – hygiene, energy efficiency, minimization of waste, labour , Overview of the types of food processing industries	**12**
Total		**48**
Pedagogy: Lectures, Assignments, Seminars		

Text Books:

1. Bhat R, Alias AK, and Paliyath G. 2012. Progress in Food Preservation. First Edition. Wiley-Blackwell.
2. Fellows PJ. 2016. Food Processing Technology Principles and Practice. Fourth Edition. Woodhead Publishing.
3. Food Science, Norman N. Potter and J.H. Hotchkiss, Chapman and Hall, 5th Edition., 1998.

Reference Books:

1. Ramaswamy HS and Marcotte M. 2005. Food Processing: Principles and Applications. Taylor & Francis.
2. Shapton DA and Shapton NF. 1998. Principles and Practices for the Safe Processing of Foods. Butterworth-Heinemann.

Subject Name: Food Microbiology	**Scheme of Evaluation: (T)**
Subject Code: FTC154C103	**Credit Units: 4-0-0-4**

Course Objective: The course aims to acquaint the students with different groups of microorganisms associated with food, their activities, destruction and detection in food.

Course outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the microorganisms involved in foods, their nutrient requirements, physiology with their classification for various food products.	**BT 1**
CO 2	**Understand** the process of fermentations and significance of microbial cultures in fermented products and the importance of prebiotics and probiotics.	**BT 2**
CO 3	**Apply** knowledge about various food borne infections and intoxications, their impact in human health and study about various quality control techniques.	**BT 3**
CO 4	**Analyse** ensures food safety, quality, and compliance with regulations.	**BT 4**
CO 5	**Evaluate** methods for detecting foodborne microorganisms.	**BT 5**

Detailed Syllabus:

Modules	**Topics / Course content**	**Periods**
I	**MICROORGANISMS IN FOOD:** Significance of microorganisms in foods – Nutrient requirements and physiology of microorganisms; Factors influencing microbial growth, survival, and destruction; Pathogenic and beneficial microorganisms, Spoilage organisms in milk, fruits, vegetables, grains, cereals, oilseeds, meat and poultry, Spoilage of canned foods, Physical and chemical methods of controlling microbes; Thermal Death Time	**12**
II	**FOOD FERMENTATION:** Microbial cultures in food fermentation and their maintenance; Bioreactors – types and designs, Traditional fermented foods of India and other Asian countries - fermented foods based on milk, meat, and vegetables; fermented beverages, Probiotics and Prebiotics	**12**

III	**FOOD PATHOGENS:** Contamination of food, Sources of contamination, Food poisoning and microbial toxins, Use of antimicrobial chemicals: Organic acids, sugars, sodium chloride, nitrites, phosphates, sulphites, benzoates, sorbets/propionates naturally occurring antimicrobials-their mode of action.	**12**
IV	**FOOD POISONING**: Food poisoning and food-borne infections, Screening, detection and enumeration techniques including rapid detection techniques for Food Micro-organisms including pathogens. Mechanism of action of antimicrobial agents. Methodologies for detection of food borne microorganisms.	**12**
Total		**48**
Pedagogy: Lectures, Assignments, Seminars		

Text Books:

1. Adams MR, Moss MO, and McCLure P. 2016. Food Microbiology. Fourth Edition. Royal Society of Chemistry.
2. Banwart GJ.1989. Basic Food Microbiology. Second Edition. AVI Publ.
3. Microbiology, J. Willey, L. M. Sherwood, C. Woolverton, McGraw Hill International, 8th Edition, 2010

Reference Books:

1. Casida LE. 2016. Industrial Microbiology. Second Edition. New Age International Publishers.
2. Early R. 2012. Guide to Quality Management Systems for the Food Industry. Blackie Academic & Professional

Subject Name: Cereals, Legumes and Oilseeds Processing Technology	**Scheme of Evaluation: (T)**
Subject Code: FTC154C104	**Credit Units: 4-0-0-4**

Course Objective: The course is designed to appraise the students to teach technology of milling of various cereals, to impart technical knowledge on refining of oilseeds and to understand the basic composition and structure of cereals and legumes.

Course Outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the nutritive value and distribution of various chemical constituents in rice grain	**BT 1**
CO 2	**Understand** the different principles, milling techniques and machineries used in wheat	**BT 2**
CO 3	**Apply** knowledge in the industrial application of corn/maize and its products	**BT 3**
CO 4	**Analyse** on the processing methods and importance of millets in the treatment of lifestyle diseases	**BT 4**
CO 5	**Evaluate** the methods of studying quality of cereals, legumes and oilseeds with	**BT 5**

Detailed Syllabus:

Modules	**Topics / Course content**	**Periods**
I	**RICE:** Structure, types, composition, quality characteristics and physicochemical properties of rice. Milling and parboiling of paddy, Curing and ageing of paddy and rice. Criteria in and assessment of milling, cooking, nutritional and storage qualities of raw & parboiled rice. Processed rice products (flaked, expanded and puffed rice). By-product (husk and rice bran) utilization.	**12**
II	**WHEAT:** General introduction, wheat production, wheat varieties, types and grades of Wheat. Nature of Wheat grain, structure, chemical composition and nutritive values. Milling of wheat – general principles and Machine operations. Roller flour milling Operations: -Principles and machinery operation including break system, reduction system, purification and Air fractionation of flours, etc. Flour and flour treatment; Utilization of by-products of wheat milling. Dough Rheology: Introduction, basic concepts to dough chemistry.	**12**

III	**LEGUMES:** Proximate Composition-Proteins, Carbohydrate, Lipids, Vitamins, and Minerals. Processing methods: Soaking, Germination, Decortication, Fermentation, Milling Anti-nutritional factors: Favism, Lathyrism etc. Products of processing: Grits, Nuggets, Isolates, Concentrates. Effect of processing on composition and nutritive Value. Fortification and Value-Addition of products.	**12**
IV	**CORN/MAIZE:** General introduction, Corn production, types and grades of Corn. Nature of grain, structure of grain, proximate composition and Nutritive value. Dry Milling of corn; general principles and machine operations. Wet milling operation of corn; general principles and machine operations Industrial applications of corn products- corn starch and corn syrups. **MILLETS:** Types, nutritive value, value added products - Processing methods and importance in treatment of lifestyle diseases. **OIL SEEDS:** Processing of oilseeds, oil extraction methods- mechanical (ghani and expellers) and chemical methods (solvent extraction), Oil refining, processing of refined oils.	**12**
Total		**48**
Pedagogy: Lectures, Assignments, Seminars		

Text books:

1. Handbook of Cereal Science and Technology, K. Kulp and J. G. Ponte. Jr., CRC, 2nd Edition, 2000.

2. Cereals Processing Technology, G. Owens, Woodhead Publishing, 2nd Edtion, 2001.

3. Legumes: Chemistry, Technology and Human Nutrition, R.H. Mathews, Marcel Dekker, 1st Edition, 1989.

Reference books:

1. Pomeranz Y. 1987. Modern Cereal Science and Technology. MVCH Publ.

2. Dubey SC. 2002. Basic Baking. The Society of Indian Bakers, New Delhi.

3. Francis FJ. 2000. Wiley Encyclopaedia of Food Science & Technology. John Wiley & Sons.

4. Pyler EJ. Bakery Science & Technology. 3rd Ed. Vols. I, II. Sosland Publ.

5. Bent A, Bennion EB & Bamford GST. 1997. The Technology of Cake Making. 6th Ed. Blackie.

Subject Name: Practical on Food Biochemistry and Nutrition	**Scheme of Evaluation:(P)**
Subject Code: FTC154C115	**Credit Units: 0-0-8-4**

Course Objective: The course is designed with an objective to give the students a wholesome practical skill required to prepare foods, and evaluate raw and processed foods.

Course Outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the practical skills associated with Microbiology, Biochemistry, Food Processing and preservation	**BT 1**
CO 2	**Understand** isolation, screening, characterization, and identification of important microbes from various sources.	**BT 2**
CO 3	**Apply** the knowledge gained during the course in the field of research and development.	**BT 3**
CO 4	**Analyse** theoretical knowledge in developing practical solutions in solving real life problems associated with microbiology.	**BT 4**
CO 5	**Create** and understand biochemical and microbial analysis and also to develop the skill of product development	**BT 5**

Detailed Syllabus:

Modules	**Topics / Course content**	**Periods**
I	1. Familiarising with basic glassware and laboratory instruments 2. Safety measures to be followed while working in biochemical laboratories 3. 3. Calculations for preparation of buffer solution, normal solution, molar solution, percent solution	**12**
II	1. Estimation of moisture content 2. Estimation of ash content 3. Estimation of crude fibre content 4. Estimation of fat content 5. Estimation of carbohydrates (%) content 6. Determination of energy value 7. Estimation of titratable acidity and pH	**28**
III	1. Application of osmotic dehydration for production of fruit candies, peeled candies and drying and packaging of vegetables (Sun drying and hot air oven drying)	**36**

	2. To determine the effect of heat on sugar solution and perform the thread and cold-water test 3. Use of chemical additives for preservation of jam, jellies, squashes, pickles, sauces etc. 4. Preparation of jam, jellies, pickles 5. Preparation of biscuit and cakes	
IV	1. Procedure of using micropipette, incubator, autoclave, laminar air flow 2. Preparation of Common Laboratory Media 3. Total plate Count (TPC) 4. Colony Forming Unit (CFU) and calculation 5. Method of Serial Dilution Technique 6. Common Plating Techniques (Streak, spread, pour plate method)	**20**
Total		**96**
Pedagogy: Lectures, Experiments, Laboratory sessions		

Texts and Reference: As suggested under theory papers

SYLLABUS (2ND SEMESTER)

Subject Name: Spices and Plantation Crop Technology	**Scheme of Evaluation:(T)**
Subject Code: FTC154C201	**Credit Units: 4-0-0-4**

Course objectives: The course is designed to acquaint students with the types of plantation crops and their processing techniques and to familiarize students with the processing of spices and condiments.

Course outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the types, varieties, classification process of coffee, tea, their products, by-products and detailed study about cashew and coconut harvesting and processing methods.	**BT 1**
CO 2	**Understand** the classification and composition of spices with their production.	**BT 2**
CO 3	**Apply** knowledge about oils, powders extracted from spices with their specifications and quality standards.	**BT 3**
CO 4	**Analyse** the classification of minor and major spices with their rate of production globally and worldwide.	**BT 4**
CO 5	**Evaluate** the market scenario of spice production their manufacturing process and their utility in food industry.	**BT 5**

Detailed syllabus:

Modules	**Topics / Course content**	**Periods**
I	**DEFINITION AND CLASSIFICATION:** Coffee – Chemical Constituents, Harvesting, Bean Processing, Types and Varieties, Manufacture, Quality and Grading, Chicory Chemistry and Use , Tea - Chemical Constituents, Harvesting, Leaf Processing, Types and Varieties, Manufacture, Quality and Grading , Cocoa – Production, Composition, Grading, Processing, Cocoa Products (cocoa mass, cocoa powder, cocoa butter, cocoa-based beverages, malted beverages, cocoa liquor) ,	**12**

	Coconut – Production, Composition, Grading, Post-Harvest Technology, Processing and Products (coconut milk, desiccated coconut) , Cashew nut Harvesting and Processing	
II	**SPICE AND CONDIMENT PROCESSING TECHNOLOGY**: History of Spices and Condiments, Classification and Composition of Spices and Condiments, Fumigation and Irradiation of Spices	**12**
III	**POST HARVEST TECHNOLOGY:** Spice oils, spice powders, oleoresins, flavour components, concentrates, Plant Suspension Cultures, Enzymatic Synthesis of Flavour Identical, Quality Standards and Specifications	**12**
IV	**MAJOR AND MINOR SPICES**: Chemistry, Constituents, Nutritive Value, and Functional Benefits of the following: Pepper, Cardamom, Ginger, Red and Green Chilli, Turmeric, Cumin, Coriander, Cinnamon, Fenugreek, Garlic, Nutmeg, Clove, Mint, Vanilla, Herbs and Greens	**12**
Total		**48**

Text Books:

1. Branen AL, Davidson PM and Salminen S. 2001. Food Additives. Second Edition. Marcel Dekker.
2. Branen AL, Davidson PM and Salminon S. 1990. Food Additives. Marcel Dekker.
3. Concon JM. 1988. Food Toxicology - Principles & Concepts. Marcel Dekker.

Reference Books:

1. Shabbir S. 2007. Food Borne Diseases. Humana Press.
2. Stephen AM. (Ed.). 2006. Food Polysaccharides and Their Applications. Marcel Dekker.

Subject: Instrumental Techniques in Food Analysis	Scheme of Evaluation: (T)
Subject Code: FTC154C202	Credit Units: 4-0-0-4

Course Objectives: This course aims to introduce students to the principles, instrumentation, and applications of various analytical instruments used in food analysis.

Course outcome:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the rules and regulations and importance of different analytical techniques in food analysis	**BT 1**
CO 2	**Understand** the principles and methodology involved in analytical techniques	**BT 2**
CO 3	**Apply** the different instrument needed in the industry for analysis	**BT 3**
CO 4	**Analyse** the instrumentation and sensors used in food industry	**BT 4**
CO 5	**Evaluate** the analytical data generated with different instruments and rapid analytical methods	**BT 5**

Detailed Syllabus:

Modules	Topics / Course content	Periods
I	**Concepts of food analysis** Rules and regulations of food analysis; Principles and methodology involved in analysis of foods: Rheological analysis, textural profile analysis of foods; Methods of analysis: Proximate constituents, moisture, adulterations, minerals analysis;	**12**
II	**Principles and methodology involved in analytical techniques:** Ion selective electrodes, spectroscopy, ultraviolet visible, florescence, infrared spectroscopy, atomic absorption and emission, mass spectroscopy, nuclear magnetic resonance and electron spin resonance; Chromatography: Adsorption, column, partition, gel-filtration, affinity, ion-exchange, size-exclusion method, high performance liquid chromatography; Separation techniques: Dialysis, electrophoresis, sedimentation, ultra-filtration, ultracentrifugation, iso-electric focusing, isotopic techniques, manometric techniques; Immuno assay techniques in food analysis;	**12**

III	**Evaluation of analytical data:** Accuracy and precision, statistical significance, co-relations regression, result interpretation; Instrumentation and sensors for the food industry; Food compositional analysis using near infrared absorption technology: Principles of measurement, instrumentation, applications in the food industry, power of process monitoring and trending, practical considerations for implementing on-line measurement, practical aspects of infra-red remote thermometry, radiation thermometers, Measurement principles, miscellaneous techniques; In-line and off-line FTIR measurements, calibration and general aspects of routine use;	**12**
IV	**Rapid analytical methods and sensors:** Overview, Conductance/impedance techniques for microbial assay; chemo-sensors, biosensors; Sensors for food flavour and freshness: Introduction to flavour assessment, modelling the human nose, electronic noses, tongues and testers, chemical marker approach, Chemically sensitive semiconductor devices: Solid-state sensors for pH, acidity, ions, gases and volatiles; amperometric, potentiometric and thermometric biosensors; Acoustic sensors, optical immune-sensors; Fluorescence sensor systems; Novel sensing receptors, sensor arrays, commercial biosensors.	**12**
Total		**48**

Text books:

1. S. Suzanne Nieisen. 2010. Food Analysis Laboratory Manual, 2nd Ed. Springer, NY, USA.
2. Wetzel, D.L. and Charalambous, G. eds., 1998. Instrumental methods in food and beverage analysis (Vol. 39). Elsevier.
3. SemihÖtles. 2009. Handbook of Food Analysis Instruments. CRC Press, Boca Raton,FL, USA.

Reference Books:

1. Da-Wen Sun. 2008. Modern Techniques for Food Authentication. Elsevier Inc., Burlington, MA, USA.
2. S. Suzanne Nieisen. 2003. Food Analysis, 3rd Ed. Kluwer Academic, New York, USA.

Subject Name: Food Safety, Quality Control and Management Systems	**Scheme of Evaluation: (T)**
Subject Code: FTC154C203	**Credit Units: 4-0-0-4**

Course Objective: The objective is to introduce the principles and methods of Food Quality Control and Assurance, principles and selection of panelists for sensory evaluation and Quality Management System and existing food Standards (ISO).

Course Outcome:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the different types of contamination in food and their harmful effects and their control measures	**BT 1**
CO 2	**Understand** the principles and methods of Quality Control and Assurance in foods	**BT 2**
CO 3	**Apply** and understand the principles of HACCP in different food processing.	**BT 3**
CO 4	**Analyse** the principles of sensory evaluation (Skills) that are carried out in a food industry	**BT 4**
CO 5	**Evaluate** a newly developed product, identify hazards and critical control points of different existing production processes	**BT 5**

Detailed Syllabus:

Modules	**Topics / Course content**	**Periods**
I	**Introduction to food safety** Introduction to food safety: Definition of food safety, food safety issues, factors affecting food safety. Safe food and importance of safe food Food Contamination; Types of food contamination, harmful effects and control. Food adulteration: Definition, common adulterated foods and harmful effects of adulterants Risk analysis- An introduction to risk analysis, risk assessment, risk management, risk communication	**9**

II	**Concepts of QC, QA & Quality Management** Concept of quality: Quality attributes- physical, chemical, nutritional, microbial. Quality control and Quality assurance- Objectives, importance and functions. Total Quality Management. Pre-requisite programmes- good hygienic practices, good manufacturing practices Hazard analysis critical control point: Definition, principles, development and application	**9**
III	**Global and domestic Food Safety Standards** ISO 22000:2005-Food safety management system ISO 9001:2000-Quality management system Global scenario- codex alimentarious commission (CAC) Auditing Domestic accrediting organisations: FSSAI, AGMARK, BIS	**9**
IV	**Quality Control:** Sensory analysis: Introduction, general testing conditions, Requirements of sensory laboratory, factors influencing sensory measurements. Sensory quality parameters – selection of sensory panellists. Sensory evaluation tests- Subjective and objective test of sensory parameters. Flavor profile tests; Statistical analysis of sensory data	**9**
Total		**36**
Pedagogy: Lectures, Assignments, Seminars		

Text books

1. Amerine MA, Pangborn RM & Rosslos EB. 1965. Principles of Sensory Evaluation of Food. Academic Press.
2. Alli, I., 2003. *Food quality assurance: principles and practices*. CRC Press.
3. Early R.1995.Guide to Quality Management Systems for Food Industries. Blackie Academic.

Reference books

1. Furia TE.1980. Regulatory status of Direct Food Additives. CRC Press.
2. Jellinek G. 1985. Sensory Evaluation of Food - Theory and Practice. Ellis Horwoood.
3. Krammer A & Twigg BA.1973. Quality Control in Food Industry. Vol. I, II. AVI Publ.
4. Macrae R, Roloson R & Sadlu MJ. 1994. Encyclopedia of Food Science & Technology & Nutrition. Vol. XVI. Academic Press.

Subject Name: Meat, Poultry, Freshwater, and Marine Food Technology	**Scheme of Evaluation: (T)**
Subject Code: FTC154C204	**Credit Units: 4-0-0-4**

Course Objective: To study about the processing of meat and preservation of meat by various techniques, to study about processing of poultry and sea foods, to provide insight into the functions and areas of responsibility of meat inspection.

Course Outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the sources of meat and meat products and its importance in India	**BT 1**
CO 2	**Understand** the factors affecting meat safety and quality and its preservative measures	**BT 2**
CO 3	**Apply** knowledge on the functional properties of eggs and its preservation by different methods	**BT 3**
CO 4	**Analyze** the post mortem changes in fish and the preservative measures of fish	**BT 4**
CO 5	**Evaluate** the different methods of slaughtering of animals in a meat processing plant	**BT 5**

Detailed Syllabus:

Modules	**Topics / Course content**	**Periods**
I	**Meat** Sources of meat and meat products in India, its importance in national economy. Chemical composition and microscopic structure of meat. Effect of feed, breed and management on meat production and quality. Stunning types and Slaughtering house operations of animals, inspection and grading of meat.	**9**
II	**Meat Processing** Factors affecting post-mortem changes. Factors affecting meat quality. Preservation of	**9**

	meat. Meat tenderization. Meat plant sanitation and safety. Modern abattoirs and design of facilities - typical layout and features. Microbiology & storage of meat. Meat products and it's by- products. Byproduct utilization. Packaging of meat.	
III	**Eggs** Structure, composition, nutritive value and functional properties of eggs and its preservation by different methods. Processing of egg (egg powder manufacturing). Factor affecting egg quality and measures of egg quality. Packaging of eggs.	**9**
IV	**Fish** Types of fish, composition, structure, post-mortem changes in fish. Fish processing and preservation: Fish by – products – shrimp and its processing. **Poultry industry in India.** Classes of poultry meat. Processing of poultry. Commercial methods of slaughtering, dressing. Microbiology of poultry meat, spoilage and its control. Preservation methods of poultry meat. By products of poultry meat and Packaging of poultry products.	**9**
Total		**36**
Pedagogy: Lectures, Assignments, Seminars		

Text books

1. Mead M. 2004. Poultry Meat Processing and Quality. Woodhead Publ.
2. Mead GC. 1989. Processing of Poultry. Elsevier.
3. Pearson AM & Gillett TA. 1996. Processed Meat. 3rd Ed. Chapman & Hall.

Reference Books

1. Forrest JC. 1975. Principles of Meat Science. Freeman.
2. Govindan TK. 1985. Fish Processing Technology. Oxford & IBH.
3. Hui YH. 2001. Meat Science and Applications. Marcel Dekker.
4. Kerry J. et al. 2002. Meat Processing. Woodhead Publ. CRC Press.
5. Levie A. 1984. Meat Hand Book. 4th Ed. AVI Publ.

Subject Name: Practical on Spices and Plantation Crop Technology	**Scheme of Evaluation: (P)**
Subject Code: FTC154C215	**Credit Units: 0-0-8-4**

Course Objective: The course is designed with an objective to familiarize students with elementary analytical methods required to determine the quality of agricultural produce, to acquaint students with rudimentary processing of pulses and oilseeds, to acquaint students with types and grades of meat, poultry, and sea foods, to familiarize students with processing techniques used for the production of commercial meat, poultry, and sea foods.

Course Outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** physicochemical tests for quality of cereals, legumes and oilseeds	**BT 1**
CO 2	**Understand** the ante mortem handling of livestock	**BT 2**
CO 3	**Apply** knowledge on microbiology and safety of livestock	**BT 3**
CO 4	**Analyse** the different Poultry Food Products – mince, salami, sausages, egg powder	**BT 4**
CO 5	**Evaluate** the Muscle Structure, Composition, Nutritional Value, Processing Operations, Colours and Flavours – fleshy fish and shell fish	**BT 5**

Detailed Syllabus:

Modules	**Topics / Course content**	**Periods**
I	1. Market Survey on Cereals, Legumes, Minor Millets, Oilseeds and their Products 2. Physicochemical Tests for Quality of Cereals, Legumes, and Oilseeds 3. Determination of Amylose in Rice 4. Extraction of Gluten from Cereals 5. Development of Simulated Milk and Milk Products from Soy 6. Preparation of Extruded Products from Pulses 7. Preparation of Peanut Butter	**24**

II	1. Muscle Structure, Meat Composition, Nutritional Value, Slaughtering and Post-Mortem Chemistry, Colours and Flavours of Livestock – buffaloes, sheep, goat, pigs, rabbits 2. Ante-Mortem Handling of Livestock 3. Microbiology and Safety of Livestock 4. Grading of Livestock and Quality of Meat 5. Storage and Preservation of Meat 6. Meat and Processed Meat Products – pickling, canning, drying, curing, smoking, kebabs, mince, salami, sausages, corned, intermediate moisture and dried meat products 7 Dressing of Meat – offal handling and inspection 8 By-product Utilization	**24**
III	1. Preparation of Non-Carbonated Beverages 2. Preparation and Evaluation of Wine 3. Estimation of Sulphur Dioxide in Beverages 4. Estimation of Ascorbic Acid Content of Commercial Juices	**24**
IV	1.Estimation of Phenolic Content in Beverages 2.Analysis of Mineral Content of Bottled Water 3.Analysis of Nutrient Content in Sports Drinks	**24**
Total		**64**
Pedagogy: Lectures, Experiments, Laboratory sessions		

- Texts: As suggested under the theory papers.

Subject Name: Food Plant Design and Layout	**Scheme of Evaluation:(T)**
Subject Code: FTC154C301	**Credit Units: 4-0-0-4**

Course objectives: The course is designed to understand the principles of plant design, develop expertise in plant location & layout, optimize process scheduling & equipment selection, implement effective maintenance & hygiene practices.

Course outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** considering plant design and layout.	**BT 1**
CO 2	**Understand** the different plant layout models and their applications in food and dairy industries.	**BT 2**
CO 3	**Apply** knowledge about plant location, levels of plant location, location of layout	**BT 3**
CO 4	**Analyze** the common problems in plant layout and process scheduling	**BT 4**
CO 5	**Evaluate** the office layout, line balancing & flexibility, common problems in plant layout and process scheduling	**BT 5**

Detailed syllabus:

Modules	**Topics / Course content**	**Periods**
I	**Overall Design of an Enterprise**: Plant design, sales planning for plant design, Strength of material – engineering materials, material science, use of various metals, including plastic, glass, etc in food industry, selection and specification – material design, concepts and manufacturing of various equipment and machineries for food processing plant	**12**
II	**Plant Location & Layout Design**: levels of Plant location, Location of layout: location factors, plant site selection, Location Theory and models, industrial buildings and grounds, Classification of Dairy and Food Plants, farm level collection and chilling centre, space requirement	**12**
III	**Preparation of a Plant Layout**: Plant Layout problem, importance, objectives, classical types of layouts. Evaluation of Plant Layout, Advantages of good layout.	**12**

	Organizing for Plant Layout, Data forms Common Problems in Plant Layout and Process scheduling, Sitting of Process sections	
IV	**Plant Maintenance & Hygiene Management:** Evaluation, Scheduling & Equipment Selection: Sitting of Process sections, Equipment selection and capacity determination Equipment selection and capacity determination, Arrangement of process, and service equipment, Estimation of Services and Utilities Office layout, line balancing, Flexibility, Practical Layouts, Maintenance of Food Plant Building, Illumination and ventillation, Cleaning and sanitization, painting and colour coding, Fly and insect control	**12**
Total		**48**

Text Books:

1. James M.Moore (1971) Plant Layout and Design Mac Millan, New York
2. Sean Moran (2015) Applied guide to process and plant design, Elsevier
3. H.S. Hall (1968) Milk Plant Layout FAO Pub., Rome

Reference Books:

1.Chandrashekar Hiregoudar (2017) Facility Planning and Layout Design Technical Publications

2. Richard Muther (1955) Practical Plant Layout, McGraw Hill

Subject Name: Research Methodology and Statistics	Scheme of Evaluation:(T)
Subject Code: FTC154C302	Credit Units: 4-0-0-4

Course Objective: The course aims to give a holistic knowledge with the principles and methods of scientific research and to familiarize students with statistical methods for data analysis.

Course Outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the steps and sampling methods of research design and various methods of data design.	**BT 1**
CO 2	**Understand** the graphical representation of research methods and scientific report writing	**BT 2**
CO 3	**Apply** knowledge about probability and distribution factors.	**BT 3**
CO 4	**Analyse** the measures of central tendency (mean, mode) for grouped and ungrouped data.	**BT 4**
CO 5	**Evaluate** the measures of sigma scores, standard scores, percentiles and calculation and interpretation of statistical procedures.	**BT 5**

Detailed Syllabus:

Modules	Topics / Course content	Periods
I	**INTRODUCTION TO RESEARCH**: Significance, Purpose and Types of Research, Ethics in Research, Plagiarism, Research Design – steps, Sampling Methods and Scaling Techniques, Research Tools and Methodology of Data Collection, Databases in Food Research	**12**
II	**RESEARCH DATA PRESENTATION**: Variables in Research and Scales of Measurement, Tabulation of Research Data, Graphical Presentation of Data – use of Excel and Statistical Software, Scientific Report Writing	**12**
III	**RELATED RESEARCH CONCEPTS:** Probability – Theoretical and Conditional, Gaussian Curve, Binomial Distribution, Poisson Distribution, Density Functions, Vital Statistics and Life Tables	**12**

IV	**DESCRIPTIVE STATISTICS**: Measures of Central Tendency – Mean, Mode, and Mode for Grouped and Ungrouped Data, Measures of Variability – Range, Variance, Standard Deviation and Standard Error, Measures of Relative Positions - Sigma Scores, Standard Scores, Percentiles, Percentile Ranks, Measures of Relationships – Correlation and Regression Analysis, Measures of Shape – Skewness, Kurtosis, Calculations and Interpretation of Statistical Procedures	**12**
Total		**48**
Pedagogy: Lectures, Assignments, Seminars		

Text Books:

1. Jackson SL. 2012. Research Methods and Statistics: A Critical Thinking Approach. Fourth Edition. Wadsworth Cengage Learning.
2. Singh, Y. K. (2006). *Fundamental of research methodology and statistics*. New Age International.
3. Krishnan V. 2011. Statistics for Beginners. Atlantic Publishers and Distributors (P) Ltd

Reference Books:

1. Kothari, C. R. (2004). Research methodology: Methods and techniques. New Age International.
2. Krishnaswamy, K.N., Sivakumar, A. I. and Mathiranjan, M. Management Research Methodology; Integration of Principles, Methods and Techniques (Pearson Education, 2006)

Subject Name: Nutraceuticals and Health Foods	**Scheme of Evaluation: (T)**
Subject Code: FTC154C303	**Credit Units: 4-0-0-4**

Course Objective: The course aims to acquaint students with the concept of functional foods and nutraceutical supplements and to familiarize students with the health benefits related to such products.

Course Outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the components of functional foods and foods containing nutraceuticals	**BT 1**
CO 2	**Understand** the development in the field of nutraceuticals and nutrigenomics	**BT 2**
CO 3	**Apply** knowledge of nutrient effects on molecular processes in the body and the role of phytochemicals in disease prevention and management.	**BT 3**
CO 4	**Analyse** the importance of probiotics and prebiotics in human health	**BT 4**
CO 5	**Evaluate** the probable prevention and treatment of chronic diseases	**BT 5**

Detailed Syllabus:

Modules	**Topics / Course content**	**Periods**
I	**Nutraceuticals**: Definition, History, Classification, Market trends, Sources. Demand drivers for health supplements and nutraceuticals in India. Development of nutraceuticals incorporated food products- Tailoring diets for special needs, critical steps, stability, and bioavailability of bioactive substances in food matrices.	**9**
II	**Functional foods**: Definition, History, and Types. Health benefits of functional foods and future promises in Indian diet. Future research and development of Functional foods- Qualified studies, modern technologies and appropriate consumer communication. Safety and regulatory aspects of functional foods.	**9**
III	**Probiotics and Prebiotics**: Definition, Types, Source and health benefits. Recent advances in probiotics and prebiotics. FAO/WHO/Standards/Guidelines on probiotics and prebiotics.	**9**

IV	**Pigments and Flavonoids**: Caretonoids, Curcumin, Teperenes, Allyl compounds for treatment and prevention of chronic diseases-Introduction, mechanism of action Curcumin, Role of curcumin in cancer, CVDs, neurological diseases, pulmonary diseases, diabetis, rheumatic and infectious diseases.	**9**
Total		**36**
Pedagogy: Lectures, Assignments, Seminars		

Text books:

1 Dilip Ghosh. 2006. Clinical aspects of functional foods and nutraceuticals, CRC Press.

2 Boye, I. and Nutraceutical, J., 2015. Functional Food Processing Technology. Wiley-Blackwell: Hoboken, NJ, USA.

3 Mehtab S Bamj, N Prahlad Rao, Vinodini Reddy. 2005. Textbook of Human Nutrition- Second Edition. Oxford and IBH Publishings Co. Pvt. Ltd.

Reference books:

1 Wilman. 2007. Handbook of nutraceuticals and functional foods, Second Edition, CRC Press.

2 Gibson GR and Williams CM. 2000. Functional Foods- Concept to Product CRC Press.

Subject Name: Practical on Food Plant Design Layout and Nutraceuticals	**Scheme of Evaluation: (P)**
Subject Code: FTC154C314	**Credit Units: 0-0-8-4**

Course Objective: This course provides postgraduate students with hands-on experience in food plant layout planning and nutraceutical processing techniques. It covers project and feasibility report preparation, design of storage facilities like godowns and cold storages, and layout planning for various food industries including dairy, bakery, and multiproduct units, along with waste management systems. The nutraceutical component focuses on the extraction of bioactive compounds, product formulation, and basic analytical techniques for evaluating functional properties, offering hands-on experience relevant to both industry and research applications.

Course Outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the fundamental principles of food plant layout, design components, and storage facility planning.	**BT 1**
CO 2	**Understand** the basic procedures for preparing project and feasibility reports for food processing units.	**BT 2**
CO 3	**Apply** practical knowledge in the extraction, formulation, and analysis of nutraceutical compounds from food sources	**BT 3**
CO 4	**Analyse** the different food plant designs and processing requirements for various food sectors including dairy, bakery, and multiproduct industries	**BT 4**
CO 5	**Evaluate** the functional properties of nutraceuticals through standard analytical techniques such as total phenolic content and antioxidant activity assays.	**BT 5**

Detailed Syllabus:

Modules	**Topics / Course content**	**Periods**
I	1. Preparation of project report 1. Preparation of feasibility report 2. Designing of layout of food storage wares and godowns 3. Designing of layout of cold storage 4. Designing of layout of preprocessing house	**24**

II	1. Designing of layout of milk and milk product plant 2. Designing of layout of bakery and related product plant 3. Designing of layout of fruit processing plant 4. Designing of Layout of vegetable processing plant	**24**
III	1. Extraction of Polyphenols from Green Tea / Pomegranate Peel 2. Isolation of Lycopene from Tomato 3. Extraction of Curcumin from Turmeric 4. Extraction of Flavonoids from Citrus Peel	**24**
IV	1. Formulation of a Nutraceutical Beverage Fortified with Herbal Extracts 2. Development of a Functional Energy Bar using Plant-based Ingredients 3. Total Phenolic Content (TPC) using Folin–Ciocalteu Method 4. Determination of Antioxidant Activity by DPPH/ABTS Assay	**24**
Total		**64**
Pedagogy: Lectures, Experiments, Laboratory sessions		

- Texts: As suggested under the theory papers.

Subject Name: Practical on Research Methodology and Statistics	**Scheme of Evaluation: (P)**
Subject Code: FTC154C315	**Credit Units: 0-0-8-4**

Course Objective: The course aims to provide practical skills in statistical data analysis, experimental design, and optimization using Excel, SPSS, and Design-Expert. It also trains students in scientific report writing, reference management, and literature search to support data-driven research.

Course Outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the basic functions of Microsoft Excel and SPSS in research data handling and statistical operations.	**BT 1**
CO 2	**Understand** the foundational concepts of data visualization, descriptive statistics, and probability distributions.	**BT 2**
CO 3	**Apply** practical knowledge in statistical analysis, experimental design, and data interpretation using Excel, SPSS, and Design-Expert software.	**BT 3**
CO 4	**Analyse** statistical test outcomes of experiments, designed by Design-Expert software	**BT 4**
CO 5	**Evaluate** experimental data and optimize responses using statistical tools, while documenting findings through scientific writing and literature referencing tools like Zotero/Mendeley.	**BT 5**

Detailed Syllabus:

Modules	**Topics / Course content**	**Periods**
I	1. Introduction to Microsoft Excel for research data entry and basic operations 2. Graph plotting in Excel – bar plots, line plots, pie charts, and spider web plots 3. Tabulation and calculation of descriptive statistics using Excel 4. Frequency distribution and histogram plotting using Excel	**24**
II	1. Analysis of variance (ANOVA) using Microsoft Excel 2. One-way and two-way ANOVA using SPSS software 3. Post hoc analysis (Tukey HSD, Bonferroni) using SPSS 4. Chi-square test and t-test using SPSS	**24**
III	1. Correlation and regression analysis using SPSS 2. Designing experiments using Design-Expert software 3. Conducting full factorial design analysis using Design-Expert	**24**

	4. Performing response surface methodology (RSM) using Design-Expert	
IV	1. Optimization of responses using desirability function in Design-Expert 2. Scientific report writing and referencing using Word and Zotero/Mendeley 3. Searching scientific databases (PubMed, ScienceDirect, Google Scholar) and managing references 4. Simulation and visualization of probability distributions (Normal, Binomial, Poisson) using Excel or R	**24**
Total		**64**
Pedagogy: Lectures, Experiments, Laboratory sessions		

- Texts: As suggested under the theory papers.

SYLLABUS (4th SEMESTER)

Subject Name: Food Additives, Adulteration and Toxicology	**Scheme of Evaluation: (T)**
Subject Code: FTC154C401	**Credit Units: 4-0-0-4**

Course Objective: The course aims to acquaint students with the additives relevant to the processed food industry for shelf-life extension, processing support and sensory appeal and to familiarize students with microbial, chemical and natural toxicants and allergens indigenously present and developed during food processing

Course Outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the classification and functions of food additives	**BT 1**
CO 2	**Understand** the different chemical agents added to enhance the quality of processed foods	**BT 2**
CO 3	**Apply** knowledge on the toxicological Evaluation of Food Additives and Adulterants.	**BT 3**
CO 4	**Analyse** and comprehend the effects of adulterants and toxic products in foods	**BT 4**
CO 5	**Evaluate** the different types and stability of flavour during food processing	**BT 5**

Detailed Syllabus:

Modules	**Topics / Course content**	**Periods**
I	**FOOD ADDITIVES AND ADULTERANTS**: Definition, Classification and Functions of Food Additives, Types of Adulteration in Food and Methods of Detection, Indirect food additives – intentional and unintentional, Toxicological Evaluation of Food Additives and Adulterants.	**9**
II	**FLAVOUR TECHNOLOGY**: Types of Flavours - reaction flavours, flavour composites, Stability of Flavours during Food Processing, Analysis of Flavours, Extraction Techniques of Flavours, Authentication of Flavours	**9**

III	**TOXICOLOGY**: Definition, Principles, and Classification of Food Toxicants, Toxicants derived from Plants, Animals, Marine, Algal, and Microbial Sources, Derived Food Toxicants (from processing and packaging)	**9**
IV	**FACTORS AFFECTING TOXICITY OF COMPOUNDS**: Manifestation of Toxic Effects - food poisoning and food-borne infections and disease, Methods used in Safety Evaluation	**9**
Total		**36**
Pedagogy: Lectures, Assignments, Seminars		

Text books:

1. Branen, A.L., Davidson, P.M., Salminen, S. and Thorngate, J. eds., 2001. Food additives. CRC Press.
2. Gerorge AB. 1996. Encyclopaedia of Food and Color Additives. Vol. III. CRC Press.
3. Concon JM. 1988. Food Toxicology - Principles & Concepts. Marcel Dekker.

Reference books:

1. Gerorge AB. 2004. Fenaroli's Handbook of Flavor Ingredients. Fifth Edition. CRC Press.
2. Hathcock JN. (Ed.). 1982. Nutritional Toxicology. Vol. I. Academic Press.
3. Madhavi DL, Deshpande SS and Salunkhe DK. 1996. Food Antioxidants: Technological, Toxicological and Health Perspective. Marcel Dekker

Subject Name: Recent trends in Food Product Development	Scheme of Evaluation: (T)
Subject Code: FTC154C402	Credit Units: 4-0-0-4

Course Objectives: Ability to generate new ideas and develop innovative food product and ability to evaluate the acceptability of develop product through consumer feedback.

Course Outcomes:

On successful completion of the course the students will be able to:		
Course Outcome		**Blooms Taxonomy Level**
CO 1	**Remember** the concept and generation of ideas in innovation product development	**BT 1**
CO 2	**Uunderstand** the different novel food packaging technologies used in an industry	**BT 2**
CO 3	**Apply** the effective active and intelligent packaging system for quality improvement of food products	**BT 3**
CO 4	**Analyse** the testing consumer responses to new packaging concepts.	**BT 4**
CO 5	**Evaluate** the ability to implement novel modified atmosphere packaging system for fresh-prepared produce	**BT 5**

Detailed Syllabus:

Modules	Topics / Course content	Periods
I	**Innovation product development:** Concept, generation of ideas. Desk Research. Screening/appraisal of initial ideas. Detailed study of product, process and market, Planning and developmental activities and evaluating them. Development of prototype product and its testing for acceptance. Development of process and planning for production trials. Planning the test market. Evaluation of test results. Launching of the product. Advertising and marketing plans. Introduction to Consumer Survey, market Survey. Detailed feasibility analysis.	**12**
II	**Novel/new product designing:** New Food Product Development (NPD) process and activities, The Stage-Gate model NPD success factors, new product design, food innovation case studies, market-oriented NPD methodologies, organization for successful NPD; Recipe Development; use of traditional recipe and modification; involvement of consumers, chefs and recipe experts; selection of materials/ingredients for specific purposes, selection of packaging material, storage studies, cost	**12**

	effectiveness, nutritional needs or uniqueness; use of novel food ingredients and novel processing technologies.	
III	**Standardization, Scaling-up, and Quality Assurance:** Process design and optimization, equipment selection, and establishment of process parameters for ensuring product quality and consistency. Sensory evaluation techniques, laboratory and statistical analysis for product assessment and market comparison. Product stability and shelf-life evaluation, including accelerated shelf-life testing and assessment of sensory changes due to environmental factors. Development of cost-effective and functional packaging systems for maintaining product integrity and minimizing interactions between packaging and food. Regulatory compliance, adherence to food safety standards, and approval processes for standard and proprietary products.	**12**
IV	**Recent advances:**3D food printing technology and its applications, alternative protein sources – air-based proteins and cell-cultured dairy, artificial intelligence in recipe development, sustainable ingredient alternatives, cocoa-free chocolate and plant-based innovations, functional foods enriched with probiotics, vitamins, and minerals, personalized nutrition and AI-driven dietary optimization, advancements in food formulation for health-conscious consumers, emerging trends in sustainable and ethical food production.	**12**
Total		**48**

Text Books:

1. Avantina Sharma, 2018, Food Product Development, CBS Publishers & Distributors
2. Khan, Z.S., Wani, S.A. and Fayaz, S. eds., 2023. Novel plant protein processing: developing the foods of the future. CRC Press.
3. Fuller, Gordon W. 2004. New Product Development- From Concept to Marketplace, CRC Press.

Reference Books:

1. Moskowitz, H.R., Saguy,S. and Straus,T. An Integrated Approach to New Food Product Development, CRC Press, 2006.
2. Creating New Foods. The Product Developer's Guide: Marie D. Earle and Richard L. Earle (2001). Chadwick House Group Ltd. New Zeeland