



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. 2022-23

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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 man power generated through the programme may be engaged in the ever increasing food industries and also for designing and development of entrepreneurship entities.

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 instill 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 now getting established with its applications in Industry, Agriculture, Health and Environment. Food Technology demands a trained, skilled human resource to establish the Industry and Research sectors. The field is novel and still expanding which demands inputs in Infrastructure and Technology. The global and local focus is on developing new technological applications. Food Technology sector in Research and Industry is expanding which is set to augur the next major revolution in the world.

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

The aim of the postgraduate degree in Food Technology is to make the students gather knowledge and understand the various basic concepts in Food Technology. The students are required to improve upon their skills in handling laboratory instruments and learn about the principles and mechanism of working of the instruments. The understanding, knowledge and skills in Food Technology need to be developed through a well-developed teaching learning processes in the class. Practical skills will be obtained through laboratory work and presentation and articulation skills through various seminars and internship exposure. The students will also be mentored and guided 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 <i>(The post graduates should be able to demonstrate the capability to:)</i>
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 holes in the arguments of others. Analyse and synthesize data from a variety of sources and 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 and 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. 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

PLO3: Develop Critical thinking and analytical reasoning ability : 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 logical reasoning and capability of recognizing and distinguishing the various aspects of real-life problems.

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

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

PLO6: Develop Research related skills: Acquire the practical knowledge and demonstrate the ability to design, conduct/trouble shoot 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 the team work 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's 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	22
II	24
III	27
IV	29

TOTAL CREDITS=102

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 three from (i) to (v) with 5 marks each	1-3	C	25%
ii	Home Assignment		1-3	H	
iii	Project		1	P	
iv	Seminar		1-2	S	
v	Viva-Voce/Presentation		1-2	V	
vi	Mid term 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	70%
	Project				100%

M.Sc. Food Technology

Programme Structure

1st semester

Sl. No.	Subject Code	Names of subjects	L	T	P	C	TCP
Core Subjects (Please Add rows, as required)							
1	FTC154C101	Food Biochemistry and Nutrition	3	1	0	4	4
2	FTC154C102	Food Preservation and Processing	3	1	0	4	4
3	FTC154C103	Food Microbiology and Food Safety Standards	3	1	0	4	4
5	FTC154C114	Practical I	0	0	8	4	8
Ability Enhancement Compulsory Courses (AECC)							
6	CEN984A101	Communicative English – I	1	0	0	1	1
7	BHS984A103	Behavioral Science – I	1	0	0	1	1
Elective: Discipline Specific DSE							
8	FTC154D101	DSE – I (Food Packaging and Food Laws)	3	1	0	4	4
		TOTAL CREDIT	14	4	8	22	26

2nd semester

Sl. No.	Subject Code	Names of subjects	L	T	P	C	TCP
Core Subjects (Please Add rows, as required)							
1	FTC154C201	Cereals, Legumes and Oilseeds Processing Technology	3	1	0	4	4
2	FTC154C202	Meat, Poultry, Freshwater, and Marine Food Technology	3	1	0	4	4
3	FTC154C203	Beverage Technology	3	1	0	4	4
4	FTC154C214	Practical II	0	0	8	4	8
Ability Enhancement Compulsory Courses (AECC)							
5	CEN984A201	Communicative English – II	1	0	0	1	1
6	BHS984A123	Behavioral Science – II	1	0	0	1	1
Elective: Discipline Specific DSE							
7		AEEC/SEC/-1*	2	0	0	2	2
8	FTC154D201	DSE – II (Spices and Plantation Crop Technology Technology)	3	1	0	4	4
		TOTAL CREDIT	16	4	8	24	28

3 rd semester							
Sl. No.	Subject Code	Names of subjects	L	T	P	C	TCP
Core Subjects <i>(Please Add rows, as required)</i>							
1	FTC154C301	Research Methodology and Statistics	2	1	0	3	3
2	FTC154C302	Food Safety, Quality Control and Management Systems	2	1	0	3	3
3	FTC154C314	Practical III	0	0	4	2	4
Ability Enhancement Compulsory Courses (AECC)							
4	CEN984A301	Communicative English – II	1	0	0	1	1
Elective: Discipline Specific DSE							
5		AECC/SEC/-2*	2	0	0	2	2
6	FTC154D301	DSE – III (Technology of Fruits and Vegetables Processing)	3	1	0	4	4
7	FTC154D302	DSE – IV (Technology of Milk and Milk Products)	3	1	0	4	4
8	FTC154D303	DSE – V (Food Biotechnology)	3	1	0	4	4
9	FTC154C321	Minor Project	0	0	10	4	10
		TOTAL CREDIT	18	3	14	27	35

4 th semester							
Sl. No.	Subject Code	Names of subjects	L	T	P	C	TCP
Core Subjects <i>(Please Add rows, as required)</i>							
1	FTC154C401	Food Additives, Adulteration and Toxicology	2	1	0	3	4
2	FTC154C402	Nutraceuticals and Health Foods	2	1	0	3	4
3	FTC154C414	Practical IV	0	0	4	2	4
Ability Enhancement Compulsory Courses (AECC)							
3	CEN984A401	Comm. Eng.	1	0	0	1	1
Elective: Discipline Specific DSE (Any Three)							
4	FTC154D401	DSE – VI (Instrumental Techniques in Food Analysis)	3	1	0	4	4
5	FTC154D402	DSE – VII (Extrusion Technology)	3	1	0	4	4
6	FTC154D403	DSE – VIII (Traditional Indian Food)	3	1	0	4	4
7	FTC154D404	DSE- IX (Recent trends in Food Product Development)	3	1	0	4	4
Project Dissertation							
5	FTC154C421	Major	0	0	10	8	10
		TOTAL CREDIT	16	3	14	29	35

SYLLABUS (1ST SEMESTER)

Subject Name: Food Biochemistry and Nutrition

Scheme of Evaluation: (T)

Subject Code: FTC154C101

Credit Units: 3-1-0-4

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:		
SI No	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 Programmes, 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, Glycogenolysis, Citric Acid Cycle, Browning Reactions in Foods, Resistant Starches and Dietary Fibre – Definition, Sources and Functions	12
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	<p>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</p> <p>VITAMINS AND MINERALS :Classification, Functions, Dietary Sources, Deficiencies and Excess, Recommended Dietary Allowances</p>	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: 3-1-0-4

Course Objective: The course is designed with the following major objectives

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:		
SI No	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 NON-THERMAL PRESERVATION: Microwave Processing, Hurdle Technology, Irradiation, Pulsed Electric Field Electroporation, Modified	12

	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.

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 and Food Safety Standards**Scheme of Evaluation: (T)****Subject Code: FTC154C103****Credit Units: 3-1-0-4****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:		
SI No	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 the functions of HACCP, ISO, BIS etc with their functions and significance.	BT 4
CO 5	Evaluate the various food sampling techniques and detection of 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 SAFETY AND QUALITY :Biochemical changes caused by microorganisms – putrefaction, lipolysis, antagonism and synergism in microorganisms , Food Hygiene – Food-borne Infections & Intoxications, Microbial Toxins, Indicator Organisms ,Industrial Plant Sanitation and Hygiene – Concept of food safety and quality; Quality attributes 4.4 Quality Control & Assurance – Objectives; Functions; GMP, GHP, GLP, GAP, HACCP; Indian and International Quality Systems and Standards (BIS, ISO, Codex Alimentarius, Codex India, etc.); CEDAC; Food Adulteration	12

IV	QUALITY ANALYSIS :Food Sampling Techniques; Rapid Detection Methods of Microorganisms, Separation techniques – Ultrafiltration, Ultracentrifugation, Sedimentation, Solid Phase Extraction, Supercritical Fluid Extraction, Chromatography, Electrophoresis, Analytical Techniques – Spectroscopy, Microscopy, Immunoassays, Isotopic techniques, Nanotechnology, Thermal Methods	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.

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: Practical I**Scheme of Evaluation:(P)****Subject Code: FTC154C114****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:		
SI No	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. 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) 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	36

IV	<ol style="list-style-type: none"> 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

Subject Name: DSE – 1 (Food Packaging and Food Laws) Scheme of Evaluation: (T)

Subject Code: FTC154D101

Credit Units: 3-1-0-4

Course Objective: The course is designed with an objective to give students knowledge on the the principles, methods, and materials used for safe packaging of foods and to familiarize students with national and international laws governing food production, import and export

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Remember the significance and functions of food packaging and their various types ,composition of materials and their usage for different food products	BT 1
CO 2	Understand the barrier and mechanical properties of packaging material and their role in shelf life of the food products.	BT 2
CO 3	apply knowledge about the role and functions of regulatory and controlling bodies like FSSAI, Codex India and their functions.	BT 3
CO 4	analyse the functions and structure of FBA, various state and central licensing agencies.	BT 4
CO 5	Evaluate the food laws, role of organizations and their functions.	BT 5

Detailed Syllabus:

Modules	Topics / Course content	Periods
I	INTRODUCTION TO FOOD PACKAGING AND MATERIALS USED :Functions and Objectives of Packaging , Forms of Packaging – rigid, semi-rigid, flexible , Packaging Closures and Sealing Systems, MATERIALS USED FOR FOOD PACKAGING :Paper and Paper-based Packaging Materials – types, properties, advantages and disadvantages ,Metal Packaging Materials - types, properties, advantages and disadvantages , Glass Packaging Materials - types, properties, advantages and disadvantages , Plastics and Composites - types, properties, advantages and disadvantages , Edible and Biodegradable Food Packaging Materials - types, properties, advantages and disadvantages , Selection and Design of Packaging Material for Dehydrated Foods, Frozen Foods, Dairy Products, Fresh Fruits & Vegetables, Meats, and Sea foods	12
II	PACKAGING MATERIAL PROPERTIES :Barrier properties – permeability, transmission rates, migration, diffusion and solubility ,Mechanical Properties – tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, stiffness, crease or flex resistance , Optical Properties , Labels, Food and Packaging Material Interactions , Methods of Testing and Evaluation ,Aseptic Packaging of Foods - definition, function and methods ,Active and Intelligent Packaging - definition, function and design	12

III	INDIAN FOOD LAWS :FDA - Structure and Function, Administrative Set-up, Roles and Responsibilities of Staff, FSSAI – Structure and Function, Administrative Set-up at the State Level, Roles and Responsibilities of Staff , Licensing and Registration of Food Units – Central and State Licensing Authorities ,Codex India	12
IV	INTERNATIONAL FOOD LAWS, ORGANIZATIONS AND AFFILIATIONS : FAO & WHO – Role and Functions ,World Animal Health Organization , World Trade Organization , European Committee for Standardization, European Union on Food Safety, EFSA, Euro-Asian Council for Standardization ,COPANT and ASEAN , ISO – special emphasis on ISO 9001:2000/2008; ISO 22000:2005; ISO 45001; ISO 14001 ,Rapid Alert System	12
Total		48
Pedagogy: Lectures, Assignments, Seminars		

Text Books:

1. Bizmanualz. 2008. ISO 22000 Standard Procedures for Food Safety Management Systems.
2. Gupta V. 2017. The Food Safety and Standards Act, 2006. Ninth Edition. Commercial Law Publishers (India) Pvt. Ltd.

Reference Books:

1. Natarajan S, Govindarajan M, and Kumar B. 2014. Fundamentals of Packaging Technology. Second Edition. PHI.
2. Prabhakar K. 2016. A Practical Guide to Food Laws and Regulations. Bloomsberry India Professional

SYLLABUS (2ND SEMESTER)

Subject Name: Cereals, Legumes and Oilseeds Processing Technology

Scheme of Evaluation: (T)

Subject Code: FTC154C201

Credit Units: 2-1-0-3

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:		
SI No	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 special reference to cooking quality	BT 5

Detailed Syllabus:

Modules	Topics / Course content	Periods
I	<p>RICE: General Introduction, rice production.</p> <p>Rice structure, proximate Composition, Nutritive value and distribution of various chemical constituents in rice grain: Methods of studying quality of Rice with special reference to cooking quality: Changes during aging of rice, accelerated aging of rice.</p> <p>Methods of enrichment of rice with nutrients like vitamins and minerals: Parboiling of rice</p> <p>Principle process and Methods of parboiling, economical and nutritional advantages of parboiling.</p> <p>Rice Milling operations; cleaning and milling machinery, Degree of Milling, Milling effect on nutrition and quality of rice; SEM process of rice milling.</p>	9
II	<p>WHEAT:</p> <p>General introduction, wheat production, wheat varieties, types and grades of Wheat. Nature of Wheat grain, structure, chemical composition and nutritive values.</p> <p>Milling of wheat – general principles and Machine operations.</p> <p>Roller flour milling Operations:-Principles and machinery operation including break</p>	9

	<p>system, reduction system, purification and Air fractionation of flours, etc.</p> <p>Flour and flour treatment; Utilization of by-products of wheat milling.</p> <p>Dough Rheology: Introduction, basic concepts to dough chemistry.</p>	
III	<p>LEGUMES: Proximate Composition-Proteins, Carbohydrate, Lipids, Vitamins, and Minerals.</p> <p>Processing methods: Soaking, Germination, Decortication, Fermentation, Milling</p> <p>Anti-nutritional factors: Favism, Lathyrism etc.</p> <p>Products of processing: Grits, Nuggets, Isolates, Concentrates.</p> <p>Effect of processing on composition and nutritive Value.</p> <p>Fortification and Value-Addition of products.</p>	9
IV	<p>CORN/MAIZE:</p> <p>General introduction, Corn production, types and grades of Corn.</p> <p>Nature of grain, structure of grain, proximate composition and Nutritive value.</p> <p>Dry Milling of corn; general principles and machine operations.</p> <p>Wet milling operation of corn; general principles and machine operations</p> <p>Industrial applications of corn products- corn starch and corn syrups.</p> <p>MILLETS:</p> <p>Types, nutritive value, value added products - Processing methods and importance in treatment of lifestyle diseases.</p> <p>OIL SEEDS:</p> <p>Processing of oil seeds, refining of oil</p> <p>Processing of oil seed as vegetable protein isolates and concentrates and their uses</p> <p>Processing of oil seeds as vegetables milk like beverages.</p>	9
Total		36
Pedagogy: Lectures, Assignments, Seminars		

Text books:

1. Manley DJR.1983. Technology of Biscuits, Crackers, and Cookies. Ellis Horwood.
2. Matz SA. 1992. Bakery Technology and Engineering. 3rd Ed. Chapman & Hall.

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. Pylar 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: Meat, Poultry, Freshwater, and Marine Food Technology Scheme of Evaluation: (T)

Subject Code: FTC154C202

Credit Units: 2-1-0-3

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:		
SI No	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 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.	9
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: Beverage Technology**Scheme of Evaluation: (T)****Subject Code: FTC154C203****Credit Units: 3-1-0-4**

Course Objective: The course is designed to acquaint students with the particulars of manufacturing industrial beverages and to familiarize students with the quality requirements of bottled beverages

Course Outcome:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Remember the significance of industrial beverage, types and functions and types of water with their treatments.	BT 1
CO 2	Understand the types of ingredients and their functionality in various carbonated and non-carbonated beverages used in food industry.	BT 2
CO 3	Apply the knowledge about processing techniques and ingredients used in beverages used for sports, domestic and industrial purpose	BT 3
CO 4	Analyse the different types of beverages with their classifications and variations.	BT 4
CO 5	Evaluate the techniques used in the processing of alcoholic beverages	BT 5

Detailed Syllabus:

Modules	Topics / Course content	Periods
I	WATER AS AN INDUSTRIAL BEVERAGE 12 hours 1.1 Status of Beverage Industry in India and globally 1.2 Types of Bottled Water – Mineral Water, Spring Water, Flavoured Water, Carbonated Water 1.3 Packaged Drinking Water – Manufacturing Process, Raw and Processed Water, Water Treatment 1.4 Quality Standards of Bottled and Packaged Water.	12
II	CARBONATED AND NON-CARBONATED BEVERAGES : Beverage Ingredients and their Functions – sweeteners, bulking agents, acidulants, flavourings, preservatives , Concentrated Beverages – ingredients, processing techniques, and standards ,Carbonated Beverages - ingredients, processing techniques, and standards , Fruit- and Vegetable-based Beverages – ingredients, processing techniques, and standards	12
III	SYNTHETIC BEVERAGES: ingredients, processing techniques, and standards , Beverages used in the Sports Industry – types, ingredients, processing techniques, and standards , Indigenous Beverages for Domestic and Commercial Use – sugarcane juice, cashew apple extract, coconut palm sap	12
IV	ALCOHOLIC BEVERAGES :Distillation and Distilled Liquors – whisky, rum, gin, vodka, brandy 3.2 Fermentation and Fermented Alcohols – wine, ciders, sake 3.3 Carbonated Alcohols – beer, champagne 3.4 Indigenous Alcohol Production – urak, feni, toddy 3.5 Liqueurs and Aperitifs	12
Total		48
Pedagogy: Lectures, Assignments, Seminars		

Text Books:

1. Hui YH et al 2004. Handbook of Food and Beverage Fermentation Technology. Marcel Dekker.
2. Priest FG & Stewart GG. 2006. Handbook of Brewing. Second Edition. CRC

Reference Books:

1. Richard P Vine. 1981. Commercial Wine Making - Processing and Controls. AVI Publ.
2. Varnam AH and Sutherland JP. 1994. Beverages: Technology, Chemistry and Microbiology. Chapman & Hall..

Subject Name: Practical II
Subject Code: FTC154C214

Scheme of Evaluation: (P)
Credit Units: 0-0-4-2

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:		
SI No	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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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.

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 Salminen 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.

SYLLABUS (3rd SEMESTER)

Subject Name: Research Methodology and Statistics

Scheme of Evaluation:(T)

Subject Code: FTC154C301

Credit Units: 3-1-0-4

Course Objective: The course is designed with the following major objectives

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:		
SI No	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. Krishnan V. 2011. Statistics for Beginners. Atlantic Publishers and Distributors (P) Ltd

Reference Books:

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

Subject Name: Food Safety, Quality Control and Management Systems Scheme of Evaluation: (P)

Subject Code: FTC154C302

Credit Units: 2-1-0-3

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:		
SI No	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 alimentarius commission (CAC) Auditing Domestic accrediting organisations: FSSAI, AGMARK, BIS	9
IV	Sensory Evaluation: Sensory analysis: Introduction, general testing conditions, Requirements of sensory laboratory, factors influencing sensory measurements. Sensory quality parameters – selection of sensory panelists. 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. 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 Horwood.
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: Practical III

Scheme of Evaluation: (P)

Subject Code: FTC154C314

Credit Units: 0-0-8-4

Course Objective:

The course is designed with an objective to give the students a wholesome practical knowledge to acquaint students with the production of industrial beverages, extraction procedure of nutrients and functional components from foods and to familiarize students with the practical aspects of toxin free foods

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Remember the preparation methods used for the production of non-carbonated beverages and wine with their estimation of sulphur dioxide and ascorbic acid content.	BT 1
CO 2	Understand the methods involved in analysis of mineral and nutrient content in various beverages and sports drink.	BT 2
CO 3	Apply the labeling methods in health and Nutraceuticals foods and extraction of vitamins and nutrients from various fruits and vegetables.	BT 3
CO 4	Analyse the preservatives, additives and colours used in food processing.	BT 4
CO 5	Evaluate the production and manufacturing process of beverages globally and worldwide with a market survey report.	BT 5

Detailed Syllabus:

Modules	Topics / Course content	Periods
I	1. Introduction to Microsoft Excel 2. Graph plotting (Bar plots, linear plot, pie chart, and spider web plots) 3. Analysis of variance (ANOVA) in Microsoft Excel and SPSS software 4. Post hoc analysis in SPSS software 5. Design of experiments using design expert 6. Response surface methodology and optimization using design expert software	20
II	1. Testing adulteration of sugar in honey using FSSAI DART protocols 2. Testing of Adulteration in turmeric powder 3. Testing of oil adulteration with Tri-ortho-cresyl phosphate 4. Testing the quality of egg using immersion method 5. Testing adulteration of bricks salt in chilli powder 6. Testing adulteration of milk with maltodextrin	20
III	1. Market Survey and Classification of Health Foods and Nutraceuticals 2. Development of Labels for Health Foods	10

IV	1. Estimation of Preservatives in Foods	14
	2. Estimation of Colours in Foods	
	3. Olfactory Analysis of Food Products	
Total		64
Pedagogy: Lectures, Experiments, Laboratory sessions		

Texts: As prescribed under theory papers

Subject Name: DSE – 3 (Technology of Fruits and Vegetables Processing)	Scheme
of Evaluation:(T)	
Subject Code: FTC154D301	Credit Units: 3-1-0-4

Course Objective:

This course is offered with the objective of familiarizing students To study the application of food processing and preservation principles and technologies in the processing, preservation, extension of shelf life and value addition of fruit and vegetable products and To impart knowledge and understanding of the basic post-harvest biological, chemical, physiological and metabolic processes and changes in fruits and vegetables.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Remember the general composition and nutritive value of fruits an vegetables	BT 1
CO 2	Understand the various processing techniques of processing of pulp, puree, concentrates, pickles and sauces from different fruits and vegetables	BT 2
CO 3	Apply knowledge on the different mechanical drying methods for fruits and vegetables	BT 3
CO 4	Analyse the principles and the different methods for food preservation	BT 4
CO 5	Evaluate the different methods of non-thermal methods of food preservation	BT 5

Detailed Syllabus:

Modules	Topics / Course content	Periods
I	Introduction to Horticulture Indian and global scenario on production and processing of fruits and vegetables General composition of fruits and vegetables and their nutritive value. Maturity indices and standards for selected fruits and vegetables. Post harvest changes in fruits and vegetables. Commodity pre-treatment - chemicals, wax coating, pre-packaging, UHT and irradiation. Quality requirements of raw materials for processing. Packaging house operations.	12
II	Fruit & Vegetable Processing Processing for pulp, puree and concentrates, pickles and sauces from different fruits and vegetables. Processing of fruits for candies, bars, toffees, jams and jellies using locally available fruits. Dehydration of fruits and vegetables using various drying technologies like sun drying, solar drying (natural and forced convection) osmotic, tunnel drying,	12

	fluidized bed drying, freeze drying, convectional and adiabatic drying. spray drying.	
III	<p>Introduction to preservation & High Temperature Processing</p> <p>Scope of Food processing and preservation in India</p> <p>Principles and methods of food preservation.</p> <p>Preservation by chemicals-Preservatives, types, chemical preservatives used in different processed foods and their functions. Permissible limits and safety aspects</p> <p>Processing and preservation by heat; canning, blanching, pasteurisation, sterilisation</p> <p>Microwave heating, extrusion cooking</p> <p>Preservation of food by fermentation</p>	12
IV	<p>Low Temperature Processing</p> <p>Processing and preservation by low-temperature refrigeration</p> <p>freezing-types of freezing</p> <p>New Techniques of Preservation</p> <p>Processing and preservation by non-thermal methods</p> <p>o Irradiation, Hurdle technology, high pressure processing, pulsed electric field, Membrane technology.</p> <p>Nanotechnology: Principles and applications in foods</p>	12
Total		48

Text Books:

1. Banerjee B. 2002. Tea Production and Processing. Oxford Univ. Press.
2. Minifie BW. 1999. Chocolate, Cocoa and Confectionery Technology. 3rd Ed. Aspen Publ.
3. NIIR. 2004. Handbook on Spices. National Institute of Industrial Research Board, Asia Pacific Business Press Inc.

Reference Books:

1. Sivetz M & Foote HE. 1963. Coffee Processing Technology. AVI Publ.
2. Kadar AA.1992. Post-harvest Technology of Horticultural Crops. 2nd Ed. University of California.
3. Lal G, Siddapa GS & Tandon GL.1986. Preservation of Fruits and Vegetables. ICAR.

Subject Name: DSE – 4 (Technology of Milk and Milk Products)	Scheme of
Evaluation: (T)	
Subject Code: FTC154D302	Credit Units: 3-1-0-4

Course Objectives:

The course aims to impart skills in the application of biological, chemical, biochemical, physical and engineering sciences in processing and preservation of milk and milk products.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Remember the composition and nutritive value of milk and milk products	BT 1
CO 2	Understand the different methods of manufacture of dried milk, condensed and evaporated milk	BT 2
CO 3	Apply knowledge on the different manufacturing methods of cream	BT 3
CO 4	Analyse the methods of manufacture and its defects in cheese and butter	BT 4
CO 5	Evaluate the different indigenous milk products produces in a dairy processing plant	BT 5

Detailed Syllabus:

Modules	Topics / Course content	Periods
I	MILK Present status of milk & milk products in India and abroad; market milk- Composition of milk of various species, quality evaluation and testing of milk, procurement, transportation and processing of market milk, cleaning & sanitization of dairy equipments. Special milks such as flavoured, sterilized, recombined & reconstituted toned & double toned.	12
II	Condensed milk- Definition, methods of manufacture, evaluation of condensed & evaporated milk; dried milk- Definition, methods of manufacture of skim & whole milk powder, instantiation, physiochemical properties, evaluation, defects in dried milk powder. Cream- Definition, classification, composition, cream separation, sampling, neutralization, sterilization, pasteurization & cooling of cream, evaluation, defects in cream;	12

III	<p>Butter- Definition, composition, classification, methods of manufacture, theories of churning, evaluation, defects in butter.</p> <p>Cheese: Definition, composition, classification, methods of manufacture, cheddar, swiss, cottage and processed cheese, evaluation, defects in cheese.</p>	12
IV	<p>Ice cream- Definition, composition and standards, nutritive value, classification, methods of manufacture, evaluation, defects in ice cream, and technology aspects of softy manufacture.</p> <p>Indigenous milk products - Present status, method of manufacture of yoghurt, dahi, khoa, burfi, kalakand, gulabjamun, rasogulla, shrikhand, chhana, paneer, ghee, lassi etc; probiotic milk products.</p>	12
Total		48

Text Books:

1. Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. Technology of Indian Milk Products. Dairy India Publ.
2. De Sukumar, 1980. Outlines of Dairy Technology. Oxford Univ. Press.

Reference Books:

1. Rathore NS et al. 2008. Fundamentals of Dairy Technology - Theory & Practices. Himanshu Publ
2. Web BH, Johnson AH & Lford JA. 1987. Fundamental of Dairy Chemistry. 3rd Ed. AVI Publ.
3. Spreer E. 1993. Milk and Dairy Products. Marcel Dekker.
4. Walstra P. 1999. Dairy Technology. Marcel Dekker.

Subject Name: DSE – 5 (Food Biotechnology)**Scheme of Evaluation:(T)****Subject Code: FTC154D303****Credit Units:3-1-0-4**

Course Objectives: The course aims to give a holistic theoretical knowledge in field of genetic material to understand the various cellular activities.

Course outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Remember the chemical nature, properties and functions of genetic material	BT 1
CO 2	Understand the production of identical cells, isolation and purification of insert DNA	BT 2
CO 3	Apply knowledge in the application of biosensors in food industry	BT 3
CO 4	Analyse the current guidelines for production, release and movement of GMOs	BT 4
CO 5	Evaluate recombinant DNA into host cell, identification and selection of cells containing cloned genes	BT 5

Detailed Syllabus:

Modules	Topics / Course content	Periods
I	DNA & RNA Chemical nature of the genetic material, properties and functions of the genetic material, organization of the genetic material in bacteria, eukaryotes and viruses; DNA replication: Replication fork, DNA polymerases, other enzymes and proteins required for DNA replication, origin of replication, replication of circular DNA molecule; Transcription and translation: RNA synthesis, types of RNA, genetic code; Mutation and DNA repair, mechanisms of repair of damaged DNA (photo reactivation, excision repair, recombination repair, SOS repair, mismatch repair), transposable elements, plasmids, types of plasmids, genetic recombination in bacteria, transformation, transduction, conjugation, regulation of gene expression in prokaryotes; Expression of foreign genes; Promoter enzymes; Recombinant DNA technology: Restriction enzymes, cloning vectors, cloning procedure, cloning of specific gene and their identification (colony hybridization, C-DNA, southern blotting, polymerase chain reaction)	12
II	Gene cloning: Production of identical cells, isolation and purification of insert DNA, isolation of vector DNA, construction of recombinant DNA, introduction of recombinant DNA into host cell, identification and selection of cells containing cloned genes;	12
III	Biosensors:	12

	Classification, application in food industry; Application of biotechnology in food: Immobilization of enzymes: Arresting of cell in insoluble matrix, immobilized cell systems, cell attachment in a surface, aggregation, entrapment, containment, physical adsorption, covalent bonding, cross linking, entrapment into polymeric films, microencapsulation, large scale cell immobilization, uses and applications in industries;	
IV	Ethical issues concerning GM foods: Testing for GMOs, current guidelines for production, release and movement of GMOs, labeling and traceability, trade related aspects, bio-safety, risk assessment, risk management, public perception of GM foods, IPR, GMO Act 2004.	12
Total		48

Text Books:

1. B. D. Singh. 2014. Biotechnology - Expanding Horizons. Kalyani Publishers, New Delhi.
2. Meenakshi Paul. 2007. Biotechnology and Food Processing Mechanics. Gene-Tech Books, New Delhi.

Reference Books:

1. James D. Watson. 2013. Molecular Biology of the Gene, 7th Ed. Benjamin Cummings, San Francisco, USA.
2. Oliver Brandenburg, Zephaniah Dhlamini, Alessandra Sensi, Kakoli Ghosh and Andrea Sonnino 2011. Introduction to Molecular Biology and Genetic Engineering. FAO, Rome, Italy
3. S. B. Primrose and R. M. Twyman. 2006. Principles of Gene Manipulation and Genomics, 7th Ed. Blackwell Publishing, Victoria, Australia.
4. Ashok Agarwal and Pradeep Parihar. 2005. Industrial Microbiology: Fundamentals and Applications. Agrobios India, Jodhpur.

SYLLABUS (4th SEMESTER)**Subject Name: Food Additives, Adulteration and Toxicology Scheme of Evaluation: (T)****Subject Code: FTC154C401****Credit Units: 2-1-0-3****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:		
SI No	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 AL, Davidson PM and Salminen S. 1990. Food Additives. Marcel Dekker.
2. Concon JM. 1988. Food Toxicology - Principles & Concepts. Marcel Dekker.

Reference books:

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

Subject Name: Nutraceuticals and Health Foods**Scheme of Evaluation: (T)****Subject Code: FTC154C402****Credit Units: 2-1-0-3****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:		
SI No	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 the effects of nutrients in molecular level process in the body and the effect of phytochemicals in disease conditions	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: Carotenoids, Curcumin, Terpenes, Allyl compounds for treatment and prevention of chronic diseases-Introduction, mechanism of action Curcumin, Role of curcumin in cancer, CVDs, neurological diseases, pulmonary diseases, diabetes, 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 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 IV**Scheme of Evaluation: (P)****Subject Code: FTC154C414****Credit Units: 0-0-4-2****Course Objective:**

To familiarize students with isolation of various biopolymers from food resources, To acquaint students with the practical aspects of toxin-free foods

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Remember the protocol for Detection and Quantification of Toxins in Food	BT 1
CO 2	Understand and preparation of a HACCP chart for a Dairy Industry	BT 2
CO 3	Apply knowledge on olfactory analysis of food products	BT 3
CO 4	Analyse the presence of additives in foods	BT 4
CO 5	Evaluate and determine the presence of adulterants in foods	BT 5

Detailed Syllabus:

Modules	Topics / Course content	Periods
I	1. Study of food labels and identification of different categories of food additives 2. Prediction of color using RGB images using possible Image based software 3. Development of native starch and retrograded starch 3. Basic Olfactory analysis of food products	12
II	1. Rapid detection of adulterants in spices like turmeric, chili powder etc. 2. Qualitative detection of adulterants in milk using DART techniques 3. Rapid detection of sugar syrup as adulterants in honey 4. Qualitative analysis of adulterants in whole grains and whole spices	12
III	1. Evaluation of Quality Attributes of Raw and Processed Foods (e.g., Fresh, Canned, and brined fruits and vegetables) 2 Evaluation of Sensory Characteristics of Bakery Products (e.g., Freshly baked and few days earlier products) 3 Evaluation of Sensory Characteristics of Thermally Processed Foods (e.g., curry mix freshly prepared and stored in retort pouches, raw milk, UHT and pasteurized milk etc.)	12
IV	1. Study of hygiene protocol followed by Food Service Organization 2. Determination of Nutrient Levels in Foods and Comparisons to Standards or databases 3. Preparation of a HACCP chart for a food Industry	12
Total		48
Pedagogy: Lectures, Experiments, Laboratory sessions		

Texts: As suggested under the theory papers.

Subject: DSE-6 (Instrumental Techniques in Food Analysis) Scheme of Evaluation: (T)

Subject Code: FTC154D401

Credit Units: 3-1-0-4

Course Objectives:

This subject aims to introduce students to the instrumentation and application of different instrument for food analysis.

Course outcome:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Remember the rules and regulations in rheological, textural profile analysis of foods	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 rapid microbiological methods in analysis of foods	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 spectro, 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, gasliquid, 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	<p>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, 93 measurement principles, practical situations, miscellaneous techniques; In-line and off-line FTIR measurements, food applications, calibration and general aspects of routine use;</p>	12
IV	<p>Rapid microbiological methods: Overview, Conductance/impedance techniques for microbial assay; chemo-sensors, biosensors, immune sensors; Electronic noses and tongues: Sensors for food flavour and freshness, electronic noses, tongues and testers; Introduction to flavour assessment, modelling the human nose, electronic nose, electronic tongue, marker chemical 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.</p>	12
Total		48

Text books:

1. S. Suzanne Nielsen. 2010. Food Analysis Laboratory Manual, 2nd Ed. Springer, NY, USA.
2. 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 Nielsen. 2003. Food Analysis, 3rd Ed. Kluwer Academic, New York, USA.

Course Objectives:

To impart knowledge on extrusion technology of food processing about different raw materials used and their role and different equipment, processing of different Products and their packaging & Quality maintenance.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Ability to remember the principles and types of extruders used in food industry	BT 1
CO 2	Ability to understand the process characteristics of extruders in food industry	BT 2
CO 3	Ability to apply knowledge practically on extrusion cooking technology	BT 3
CO 4	Ability to analyze the knowledge in the areas of extruded products processing	BT 4
CO 5	Ability to evaluate the different generation snacks in extrusion technology	BT 5

Detailed Syllabus:

Modules	Topics / Course content	Periods
I	<p>Introduction to Extrusion</p> <p>Extrusion: definition, introduction to extruders, Extruders in the food industry – History, uses, principles and types – Chemical and nutritional changes in food during extrusion.</p> <p>Single screw extruder: principle of working, net flow, factors affecting extrusion process, co-kneaders</p>	12
II	<p>Extruders</p> <p>Twin screw extruder: counter rotating and co-rotating twin screw extruder. Process characteristics of the twin screw extruder – heat transfer and energy balances. Problems associated with twin screw extruder. Interpreted flight expanders/ extruders, dry extruders.</p>	12
III	<p>Pre Conditioning & Practical considerations</p> <p>Pre-conditioning of raw materials used in extrusion process, Pre-conditioning operations and benefits of pre-conditioning,</p> <p>Practical considerations in extrusion processing: pre-extrusion processes, Extrusion cooking technology, post extrusion processes</p>	12

IV	<p>Breakfast Cereals & TVP</p> <p>Breakfast cereals; Texturized vegetable proteins – Introduction, Definition, classification, Formulation and processing technology; Types of processes: traditional and extrusion methods.</p> <p>Snack food extrusion: Direct expanded (DX) and third generation (3G) Snacks: types, available brands, co- extruded snack and indirect-expanded products</p>	12
Total		48

Text Books:

1. Edmund WL. Snack Foods Processing.
2. Frame ND .1994.The Technology of Extrusion Cooking. Blackie Academic.

Reference Books:

1. Gordon BR.1997. Snack Food.AVI Publications.

Subject Name: DSE-8 (Traditional Indian Food)

Scheme of Evaluation: (T)

Subject Code: FTC154D403

Credit Units: 3-1-0-4

Course Objectives:

The course is designed to provide knowledge in the field of traditional food of India and ability to classify the various types of traditional food product of India,

Course Outcome:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Remember the composition and nutritive value of Traditional Indian Foods	BT 1
CO 2	Understand the processing and preservation methods of sweets and desserts	BT 2
CO 3	Apply knowledge on the invention and processing aspect related to food product	BT 3
CO 4	Analyse techniques to support the entrepreneur of traditional Indian Foods	BT 4
CO 5	Evaluate the processing and preservation methods of preserves and beverages	BT 5

Detailed Syllabus:

Modules	Topics / Course content	Periods
I	Introduction Introduction to traditional foods of India, composition and nutritive values, microbial and biochemical diversity, quality and food safety challenges.	12
II	Processing & Preservation methods of Sweets & Desserts: Kulfi, Falooda, Kheer, khurchan, khoa/mawa, Rabri, jalebi, imarti, Gulabjamun, Peda, petha, rewdi, gajak, milk cake, balushahi, balmithai, singoni, Ras-malayi, Gulqand, ghevar, rasgolla, chamcham, sonhalwa, sonpapri, several varieties of halwa, laddu, barfi & rasgolla.	12
III	Traditional fermented foods: Idli, dosa, Vada, khamman dhokla, Dahi (Curd), Srikhand. Processing & Preservation methods of Snacks: Gujiya, kachauri, samosa, mirchibada, kofta, potato chips, banana-chips, mathri, bhujija, fried dhals, bhujia, shakarpara, pakora, vada. Processing & Preservation methods of Baked Products: Biscuits, Toast, Candies, Cookies, Breads, Roti, Naan, Tandoori Roti, parantha, kulcha, puri, bhatura.	12

IV	Processing & Preservation methods of Preserves & Beverages: Murabba, sharbat, pana, aampapad, sharbat, coconut water, tea, milk (khas, rose), Alcoholic Beverages Industrialization, Socioeconomic Conditions and Sustainability of Traditional Foods.	12
Total		48

Text Books:

1. K.H. Steinkrus, Handbook of Indigenous Fermented Foods. 2nd Edition, Marcel Dekkar Inc. 1998.
2. Sukumar De, Outlines of Dairy Technology, 1st Edition, Oxford University Press, (PB), 2009.

Reference Books:

1. P. Wickramasinghe, and C. Selva Rajah, The Food of India 1st Edition, Oberoi Group, Periplus, 2001.
2. Aneja, B.N. Mathur, R.C. Chandan, and A.K. Banerjee, Technology of Indian Milk Products. R.P. Dairy India Year Book, 2009.
3. Rakesh Mangal, Fundamentals of Indian Cooking 2nd Edition, Subling Publication, 2003.

Subject Name: DSE – 9 (Recent trends in Food Product Development)

Scheme of Evaluation:

Subject Code: FTC154D404

(T)

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:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Remember the concept and generation of ideas in innovation product development	BT 1
CO 2	Understand the different novel food packaging technologies used in a 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 Food Packaging: Active and intelligent packaging: An introduction; Oxygen, ethylene and other scavengers; Antimicrobial food packaging; non-migratory bioactive polymers (NMBP) in food packaging; Time-temperature indicators (TTIs); The use of freshness indicators in packaging; Packaging-flavour interactions; Moisture regulation.	12

III	<p>Developments in modified atmosphere packaging (MAP):</p> <p>Novel MAP applications for fresh-prepared produce; MAP, product safety and nutritional quality; Reducing pathogen risks in MAP-prepared produce; Detecting leaks in modified atmosphere packaging.</p>	12
IV	<p>Optimizing packaging</p> <p>Legislative issues relating to active and intelligent packaging; Recycling packaging materials; Green plastics for food packaging; Integrating intelligent packaging, storage and distribution; Testing consumer responses to new packaging concepts.</p>	12
Total		48

Text Books:

1. Ahvenainen, R. Novel food packaging techniques, Elsevier, 2003.

Reference Books:

1. Moskowitz, H.R., Saguy, S. and Straus, T. An Integrated Approach to New Food Product Development, CRC Press, 2006.