

SYLLABUS OF M.Sc. FOOD TECHNOLOGY PROGRAMME

(with effect from academic year 2018-2019)

Food scientists and technologists are versatile, interdisciplinary, and collaborative practitioners in a profession at the crossroads of scientific and technological developments. As the food system has drastically changed, from one centred around family food production on individual farms and home food preservation to the modern system of today, most people are not connected to their food nor are they familiar with agricultural production and food manufacturing designed for better food safety and quality. The Post Graduate (Degree) Department of Food Technology, set up in 2017, endeavours to develop professionals skilled at advancing the science of food. The objectives of M.Sc. (Food Technology) are:

- ✓ Provide students with theoretical knowledge and practical abilities required to work in the food industry, research centres, and food-related national and international organizations*
- ✓ Contribute to a healthier population by imparting education and understanding of nutritional science*
- ✓ Develop confident and competent individuals, able to adapt to the changing fabric of society through their professional expertise and personal traits*

The Programme equips students for higher research leading to a Ph.D. Degree or to setting up an enterprise of their own, or for employment in Research Institutes, in teaching, and in Industry.

Prerequisites:

B. Sc. in Food Technology/ Food, Nutrition, and Dietetics/ Microbiology/ Biotechnology/ Chemistry/ Botany/ Life Sciences/ Bio-sciences or Allied Subject

M.Sc. (Food Technology) Part I

SEMESTER I – CORE PAPERS				
CODE	TITLE OF PAPER	THEORY/ PRACTICAL	NUMBER OF CREDITS	CONTACT HOURS
FTC 101	Food Biochemistry and Nutrition	Theory	3	36
FTC 102	Food Microbiology and Food Safety Standards	Theory	3	36
FTC 103	Fundamentals of Food Preservation and Processing	Theory	3	36
FTC104	Food Packaging and Food Laws	Theory	3	36
FTC 105	Lab in Food Analysis and Food Microbiology	Practical	2	48
FTC 106	Lab in Food Processing and Quality Management	Practical	2	48

SEMESTER II – CORE PAPERS				
CODE	TITLE OF PAPER	THEORY/ PRACTICAL	NUMBER OF CREDITS	CONTACT HOURS
FTC 201	Food Biotechnology and Industrial Food Waste Management	Theory	3	36
FTC202	Normal and Clinical Nutrition	Theory	3	36
FTC 203	Food Engineering	Theory	3	36
FTC204	Research Methodology and Statistics	Theory	3	36
FTC 205	Lab in Food Biotechnology and Industrial Food Waste Management	Practical	2	48
FTC206	Lab in Clinical Nutrition and Dietetics	Practical	2	48

M.Sc. (Food Technology) Part II

SEMESTER III and IV – OPTIONAL PAPERS				
CODE	TITLE OF PAPER	THEORY/ PRACTICAL	NUMBER OF CREDITS	CONTACT HOURS
*FTO101	Cereal, Legume, and Oilseed Processing Technology	Theory	3	36
*FTO 102	Lab in Cereal, Legume, and Oilseed Processing Technology	Practical	1	24
*FTO 103	Meat, Poultry, Freshwater, and Marine Food Technology	Theory	3	36
*FTO 104	Lab in Meat, Poultry, Freshwater, and Marine Food Technology	Practical	1	24
FTO 105	Bakery, Confectionery, and Convenience Food Technology	Theory	3	36
FTO 106	Lab in Bakery, Confectionery, and Convenience Food Technology	Practical	1	24
FTO 107	Spice and Plantation Crop Technology	Theory	3	36
FTO 108	Lab in Spice and Plantation Crop Technology	Practical	1	24
FTO 109	Dairy Technology	Theory	3	36
FTO 110	Lab in Dairy Technology	Practical	1	24
FTO 111	Beverage Technology	Theory	3	36
FTO 112	Lab in Beverage Technology	Practical	1	24
FTO 113	Nutraceuticals and Health Foods	Theory	3	36
FTO 114	Lab in Nutraceuticals and Health Foods	Practical	1	24
FTO 115	Pre- and Post-Harvest Technology of Horticulture Produce	Theory	3	36
FTO 116	Lab in Pre- and Post-Harvest Technology of Horticulture Produce	Practical	1	24
FTO 117	Snack Food Technology	Theory	3	36
FTO 118	Lab in Snack Food Technology	Practical	1	24
FTO 119	Food Additives, Adulteration and Toxicology	Theory	3	36
FTO 120	Lab in Food Additives, Adulteration and Toxicology	Practical	1	24
FTO 121	Entrepreneurship and Business Management	Theory	3	36
FTO 122	Lab in Entrepreneurship and Business Management	Practical	1	24
FTO 123	Food Product Development and International Trade	Theory	3	36
FTO 124	Lab in Food Product Development and International Trade	Practical	1	24
FTO 125	Field Trips/ Study Tour	Practical	2	48
@FTO 126	Internship	Practical	8	
#FTD	Dissertation	Dissertation	8	

- The optional theory course is a prerequisite for any optional practical course
- Students of M.Sc. Food Technology Programme shall be required to take both theory and practical courses under a given course title
- *FTO 101, FTO 102, FTO 103, and FTO 104 are mandatory papers
- # FTD will be running through Semesters III and IV. The assessment of these courses will be done in Semester IV.
- @FTO 126 is a mandatory paper and will be running during Semester IV.

COURSE CODE	FTC 101
COURSE TITLE	FOOD BIOCHEMISTRY AND NUTRITION
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should be knowledgeable about chemistry and the different types of food	
OBJECTIVES	1. To acquaint students with the chemical constituents of food, their interactions during cooking, and evaluation of taste characteristics of food 2. To familiarize students with the classification of foods and nutrients, and their metabolism in the human body	
CONTENT		
1	FOOD AND ITS CONSTITUENTS	8 hours
1.1	Food and Nutrients - <i>Definition, Classification, and Functions</i>	
1.2	Role of Water in Food and Human Health	
1.3	Pigments, Phytonutrients, Antioxidants, Flavour Components – <i>Definition, Classification, and Functions</i>	
1.4	Sensory Evaluation of foods – <i>Organoleptic Analysis, Methods and Tests of Sensory Evaluation, Organizing Sensory Evaluation Programmes, Computer-Aided Sensory Evaluations</i>	
1.5	Anti-nutritional Factors in Foods	
1.6	Digestion, Absorption, and Transport of Foods and Nutrients	
2	CARBOHYDRATES	8 hours
2.1	Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions, Deficiencies and Excess, Recommended Dietary Allowances	
2.2	Metabolic Pathways - <i>Glycolysis, Gluconeogenesis, Glycogenesis, Glycogenolysis, Citric Acid Cycle</i>	
2.3	Browning Reactions in Foods	
2.4	Resistant Starches and Dietary Fibre – <i>Definition, Sources and Functions</i>	
3	PROTEINS AND AMINO ACIDS	8 hours
3.1	Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions, Deficiencies and Excess, Recommended Dietary Allowances	
3.2	Metabolic Pathways - <i>Transamination, Deamination, Decarboxylation, Urea Cycle</i>	
3.3	Stress and Anti-freeze Proteins; Protein Isolates and Concentrates	
3.4	Denaturation of Proteins	
3.5	Evaluation of Protein Quality	

4	LIPIDS, FATS AND OILS	8 hours
4.1	Definition, Structure, Properties, Functions, Classification, Dietary Sources, Chemical Reactions, Deficiencies and Excess, Recommended Dietary Allowances	
4.2	Metabolic Pathways - <i>Fatty Acid Oxidation, Biosynthesis of Fatty Acids</i>	
4.3	Synthesis and Functions of Cholesterol; Ketogenesis	
4.4	Rancidity of Fats	
4.5	Emulsions	
5	VITAMINS AND MINERALS	4 hours
5.1	Classification, Functions, Dietary Sources, Deficiencies and Excess, Recommended Dietary Allowances	
PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	<p>Agarwal A and Udipi SA. 2014. <i>Textbook of Human Nutrition</i>. Jaypee Brothers Medical Publishers (P) Ltd.</p> <p>Bamji MS, Krishnaswamy K, and Brahman GNV. 2009. <i>Textbook of Human Nutrition</i>. Third Edition. Oxford and IBH Publishing Co. Pvt. Ltd.</p> <p>Belitz H.-D, Grosch W, and Schieberle P. 2009. <i>Food Chemistry</i>. Fourth Edition. Springer.</p> <p>Civille GV and Carr BT. 2016. <i>Sensory Evaluation Techniques</i>. Fifth Edition. CRC Press.</p> <p>Damodaran S and Parkin K. 2017. <i>Fennema's Food Chemistry</i>. Fifth Edition. CRC Press.</p> <p>Lawless HT and Heymann H. 2010. <i>Sensory Evaluation of Food</i>. Second Edition. Springer</p> <p>Meyer LH. 2004. <i>Food Chemistry</i>. CBS Publishers and Distributors</p> <p>Nelson DL and Cox MM. 2017. <i>Lehninger Principles of Biochemistry</i>. Seventh Edition. WH Freeman.</p> <p>Potter NN, and Hotchkiss JH. 2007. <i>Food Science</i>. 5th Edition. CBS Publishers and Distributors.</p> <p>Rodwell VW, Bender DA, Botham KM, Kennelly PJ, Weil PA. 2015. <i>Harper's Illustrated Biochemistry</i>. 30th Edition. McGraw Hill Education.</p>	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to relate the metabolic pathways of macronutrients to function in the body 2. The student will gain an understanding of macro- and micronutrient sources and functions in the human body 	

COURSE CODE FTC 102
COURSE TITLE FOOD MICROBIOLOGY AND FOOD SAFETY STANDARDS
NUMBER OF CREDITS 3

PRE-REQUISITES	The student should be aware of the different types of microorganisms and their impact on health	
OBJECTIVES	1. To acquaint the students with different groups of microorganisms associated with food, their activities, destruction and detection in food 2. To familiarize the students with industrial standards concerning safe food production and the existent national and international systems that ensure food quality	
CONTENT		
1	MICROORGANISMS IN FOOD	8 hours
1.1	Significance of microorganisms in foods – <i>Nutrient requirements and physiology of microorganisms; Factors influencing microbial growth, survival, and destruction; Pathogenic and beneficial microorganisms</i>	
1.2	Spoilage organisms in milk, fruits, vegetables, grains, cereals, oilseeds, meat and poultry	
1.3	Physical and chemical methods of controlling microbes; Thermal Death Time	
2	MICROBIOLOGICAL MEDIA	4 hours
2.1	Types of Media	
2.2	Composition, preparation and methods of sterilization of microbiological media	
2.3	Methods of disinfection, sanitation and asepsis	
3	FOOD FERMENTATION	8 hours
3.1	Microbial cultures in food fermentation and their maintenance; Bioreactors – <i>types and designs</i>	
3.2	Traditional fermented foods of India and other Asian countries - <i>fermented foods based on milk, meat, and vegetables; fermented beverages</i>	
3.3	Probiotics and Prebiotics	
4	FOOD SAFETY AND QUALITY	8 hours
4.1	Biochemical changes caused by microorganisms – <i>putrefaction, lipolysis, antagonism and synergism in microorganisms</i>	
4.2	Food Hygiene – <i>Food-borne Infections & Intoxications, Microbial Toxins, Indicator Organisms</i>	
4.3	Industrial Plant Sanitation and Hygiene – <i>Concept of food safety and quality; Quality attributes</i>	
4.4	Quality Control & Assurance – <i>Objectives; Functions; GMP, GHP, GLP, GAP, HACCP; Indian and International Quality Systems and Standards (BIS, ISO, Codex Alimentarius, Codex India, etc.); CEDAC; Food Adulteration</i>	

5	QUALITY ANALYSIS	8 hours
5.1	Food Sampling Techniques; Rapid Detection Methods of Microorganisms	
5.2	Separation techniques – <i>Ultrafiltration, Ultracentrifugation, Sedimentation, Solid Phase Extraction, Supercritical Fluid Extraction, Chromatography, Electrophoresis</i>	
5.3	Analytical Techniques – <i>Spectroscopy, Microscopy, Immunoassays, Isotopic techniques, Nanotechnology, Thermal Methods</i>	
PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Adams MR, Moss MO, and McClure P. 2016. <i>Food Microbiology</i> . Fourth Edition. Royal Society of Chemistry.	
	Banwart GJ.1989. <i>Basic Food Microbiology</i> . Second Edition. AVI Publ.	
	Casida LE. 2016. <i>Industrial Microbiology</i> . Second Edition. New Age International Publishers.	
	Early R. 2012. <i>Guide to Quality Management Systems for the Food Industry</i> . Blackie Academic & Professional	
	Frazier WC and Westhoff DC. 2008. <i>Food Microbiology</i> . Fourth Edition. Tata McGraw-Hill Publishing Company Limited.	
	Garbutt J. 1997. <i>Essentials of Food Microbiology</i> . Second Edition. Arnold Heinemann.	
	Heinz HJ. 1991. <i>Principles and Practices for the Safe Processing of Foods</i> . First Edition. Butterworth-Heinemann.	
	Jay JM, Loessner MJ, and Golden DA. 2005. <i>Modern Food Microbiology</i> . Seventh Edition. Springer.	
	Paniker CKJ. 2005. <i>Ananthanarayan and Paniker's Textbook of Microbiology</i> . Seventh Edition. Orient Blackswan.	
	Raj D, Sharma R, and Joshi VK. 2011. <i>Quality Control for Value Addition in Food Processing</i> . New India Publishing Agency.	
	Ray B and Bhunia A. 2013. <i>Fundamental Food Microbiology</i> . Fifth Edition. CRC Press.	
	Steinkraus KS.1996. <i>Handbook of Indigenous Fermented Foods</i> . Marcel Dekker.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to apply microbiological aspects involved in different settings of food industry 2. The student will gain an understanding of safety standards to be followed in a food industry 	

COURSE CODE	FTC 103
COURSE TITLE	FUNDAMENTALS OF FOOD PRESERVATION AND PROCESSING
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should be knowledgeable about chemistry and the different types of food	
OBJECTIVES	1. To acquaint students with the industrial techniques used to preserve and process foods, extend their shelf-life and improve their palatability characteristics 2. To familiarize students with advances in food processing techniques	
CONTENT		
1	INTRODUCTION TO FOOD PRESERVATION	4 hours
1.1	Principles of Food Preservation	
1.2	Water Activity and its significance in food preservation	
1.3	Overview of the Traditional Methods of Food Preservation	
1.4	Natural and Chemical Food Preservatives – <i>types, permissible limits, safety aspects</i>	
1.5	Psychrometric Charts	
2	THERMAL PRESERVATION	8 hours
2.1	Blanching, Pasteurization, Sterilization, Canning, Extrusion Cooking	
2.2	Baking, Roasting, Grilling	
2.3	Dehydration, Concentration, Evaporation, Intermediate Moisture Foods	
3	PRESERVATION BY THE USE OF LOW TEMPERATURES	8 hours
3.1	Refrigeration, Freezing, Lyophilisation, Cryogenic Freezing, Dehydrofreezing, Freeze Concentration, IQF	
3.2		
4	NON-THERMAL PRESERVATION	8 hours
4.1	Microwave Processing, Hurdle Technology, Irradiation, Pulsed Electric Field Electroporation	
4.2	Modified Atmosphere, Biopreservation, High-Pressure Food Preservation, Membrane Technology, Cold Plasma Technology	
4.3	Enzymes and Microbes in Food Preservation	

5	FOOD PROCESSING	8 hours
5.1	Definition and Difference between Food Processing and Food Preservation; Functions, Benefits and Drawbacks of Food Processing	
5.2	Primary Processing Techniques – <i>dicing, slicing, mincing, macerating, liquefaction, emulsification</i>	
5.3	Novel Food Processing – <i>mushrooms, algae, leaf protein concentrates, protein from petroleum yeast, food analogues, edible insects</i>	
5.4	Performance Parameters for Food Processing – <i>hygiene, energy efficiency, minimization of waste, labour</i>	
5.5	Overview of the types of food processing industries	
PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Bhat R, Alias AK, and Paliyath G. 2012. <i>Progress in Food Preservation</i> . First Edition. Wiley-Blackwell.	
	Desrosier NW.	
	Fellows PJ. 2016. <i>Food Processing Technology Principles and Practice</i> . Fourth Edition. Woodhead Publishing.	
	Ramaswamy HS and Marcotte M. 2005. <i>Food Processing: Principles and Applications</i> . Taylor & Francis.	
	Shapton DA and Shapton NF. 1998. <i>Principles and Practices for the Safe Processing of Foods</i> . Butterworth-Heinemann.	
	Sivasankar B. 2009. <i>Food Processing and Preservation</i> . First Edition. PHI Learning	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to utilize the various preservative methods for food in industrial settings 2. The student will comprehend the processing techniques utilized in food industries 	

COURSE CODE	FTC 104
COURSE TITLE	FOOD PACKAGING AND FOOD LAWS
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should be knowledgeable about the different types of food	
OBJECTIVES	1. To acquaint students with the principles, methods, and materials used for safe packaging of foods 2. To familiarize students with national and international laws governing food production, import and export	
CONTENT		
1	INTRODUCTION TO FOOD PACKAGING	4 hours
1.1	Functions and Objectives of Packaging	
1.2	Forms of Packaging – <i>rigid, semi-rigid, flexible</i>	
1.3	Packaging Closures and Sealing Systems	
2	MATERIALS USED FOR FOOD PACKAGING	12 hours
2.1	Paper and Paper-based Packaging Materials – <i>types, properties, advantages and disadvantages</i>	
2.2	Metal Packaging Materials - <i>types, properties, advantages and disadvantages</i>	
2.3	Glass Packaging Materials - <i>types, properties, advantages and disadvantages</i>	
2.4	Plastics and Composites - <i>types, properties, advantages and disadvantages</i>	
2.5	Edible and Biodegradable Food Packaging Materials - <i>types, properties, advantages and disadvantages</i>	
2.6	Selection and Design of Packaging Material for Dehydrated Foods, Frozen Foods, Dairy Products, Fresh Fruits & Vegetables, Meats, and Sea foods	
3	PACKAGING MATERIAL PROPERTIES	12 hours
3.1	Barrier properties – <i>permeability, transmission rates, migration, diffusion and solubility</i>	
3.2	Mechanical Properties – <i>tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, stiffness, crease or flex resistance</i>	
3.3	Optical Properties	
3.4	Labels, Food and Packaging Material Interactions	
3.5	Methods of Testing and Evaluation	
3.6	Aseptic Packaging of Foods - <i>definition, function and methods</i>	
3.7	Active and Intelligent Packaging - <i>definition, function and design</i>	

4	INDIAN FOOD LAWS	4 hours
4.1	FDA - <i>Structure and Function, Administrative Set-up, Roles and Responsibilities of Staff</i>	
4.2	FSSAI – <i>Structure and Function, Administrative Set-up at the State Level, Roles and Responsibilities of Staff</i>	
4.3	Licensing and Registration of Food Units – <i>Central and State Licensing Authorities</i>	
4.4	Codex India	
5	INTERNATIONAL FOOD LAWS, ORGANIZATIONS AND AFFILIATIONS	4 hours
5.1	FAO & WHO – <i>Role and Functions</i>	
5.2	World Animal Health Organization	
5.3	World Trade Organization	
5.4	European Committee for Standardization, European Union on Food Safety, EFSA, Euro-Asian Council for Standardization	
5.5	COPANT and ASEAN	
5.6	ISO – special emphasis on ISO 9001:2000/2008; ISO 22000:2005; ISO 45001; ISO 14001	
5.7	Rapid Alert System	
PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Bizmanualz. 2008. <i>ISO 22000 Standard Procedures for Food Safety Management Systems</i> . Gupta V. 2017. <i>The Food Safety and Standards Act, 2006</i> . Ninth Edition. Commercial Law Publishers (India) Pvt. Ltd. Natarajan S, Govindarajan M, and Kumar B. 2014. <i>Fundamentals of Packaging Technology</i> . Second Edition. PHI. Prabhakar K. 2016. <i>A Practical Guide to Food Laws and Regulations</i> . Bloomsberry India Professional. Rees N and Watson D. 2000. <i>International Standards for Food Safety</i> . Aspen Publication. Robertson GL. 2016. <i>Food Packaging Principles and Practice</i> . Third Edition. CRC Press. Singhal KL and Singhal D. 2012. <i>Implementing ISO 9001:2008 Quality Management System: A Reference Guide</i> . Second Edition. PHI Learning.	
LEARNING OUTCOMES	1. The student will gain an understanding of the material used for packaging in the food industry 2. The student will comprehend the national and international laws relevant to the food industry	

COURSE CODE	FTC 105
COURSE TITLE	LAB IN FOOD ANALYSIS AND FOOD MICROBIOLOGY
NUMBER OF CREDITS	2

PRE-REQUISITES	The student should have theoretical knowledge about the nutritional and microbiological components of food	
OBJECTIVES	1. To enable students work towards analysing foods for their nutritional content 2. To familiarize students with laboratory procedures required for determining the microbiological safety of foods	
CONTENT		
1	FOOD ANALYSIS	24 hours
1.1	Estimation of Reducing and Non-Reducing Sugars in Honey by Lane Eynon Method	
1.2	Estimation of Proteins in food using the Biuret Method	
1.3	Saponification, Iodine, and Acid Value of Edible Oils – fresh, stale and packed foods	
1.4	Estimation of Lactose in Milk	
1.5	Estimation of Ascorbic Acid in Foods	
1.6	Estimation of Beta-Carotene in Foods	
1.7	Estimation of Calcium, Phosphorous and Iron content of Foods	
1.8	Estimation of Browning intensity	
1.9	Estimation of Anti-Nutritional Factors in Foods	
2	FOOD MICROBIOLOGY	24 hours
2.1	Grams Staining of Bacteria	
2.2	Determination of Bacterial Viable Count in Food	
2.3	Plate Culture and Microscopic Examination of <i>Saccharomyces Cerevisiae</i>	
2.4	Isolation of Food (Bread, Fruit) Pathogenic Fungi, Microscopic Examination and Identification	
2.5	Detection and Enumeration of Pathogenic and Indicator Organisms in Food	
2.6	Evaluation of Microbiological Quality of Water and MPN of Coliforms	
2.7	Enumeration of Microbes from Fermented Foods	
2.8	Detection of Physiological Groups in Food: Osmophiles/ Halophiles	
2.9	Evaluation of Microbiological Quality of Water and Commonly Consumed Street Foods	
PEDAGOGY	Experiments in the Laboratory	

REFERENCE BOOKS	Garg N, Garg KL, and Mukerji KG. 2010. <i>Laboratory Manual of Food Microbiology</i> . I.K. International Publishing House Pvt. Ltd.	
	Sehgal S. 2016. <i>A Laboratory Manual of Food Analysis</i> . I.K. International Publishing House Pvt. Ltd.	
	Other books shown under the respective theory section	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to estimate and draw conclusions regarding nutrients present in foods 2. The student will be able to understand the importance of microbes in food 	

COURSE CODE	FTC 106
COURSE TITLE	LAB IN FOOD PROCESSING AND QUALITY MANAGEMENT
NUMBER OF CREDITS	2

PRE-REQUISITES	The student should have theoretical knowledge regarding food preparation and quality	
OBJECTIVES	1. To provide students with the basic practical skills required to prepare foods, and evaluate raw and processed foods 2. To enable students evaluate food establishments for their consumer acceptability and sanitation attributes	
CONTENT		
1	FOOD PROCESSING	24 hours
1.1	Stages of Preparation and Observation of Sugar Syrup	
1.2	Preparation of Bakery Products – <i>Cakes, Cookies, Breads, Pies, Pastries</i>	
1.3	Extrusion Cooking – <i>Preparation of Pastas</i>	
1.4	Dehydration & Evaporation – <i>Preparation of Condensed Milk & Salted Dry Fish</i>	
1.5	Fruit & Vegetable Processing; Use of Chemical Additives for Preservation; Thermal Processing of Foods – <i>Preparation of Jams, Jellies, Squashes, Pickles, Chutneys, Sauces</i>	
1.6	Emulsions and Emulsifying Agents – <i>Preparation of Mayonnaise & Vinaigrettes</i>	
1.7	Fermented Foods – <i>Preparation of idlis and curds/ yoghurt</i>	
1.8	Frozen Foods – <i>Preparation of Ice Cream & Fruit/ Vegetable Pulp</i>	
2	QUALITY MANAGEMENT	24 hours
2.1	Evaluation of Quality Attributes of Raw and Processed Foods	
2.2	Evaluation of Sensory Characteristics of Bakery Products	
2.3	Evaluation of Sensory Characteristics of Thermally Processed Foods	
2.4	Detection of Adulterants in Foods	
2.5	Detection of Heavy Metals, Insecticides & Pesticides in Foods	
2.6	Determination of Nutrient Levels in Foods and Comparisons to Standards	
2.7	Determination of Hygiene of a Food Service Organization	
2.8	Preparation of a HACCP chart for a Dairy Industry	

PEDAGOGY	Experiments in the Laboratory	
REFERENCE BOOKS	Mahindru SN. 2010. <i>Encyclopaedia of Food Analysis</i> .	
	Vaclavik VA, Devine MM, and Pimentel MH. 2010. <i>Dimensions of Food</i> . Seventh Edition. CRC Press.	
	Weaver CM and Daniel JR. 2003. <i>The Food Chemistry Laboratory: A Manual for Experimental Foods, Dietetics, and Food Scientists</i> . Second Edition. CRC Press.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to prepare basic foods while relating the same to the principles of food chemistry and processing 2. The student will be able to apply the principles of quality analysis to foods and industry 	

COURSE CODE FTC201

COURSE TITLE FOOD BIOTECHNOLOGY AND INDUSTRIAL FOOD WASTE MANAGEMENT

NUMBER OF CREDITS 3

PRE-REQUISITES	The student should have basic knowledge of biotechnology and microbiology	
OBJECTIVES	1. To acquaint students with the fundamentals of Biotechnology and its application in food processing, nutrition, fermentation, and waste utilisation 2. To familiarize students with waste generated from food industries and methods of by-product utilization	
CONTENT		
1	FUNDAMENTALS OF BIOTECHNOLOGY	8 hours
1.1	Definition, Scope, and Application of Biotechnology - <i>Application in Food Industries, Pharmaceuticals, Agriculture, and Waste Utilisation</i>	
1.2	Molecular Genetics - <i>Fundamentals of Molecular Biology with reference to Chemistry and Biology of DNA; Types of DNA; DNA Mutations and the Role of Mutagenic Agents; Recombinant DNA Technology; Expression of Foreign Genes and Enzyme Promoters</i>	
1.3	Role of DNA in Cell Metabolism; Cell and Tissue Culture; Cloning and Micromanipulation	
1.4	Bioinformatics - <i>Scope and Importance; Application in Food Technology; Regulatory and Social aspects of Biotechnology of Foods (GM Foods)</i>	
2	GENETIC MODIFICATIONS	4 hours
2.1	Genetically Modified Crops (insect resistant and herbicide tolerant crops)	
2.2	Transgenic Plants and Animals - <i>Commercial transgenic crops like golden rice</i>	
2.3	Genetically Modified Microorganisms and their Products - <i>genetic recombination mechanisms and techniques for improvement in microbial strains</i>	
3	INDUSTRIAL BIOTECHNOLOGY	8 hours
3.1	Genetically Modified Organisms (GMOs) in Industrial Fermentation Processes (Induction, Manipulation And Recombination)	
3.2	Therapeutic Proteins produced by Biotechnological Processes	
3.3	Industrial Production of Chemicals (Alcohols, Acids And Solvents)	
3.4	Use of Microorganisms in Mineral Beneficiation and Recovery; Biomass Production using Microorganisms	
3.5	Role of Plants For Production of Nutraceuticals and Bioremediation	
3.6	Manufacture of Beer, Wine, Vinegar, Cheese, and Mould-Modified Foods	

4	FOOD WASTE MANAGEMENT	8 hours
4.1	Types, Consequences on Environment, Present Disposal Methods	
4.2	Treatment by Physical, Chemical and Biological Methods	
4.3	Effluent Treatment Plants and Solid Waste Utilization and Management – SCP, Biogas, Plant-derived Fuels, Landfill Gas, Biomethanation and Biocomposting Technology for Organic Waste, Incineration and Combustion Technology	
4.4	Waste Water Management – Quality, Treatment, Recycle, Reuse, BOD, COD, Role of Macrophytes and Microphytes	
4.5	Integration of New and Renewable Energy Sources for Waste Utilization	
5	WASTE GENERATED FROM PROCESSING UNITS	8hours
5.1	Grains, Legumes and Oilseeds	
5.2	Fruits and Vegetables	
5.3	Sugar Factories	
5.4	Breweries, and Distilleries	
5.5	Dairy Industry	
5.6	Flesh Foods Processing Units – Meats, Poultry and Sea foods	
PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Anal AK. 2017. <i>Food Processing By-Products and their Utilization (IFST Advances in Food Science)</i> . Wiley Blackwell.	
	Arvanitoyannis I. 2007. <i>Waste Management for the Food Industries</i> . First Edition. Academic Press.	
	Bains W. 1993. <i>Biotechnology from A to Z</i> . Third Edition. Oxford University Press	
	Chawla HS. 2002. <i>Introduction to Plant Biotechnology</i> . Second Edition. Science Publishers.	
	Doyle A and Griffiths JB. 1998. <i>Cell and Tissue Culture: Laboratory Procedures in Biotechnology</i> . John Wiley and Sons, UK.	
	El-Mansi EMT, Bryce CFA, Demain AL, and Allman AR. 2012. <i>Fermentation Microbiology and Biotechnology</i> . Third Edition. CRC Press.	
	Joshi VK and Singh RS. 2013. <i>Food Biotechnology: Principles and Practices</i> . I.K. International Publishing House Pvt. Ltd.	
	Knorr D. 1982. <i>Food Biotechnology</i> . Marcel Dekker	
	Oreopoulou V and Russ W. 2007. <i>Utilization of By-Products and Treatment of Waste in the Food Industry</i> . Springer.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to apply the principles of microbiology and biotechnology in handling wastes produced by the food industry 2. The student will be able to develop processes for utilization of food waste 	

COURSE CODE	FTC202
COURSE TITLE	NORMAL AND CLINICAL NUTRITION
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should have knowledge of human physiology		
OBJECTIVES	1. To acquaint students with the nutritional requirements at various stages of human growth and development. 2. To familiarize students with dietary modifications necessitated by disease and disorder.		
CONTENT			
1	DIET THERAPY		4 hours
1.1	Definition and Principles; Scope of Dietetics; Responsibilities of a Dietitian		
1.2	Progression of Hospital Diets		
1.3	Enteral and Parenteral Nutrition		
2	NUTRITION THROUGH THE YEARS		14 hours
2.1	Nutrient Requirements of Infants, Pre-Schoolers, School Children, Adolescents, Adults, and the Elderly – <i>dietary issues and special formulations</i>		
2.2	Dietary Recommendations during Pregnancy and Lactation		
2.3	Nutritional Care of the Low Birth Weight and Pre-term Infant & Children with Special Needs		
3	DIET THERAPY FOR CLINICAL CONDITIONS		14 hours
3.1	Overweight, Obesity, and Underweight		
3.2	Diabetes (IDDM, NIDDM, and Gestational Diabetes)		
3.3	Cardiovascular Disease (Hypertension and Atherosclerosis)		
3.4	Hepatic Disease (Hepatitis, Cirrhosis, Gall Bladder Disease)		
3.5	Renal Disorders (Glomerulonephritis, Nephrotic Syndrome, Urinary Calculi, ESRD)		
3.6	Gastrointestinal Disorders (Peptic Ulcers, Diarrhoea, Constipation, Irritable Bowel Syndrome)		
3.7	Cancer		
3.8	Osteoporosis		
4	EMERGING NUTRITIONAL NEEDS		4 hours
4.1	Allergies and Intolerances		
4.2	Sports Nutrition		
4.3	Nutrition at High Altitudes		
4.4	Nutrition in Space		
4.5	Ergogenic Aids		
4.6	Nutrigenomics		
4.7	Current Needs		

PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Antia FP and Abraham P. 1998. <i>Clinical Dietetics and Nutrition</i> . Fourth Edition. OUP India.	
	Joshi SA. 2017. <i>Nutrition and Dietetics</i> . Fourth Edition. McGraw Hill.	
	Mahan LK and Escott-Stump S. 2003. <i>Krause's Food, Nutrition, and Diet Therapy</i> . Eleventh Edition. Saunders.	
	McIntosh SN. 2013. <i>William's Basic Nutrition and Diet Therapy</i> . Fourteenth Edition. Mosby.	
	Robinson CH, Lawler MR, Chenoweth WL, and Garwick AE. 1990. <i>Normal and Therapeutic Nutrition</i> . Seventeenth Edition. MacMillan Publishing Company.	
	Srilakshmi B. 2007. <i>Dietetics</i> . Seventh Edition. New Age International Publishers.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to apply the principles of nutrition and dietetics to the stages of human development 2. The student will be able to apply the principles of nutrition and dietetics to diseased as well as normal conditions 	

COURSE CODE FTC203

COURSE TITLEFOOD ENGINEERING

NUMBER OF CREDITS 3

PRE-REQUISITES	The student should have an understanding of the physical characteristics of food	
OBJECTIVES	1. To acquaint students with the principles and processes of food engineering 2. To familiarize students with basic operations and calculations of importance in the food industry	
CONTENT		
1	THERMODYNAMICS AND HEAT TRANSFER	8 hours
1.1	Principles; Thermal Properties of Foods; Mass Transfer	
1.2	Modes of Heat Transfer – <i>in solids and liquids; radiative heat transfer</i>	
1.3	Steady and Unsteady State Heat Transfer	
1.4	Microwave Heating	
1.5	Fourier’s Law; Stefan Boltzmann Law	
2	RHEOLOGY OF FOODS	8 hours
2.1	Properties and Classification of Fluids	
2.2	Newtonian and Non-Newtonian Fluids	
2.3	Newton’s Law of Viscosity	
2.4	Bernoulli’s Equation	
2.5	Flow-Measuring Devices and Flow Rate Calculations	
3	UNIT OPERATIONS IN FOOD ENGINEERING	8 hours
3.1	Distillation	
3.2	Evaporation – <i>types of evaporators</i>	
3.3	Drying – <i>drying curve, drying instruments</i>	
4	REFRIGERATION AND FREEZING	8 hours
4.1	Parts and Functions of a Refrigerator	
4.2	Refrigeration Cycle	
4.3	Refrigerants	
4.4	Concept of Refrigerator Load (one ton, etc.)	
4.5	Cryogenic Freezing and IQF	
4.6	Parts and Functions of a Refrigerator	
4.7	Refrigeration Cycle	
5	MECHANICAL OPERATIONS IN FOOD PROCESSING	4 hours
5.1	Size Reduction and Related Laws	
5.2	Methods of Size Reduction – <i>crushing, grinding</i>	
5.3	Equipment used for Size Reduction	
5.4	Applications in a Food Processing Industry	

PEDAGOGY	Lectures/ Assignments/ Seminars/ Numerics, where applicable	
REFERENCE BOOKS	Rao DG. 2009. <i>Fundamentals of Food Engineering</i> . PHI.	
	Sharma K, Mulvaney SJ, and Rizvi SSH. 2012. <i>Food Process Engineering: Theory and Laboratory Experiments</i> . Wiley-India.	
	Singh RP and Heldman DR. 2013. <i>Introduction to Food Engineering</i> . Fifth Edition. AP.	
	Toledo RT. 2000. <i>Fundamentals of Food Process Engineering</i> . Second Edition.	
LEARNING OUTCOME	The student will gain an understanding of the influence of food characteristics on unit operations used in the food industry and thus, the processing techniques	

COURSE CODE	FTC 204
COURSE TITLE	RESEARCH METHODOLOGY AND STATISTICS
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should be knowledgeable about basic sciences and computations	
OBJECTIVES	1. To acquaint students with the principles and methods of scientific research 2. To familiarize students with statistical methods for data analysis 3. To develop scientific writing skills in students	
CONTENT		
1	INTRODUCTION TO RESEARCH	8 hours
1.1	Significance, Purpose and Types of Research	
1.2	Ethics in Research, Plagiarism	
1.3	Research Design – <i>steps</i>	
1.4	Sampling Methods and Scaling Techniques	
1.5	Research Tools and Methodology of Data Collection	
1.6	Databases in Food Research	
2	RESEARCH DATA PRESENTATION	4 hours
2.1	Variables in Research and Scales of Measurement	
2.2	Tabulation of Research Data	
2.3	Graphical Presentation of Data – <i>use of Excel and Statistical Software</i>	
2.4	Scientific Report Writing	
3	RELATED RESEARCH CONCEPTS	4 hours
3.1	Probability – <i>Theoretical and Conditional</i>	
3.2	Gaussian Curve	
3.3	Binomial Distribution	
3.4	Poisson Distribution	
3.5	Density Functions	
3.6	Vital Statistics and Life Tables	
4	DESCRIPTIVE STATISTICS	10 hours
4.1	Measures of Central Tendency – <i>Mean, Mode, and Mode for Grouped and Ungrouped Data</i>	
4.2	Measures of Variability – <i>Range, Variance, Standard Deviation and Standard Error</i>	
4.3	Measures of Relative Positions - <i>Sigma Scores, Standard Scores, Percentiles, Percentile Ranks</i>	
4.4	Measures of Relationships – <i>Correlation and Regression Analysis</i>	
4.5	Measures of Shape – <i>Skewness, Kurtosis</i>	
4.6	Calculations and Interpretation of Statistical Procedures	

5	HYPOTHESIS TESTING IN RESEARCH	10 hours
5.1	Confidence Intervals and Levels of Significance	
5.2	Degrees of Freedom	
5.3	Tests of Significance	
5.4	Parametric Tests – Z-test, t-Test, and F-test, ANOVA	
5.5	Non-Parametric Tests – Chi-Square	
5.6	Calculations and Interpretation of Parametric and Non-Parametric Tests – <i>use of statistical software</i>	
PEDAGOGY	Lectures/ Assignments/ Seminars/ Scientific Report Writing	
REFERENCE BOOKS	Jackson SL. 2012. <i>Research Methods and Statistics: A Critical Thinking Approach</i> . Fourth Edition. Wadsworth Cengage Learning.	
	Krishnan V. 2011. <i>Statistics for Beginners</i> . Atlantic Publishers and Distributors (P) Ltd.	
	Singh YK. 2006. <i>Fundamentals of Research Methodology and Statistics</i> . New Age International Publishers.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to appreciate approved methodology in the conduct of scientific research 2. The student will gain an understanding of the application of statistics to derive scientific results 	

COURSE CODE	FTC205
COURSE TITLE	LAB IN FOOD BIOTECHNOLOGY AND INDUSTRIAL FOOD WASTE MANAGEMENT
NUMBER OF CREDITS	2

PRE-REQUISITES	The student should have theoretical knowledge of food science	
OBJECTIVES	1. To enable students experiment with and observe the outcomes of biotechnological techniques propagated in food industries 2. To provide students a practical understanding of industrial food waste management processes	
CONTENT		
1	FOOD BIOTECHNOLOGY	24 hours
1.1	Micropropagation through Tissue Culture	
1.2	Strain Improvement through UV Mutation for Lactose Utilization	
1.3	Chemical Mutagenesis using EMS/ MMS	
1.4	Isolation of Bacterial Genomic DNA and Analysis by Agarose Gel Electrophoresis	
1.5	Isolation of Plasmid DNA and Analysis by Agarose Gel Electrophoresis	
1.6	Separation of Protoplast using Lytic Enzymes	
1.7	Pesticide Degradation (DDT) by <i>Pseudomonas</i> sp.	
2	INDUSTRIAL FOOD WASTE MANAGEMENT	24 hours
2.1	Use of Crop Residue for the Production of Cellulose	
2.2	Extraction of Banana Pseudostem Fibre for Juice Production	
2.3	Use of Mango Kernel for the Manufacture of Mango Oil	
2.4	Production of Pectin from Organic Waste	
2.5	Production of Biogas from Organic Waste	
2.6	Utilization of Buttermilk Powder in Bakery Products	
2.7	Utilization of Ghee Residue in Confectioneries	
PEDAGOGY	Experiments in the Laboratory	
REFERENCES	As suggested in FTC 201	

LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to apply the principles of microbiology and biotechnology in handling wastes produced by the food industry 2. The student will be able to develop processes for utilization of food waste 	
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COURSE CODE	FTC206
COURSE TITLE	LAB IN CLINICAL NUTRITION AND DIETETICS
NUMBER OF CREDITS	2

PRE-REQUISITES	The student should have knowledge about food	
OBJECTIVES	1. To make students competent in planning diets for different age groups and physiological conditions 2. To acquaint students with the link between diet therapy and food technology	
CONTENT		
1	BALANCED DIETS	4 hours
1.1	Food Exchange List and Steps in Diet Planning	
2	DIET PLANNING	40 hours
2.1	Pre-Schoolers, School Children with Packed Meals, Adolescents, Pregnant Adults, Lactating Women, Ageing Adults	
2.2	Individuals with Weight Issues – <i>Obese and Underweight</i>	
2.3	Diabetes Mellitus	
2.4	Hypertension and Coronary Heart Disease	
2.5	Gastrointestinal Disturbances – <i>Lactose Intolerance, Constipation, Diarrhoea, Irritable Bowel Syndrome, Peptic Ulcers</i>	
2.6	Liver Disorders – <i>Hepatitis and Cirrhosis</i>	
2.7	Renal Disorders – <i>Glomerulonephritis and Urinary Calculi</i>	
2.8	Sportspersons	
2.9	Space Travel (Astronauts)	
3	ROLE OF FOOD TECHNOLOGY IN CLINICAL NUTRITION	4 hours
3.1	<i>Industrial food formulations for the above clinical conditions</i>	
PEDAGOGY	Planning Diets and Experiments in the Laboratory	
REFERENCES	As suggested in FTC 202	

LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will become competent in planning balanced diets for various normal and therapeutic conditions 2. The student will gain an understanding of designing special feeds for normal and therapeutic conditions 	

PRE-REQUISITES	The student should be aware of the major agricultural crops of India and their basic market uses	
OBJECTIVES	1. To acquaint students with major agricultural crops of India and their processing techniques 2. To familiarize students with nutritional value differences as a result of crop processing	
CONTENT		
1	CEREALS AND CEREAL PRODUCTS	12 hours
1.1	Structure, Composition, Nutritional Value, and Market Varieties of Cereals and Minor Millets such as Rice, Wheat, Maize, <i>Jowar, Bajra, Ragi, Barley</i>	
1.2	Farming, Consumption and Industrial Utilization Trends of Cereals in India and internationally	
1.3	Post-Harvest Technology – <i>storage, transportation, handling, prevention of spoilage and post-harvest losses, fumigation, etc.</i>	
1.4	Processing Methods – <i>parboiling, germination, fermentation, malting</i>	
1.5	Milling – <i>classification and types</i>	
1.6	Products of Processing – <i>flours; semolina; breakfast cereals; flaked, puffed, and popped products; infant foods; corn syrup; corn starch; corn oil; extruded products (pasta, etc.); convenience foods (ready-to-eat and ready-to-cook)</i>	
1.7	Effect of Processing on Composition and Nutritive Value	
1.8	Fortification and Value-Addition of Products	
1.9	Quality Control and Standards for Cereal-based Products	
2	LEGUMES AND PULSES	12 hours
2.1	Structure, Composition, Nutritional Value, Toxic Constituents, and Market Varieties of Pulses including Soybean	
2.2	Farming, Consumption and Industrial Utilization Trends of Pulses in India and internationally	
2.3	Post-Harvest Technology – <i>storage, transportation, handling, prevention of spoilage and post-harvest losses, fumigation, etc.</i>	
2.4	Processing Methods – <i>sprouting, fermentation</i>	
2.5	Products of Processing – <i>grits, nuggets, isolates, concentrates</i>	
2.6	Effect of Processing on Composition and Nutritive Value	
2.7	Fortification and Value-Addition of Products	
2.8	Quality Control and Standards for Pulse-based Products	

3	OILSEEDS	12 hours
3.1	Structure, Composition, Nutritional Value, Toxic Constituents, and Market Varieties of Oilseeds	
3.2	Farming, Consumption and Industrial Utilization Trends of Oilseeds in India and internationally	
3.3	Post-Harvest Technology – <i>storage, transportation, handling, prevention of spoilage and post-harvest losses, fumigation, etc.</i>	
3.4	Processing Methods and Manufacture of Oils and Fats	
3.5	Products of Processing – <i>grits, nuggets, isolates, concentrates, low-cost protein foods, oils</i>	
3.6	Effect of Processing on Composition and Nutritive Value	
3.7	Fortification and Value-Addition of Products	
3.8	Quality Control and Standards for Oilseed-based Products	
PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Chakrabarty MM. 2003. <i>Chemistry and Technology of Oils and Fats</i> . Prentice Hall.	
	Dendy DAV and Dobraszczyk BJ. 2001. <i>Cereal and Cereal Products</i> . Aspen.	
	Hamilton RJ & Bhati A. 1980. <i>Fats and Oils - Chemistry and Technology</i> . App. Sci. Publ.	
	Hoseney RS. 1994. <i>Principles of Cereal Science and Technology</i> . Second Edition. AACC.	
	Kay DE. 1979. <i>Food Legumes</i> . Tropical Products Institute.	
	Kent NL. 1983. <i>Technology of Cereals</i> . Fourth Edition. Pergamon Press.	
	Kulp K and Ponte GJ. 2000. <i>Handbook of Cereal Science and Technology</i> . Second Edition. Marcel Dekker.	
	Lorenz KL. 1991. <i>Handbook of Cereal Science and Technology</i> . Marcel Dekker.	
	Marshall WE and Wadsworth JI. 1994. <i>Rice Science and Technology</i> . Marcel Dekker.	
	Mathews RH. 1989. <i>Legumes Chemistry, Technology and Human Nutrition</i> . Marcel Dekker.	
	Matz SA. 1969. <i>Cereal Science</i> . AVI Publ.	
	Paquot C. 1979. <i>Standard Methods of Analysis of Oils, Fats and Derivatives</i> . Pergamon Press.	
	Pomeranz Y. 1987. <i>Modern Cereal Science & Technology</i> . VCH Publ.	
	Salunkhe DK. 1992. <i>World Oilseeds: Chemistry, Technology and Utilization</i> . VNR.	
	Swern D. 1964. <i>Bailey's Industrial Oil and Fat Products</i> . InterSci. Publ. 28	
	Watson SA and Ramstad PE. 1987. <i>Corn Chemistry and Technology</i> .	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will gain an understanding of processing techniques used for agricultural produce 2. The student will comprehend the effect of processing on nutritional value of agricultural produce 	

COURSE CODE	FTO 102
COURSE TITLE	LAB INCEREAL, LEGUME, AND OILSEED PROCESSING TECHNOLOGY
NUMBER OF CREDITS	1

PRE-REQUISITES	The student should have theoretical knowledge regarding components of cereals, pulses, and oilseeds	
OBJECTIVES	1. To familiarize students with elementary analytical methods required to determine the quality of agricultural produce 2. To acquaint students with rudimentary processing of pulses and oilseeds	
CONTENT	24 hours	
1.1	Market Survey on Cereals, Legumes, Minor Millets, Oilseeds and their Products	
1.2	Physicochemical Tests for Quality of Cereals, Legumes, and Oilseeds	
1.3	Determination of Amylose in Rice	
1.4	Extraction of Gluten from Cereals	
1.5	Development of Simulated Milk and Milk Products from Soy	
1.6	Preparation of Extruded Products from Pulses	
1.7	Preparation of Peanut Butter	
PEDAGOGY	Experiments in the Laboratory	
REFERENCES	As suggested in FTO 101	
LEARNING OUTCOMES	1. The student will be able to practically analyse the quality of agricultural produce 2. The student will be able to design and develop agriculture-based processed products	

COURSE CODE	FTO 103
COURSE TITLE	MEAT, POULTRY, FRESHWATER, AND MARINE FOOD TECHNOLOGY
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should be aware of the contribution of flesh foods to human nutrition	
OBJECTIVES	1. To acquaint students with types and grades of meat, poultry, and sea foods 2. To familiarize students with processing techniques used for the production of commercial meat, poultry, and sea foods	
CONTENT		
1	MEAT PROCESSING	12 hours
1.1	Muscle Structure, Meat Composition, Nutritional Value, Slaughtering and Post-Mortem Chemistry, Colours and Flavours of Livestock – <i>buffaloes, sheep, goat, pigs, rabbits</i>	
1.2	Ante-Mortem Handling of Livestock	
1.3	Microbiology and Safety of Livestock	
1.4	Grading of Livestock and Quality of Meat	
1.5	Storage and Preservation of Meat	
1.6	Meat and Processed Meat Products – <i>pickling, canning, drying, curing, smoking, kebabs, mince, salami, sausages, corned, intermediate moisture and dried meat products</i>	
1.7	Dressing of Meat – <i>offal handling and inspection</i>	
1.8	By-product Utilization	
2	POULTRY PROCESSING	12 hours
2.1	Muscle Structure, Composition, Nutritional Value, Meat Processing Operations, Colours and Flavours – <i>chicken, duck, quail</i>	
2.2	Ante-Mortem Handling of Poultry Species	
2.3	Microbiology and Safety of Poultry Species	
2.4	Grading of Poultry Species and Eggs	
2.5	Storage and Preservation Techniques	
2.6	Poultry Food Products – <i>mince, salami, sausages, egg powder</i>	
2.7	By-product Utilization	
3	FRESHWATER AND MARINE FOOD PROCESSING	12 hours
3.1	Muscle Structure, Composition, Nutritional Value, Processing Operations, Colours and Flavours – <i>fleshy fish and shell fish</i>	
3.2	Post-Mortem Chemistry of Marine Foods	
3.3	Microbiology and Safety of Marine Foods	
3.4	Grading of Marine Foods	
3.5	Storage and Preservation Techniques	
3.6	Marine Food Products	
3.7	By-product Utilization	

PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Forrest JC. 1975. <i>Principles of Meat Science</i> . Freeman.	
	Govindan TK. 1985. <i>Fish Processing Technology</i> . Oxford & IBH.	
	Hui YH. 2001. <i>Meat Science and Applications</i> . Marcel Dekker.	
	Kerry J. et al. 2002. <i>Meat Processing</i> . Woodhead Publ. CRC Press.	
	Levie A. 1984. <i>Meat Hand Book</i> . Fourth Edition. AVI Publ.	
	Mead M. 2004. <i>Poultry Meat Processing and Quality</i> . Woodhead Publ.	
	Mead GC. 1989. <i>Processing of Poultry</i> . Elsevier.	
	Pearson AM and Gillett TA. 1996. <i>Processed Meat</i> . Third Edition. Chapman & Hall.	
	Stadelman WJ and Cotterill OJ. 2002. <i>Egg Science and Technology</i> . Fourth Edition. CBS.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will gain an understanding of the composition of flesh foods 2. The student will be theoretically competent with flesh food processing techniques and their effect on nutritional value 	

COURSE CODE FTO 104

COURSE TITLE LAB IN MEAT, POULTRY, FRESHWATER, AND MARINE FOOD TECHNOLOGY

NUMBER OF CREDITS 1

PRE-REQUISITES	The student should have knowledge about the nutrient value of flesh foods	
OBJECTIVES	1. To make students practically competent in analysing characteristics of importance in meats, poultry, and sea foods 2. To enable students formulate and prepare processed meat, poultry, and sea food products	
CONTENT	24 hours	
1.1	Inspection and Grading of Eggs	
1.2	Development and Preparation of Meat Products	
1.3	Development and Preparation of Poultry Food Products	
1.4	Development and Preparation of Freshwater and Marine Food Products	
1.5	Preparation of Preserved Meat, Poultry, and Marine Food Products	
1.6	Estimation of Meat:Bone Ratios	
1.7	Shelf-life Studies on Processed Meat Products	
PEDAGOGY	Experiments in the Laboratory	
REFERENCES	As suggested in FTO 103	
LEARNING OUTCOMES	1. The student will gain an understanding of quality parameters utilized in the flesh food processing industry 2. The student will be able to develop food products related to flesh foods	

COURSE CODE	FTO 105
COURSE TITLE	BAKERY, CONFECTIONERY, AND CONVENIENCE FOOD TECHNOLOGY
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should be aware of types of processed foods	
OBJECTIVES	1. To acquaint students with the principles of bakery and confectionery 2. To familiarize students with processing techniques, quality parameters, and nutritional comparisons of baked products	
CONTENT		
1	BAKERY TECHNOLOGY	12 hours
1.1	Principles of Baking	
1.2	Raw Material and their Role – <i>flour, leavening agents, sugars, fats, additives, spice</i>	
1.3	Types of Bakery Products and Technology for their Manufacture – <i>dough and batters; cakes, pies, pastries, bread, biscuits</i>	
1.4	Icings and Fillings	
1.5	Quality Parameters of Bakery Products - <i>chemistry of dough and batters; rheological testing and interpretation of data; sensory evaluation</i>	
1.6	Staling and Nutrient Losses in Bakery Products	
1.7	Sanitation and Hygiene in a Bakery Unit	
1.8	Equipment used in the Bakery Industry	
2	CONFECTIONERY TECHNOLOGY	12 hours
2.1	Principles of Confectionery Manufacture	
2.2	Raw Material and their Role – <i>interfering agents, inversion of sugars, etc.</i>	
2.3	Types of Confectionery Products and Technology for their Manufacture	
2.4	Quality Parameters of Confectionery Products	
2.5	Nutrient and other Losses in Confectionery Products	
2.6	Sanitation and Hygiene in a Confectionery Unit	
2.7	Equipment used in the Confectionery Industry	
2.8	Manufacture of Indian Confectioneries	
3	CONVENIENCE FOOD TECHNOLOGY	12 hours
3.1	Sugar – <i>raw material, types, and manufacture</i>	
3.2	Chocolate – <i>raw material, types, and manufacture</i>	
3.3	Chewing Gum - <i>raw material, types, and manufacture</i>	
3.4	Lozenges - <i>raw material, types, and manufacture</i>	
3.5	Pan Coating – <i>hard and soft panning; problems in coating; glazing, polishing, and tableting</i>	
3.6	Nutritional Value	
3.7	Quality Parameters	

PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Dubey SC. 2002. <i>Basic Baking</i> . The Society of Indian Bakers, New Delhi.	
	Francis FJ. 2000. <i>Wiley Encyclopedia of Food Science & Technology</i> . John Wiley & Sons.	
	Manley D. 2000. <i>Technology of Biscuits, Crackers & Cookies</i> . Second Edition. CRC Press.	
	Pyler EJ. <i>Bakery Science & Technology</i> . Third Edition. Vols. I, II. Sosland Publ.	
	Qarooni J. 1996. <i>Flat Bread Technology</i> . Chapman & Hall.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will gain an understanding of processing techniques utilized in the bakery and confectionery industry 2. The student will comprehend the role of convenience food technology as an important aspect of commercial foods 	

COURSE CODE	FTO 106
COURSE TITLE	LAB INBAKERY, CONFECTIONERY, AND CONVENIENCE FOOD TECHNOLOGY
NUMBER OF CREDITS	1

PRE-REQUISITES	The student should be able to handle various types of food material	
OBJECTIVES	1. To acquaint students with techniques involved in advanced baking and confectionery 2. To familiarize students with quality analysis procedures of baked products	
CONTENT	24 hours	
1.1	Tests for the Rheological Properties of Dough	
1.2	Preparation of Advanced Bakery Products – <i>sourdoughs, pastries, croissants, doughnuts</i>	
1.3	Preparation of Filled and Iced Cakes	
1.4	Preparation of Chocolate	
1.5	Preparation of Coated Confectionery	
1.6	Quality Evaluation of the Bakery Products, Filled and Iced Cakes, Chocolate, and Coated Confectionery	
1.7	Determination of Nutritional Value of Bakery and Confectionery Products	
PEDAGOGY	Experiments in the Laboratory	
REFERENCES	As suggested in FTO 105	
LEARNING OUTCOMES	1. The student will be able to prepare advanced bakery products as well as confectionery items 2. The student will be able to qualitatively analyse baked food products	

COURSE CODE	FTO 107
COURSE TITLE	SPICE AND PLANTATION CROP TECHNOLOGY
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should be aware of the common spices and the plantation crops in use	
OBJECTIVES	1. To acquaint students with the types of plantation crops and their processing techniques 2. To familiarize students with the processing of spices and condiments	
CONTENT		
1	PLANTATION CROPS	20 hours
1.1	Definition and Classification	
1.2	Coffee – <i>Chemical Constituents, Harvesting, Bean Processing, Types and Varieties, Manufacture, Quality and Grading, Chicory Chemistry and Use</i>	
1.3	Tea - <i>Chemical Constituents, Harvesting, Leaf Processing, Types and Varieties, Manufacture, Quality and Grading</i>	
1.4	Cocoa – <i>Production, Composition, Grading, Processing, Cocoa Products (cocoa mass, cocoa powder, cocoa butter, cocoa-based beverages, malted beverages, cocoa liquor)</i>	
1.5	Coconut – <i>Production, Composition, Grading, Post-Harvest Technology, Processing and Products (coconut milk, desiccated coconut)</i>	
1.6	Cashew nut Harvesting and Processing	
2	SPICE AND CONDIMENT PROCESSING TECHNOLOGY	8 hours
2.1	History of Spices and Condiments	
2.2	Classification and Composition of Spices and Condiments	
2.3	Fumigation and Irradiation of Spices	
2.4	Post-Harvest Technology – <i>spice oils, spice powders, oleoresins, flavour components, concentrates</i>	
2.5	Plant Suspension Cultures	
2.6	Enzymatic Synthesis of Flavour Identicals	
2.7	Quality Standards and Specifications	
3	MAJOR AND MINOR SPICES	8 hours
	<i>Chemistry, Constituents, Nutritive Value, and Functional Benefits of the following:</i>	
3.1	Pepper, Cardamom, Ginger, Red and Green Chilli, Turmeric	
3.2	Cumin, Coriander, Cinnamon, Fenugreek, Garlic, Nutmeg, Clove, Mint, Vanilla	
3.3	Herbs and Greens	

PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Banerjee B. 2002. <i>Tea Production and Processing</i> . Oxford Univ. Press.	
	Minifie BW. 1999. <i>Chocolate, Cocoa and Confectionery Technology</i> . Third Edition. Aspen Publ.	
	NIIR. 2004. <i>Handbook on Spices</i> . National Institute of Industrial Research Board, Asia Pacific Business Press Inc.	
	Sivetz M and Foote HE. 1963. <i>Coffee Processing Technology</i> . AVI Publ.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will gain an understanding of processing techniques used for plantation crops 2. The student will comprehend the processing and use of herbs and spices 	

COURSE CODE	FTO 108
COURSE TITLE	LAB INSPIRE AND PLANTATION CROP TECHNOLOGY
NUMBER OF CREDITS	1

PRE-REQUISITES	The student should be theoretically aware of the constituents of spices	
OBJECTIVES	1. To acquaint students with quality analysis of spices and plantation crops 2. To make students practically competent in rudimentary spice processing	
CONTENT	24 hours	
1.1	Market Survey of Plantation Crops and their Products	
1.2	Market Survey of Spices, Condiments, Herbs, and their Products	
1.3	Preparation of Spice Powders	
1.4	Detection of Adulteration in Spices	
1.5	Determination of Capsaicin Content of Chillies	
1.6	Estimation of Curcumin in Turmeric	
1.7	Preparation of Virgin Coconut Oil	
1.8	Processing of Cashew Nut through Steam Roasting	
1.9	Processing of Cashew Apple for Beverages	
PEDAGOGY	Experiments in the Laboratory	
REFERENCES	As suggested in FTO 107	
LEARNING OUTCOMES	1. The student will be able to practically analyse the quality of spices 2. The student will gain a practical understanding of processing plantation crops to derive edible products	

COURSE CODE	FTO 109
COURSE TITLE	DAIRY TECHNOLOGY
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should have knowledge of chemistry and microbiology	
OBJECTIVES	1. To acquaint students with the types of dairy products 2. To familiarize students with processing techniques specific to the dairy industry	
CONTENT		
1	MILK	12 hours
1.1	Definition, Sources, Composition, Nutritive Value, and Procurement of Milk	
1.2	Quality Tests, Grading, and Labelling of Milk	
1.3	Storage and Transportation	
1.4	Processing and Packaging	
2	MILK PRODUCTS	12 hours
	Manufacture, Composition, Quality Standards, Varieties, and Nutritive Value of the following:	
2.1	Types of Milk – <i>whole milk, low fat milk, toned milk, double toned milk, fortified milk, flavoured milk, spray dried milk</i>	
2.2	Processed Milk Products – <i>cream, butter, dairy whiteners, condensed milk, ice creams</i>	
2.3	Fermented Milk Products – <i>cheese, yoghurt, curds, lassi, shrikhand, buttermilk</i>	
2.4	Other Milk Products – <i>ghee, khoa, chenna, paneer, rasogulla, shrikhand, barfi, kalakhand, kulfi</i>	
3	ADVANCES IN DAIRY TECHNOLOGY	12 hours
3.1	Application of Membrane Technology (<i>ultrafiltration, monofiltration, microfiltration, reverse osmosis, ion exchange and electrodialysis processes</i>) in Fluid Milk Processing	
3.2	Irradiation of Milk	
3.3	Application of Stabilizers and Emulsifiers in Dairy Products	
3.4	Application of Enzymes and Developments in Biotechnology for Milk Products	
3.5	Probiotics – <i>definition and products</i>	
PEDAGOGY	Lectures/ Assignments/ Seminars	

REFERENCE BOOKS	Aneja RP, Mathur BN, Chandan RC and Banerjee AK. 2002. <i>Technology of Indian Milk Products</i> . Dairy India Publ.	
	De S.1980. <i>Outlines of Dairy Technology</i> . Oxford Univ. Press.	
	Henderson JL. 1971. <i>Fluid Milk Industry</i> . AVI Publ.	
	Rathore NS et al. 2008. <i>Fundamentals of Dairy Technology- Theory & Practices</i> . HimanshuPubl	
	Spreer E. 1993. <i>Milk and Dairy Products</i> . Marcel Dekker.	
	Walstra P. 1999. <i>Dairy Technology</i> . Marcel Dekker.	
	Walstra P. (Ed.). 2006. <i>Dairy Science and Technology</i> . Second Edition. Taylor & Francis.	
	Web BH, Johnson AH and Lansford JA. 1987. <i>Fundamentals of Dairy Chemistry</i> . Third Edition. AVI Publ.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will gain an understanding of processing techniques used in the dairy industry 2. The student will be able to develop products from processing of milk 	

COURSE CODE	FTO 110
COURSE TITLE	LAB INDAIRY TECHNOLOGY
NUMBER OF CREDITS	1

PRE-REQUISITES	The student should have knowledge of chemistry and microbiology	
OBJECTIVES	<ol style="list-style-type: none"> 1. To acquaint students with quality control tests specific to the dairy industry 2. To make students competent in practically performing fundamental dairy processing techniques 	
CONTENT	24 hours	
1.1	Market Survey of Milk and Milk Products	
1.2	Platform Tests in Raw Milk	
1.3	Nutrient Analysis of Milk – Fat, Lactose, SNF	
1.4	Preparation and Evaluation of Curds	
1.5	Preparation and Evaluation of Butter, Ghee, and <i>Paneer</i>	
1.6	Preparation and Evaluation of Indian Milk Sweets (<i>rasgulla, shrikhand, gulabjamun</i>)	
1.7	Development of a high-protein, low-fat Dairy Product	
PEDAGOGY	Experiments in the Laboratory	
REFERENCES	As suggested in FTO 109	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to practically assess the quality of milk for nutritional value and safety 2. The student will gain a practical understanding of the preparation of milk products 	

COURSE CODE FTO 111
COURSE TITLE BEVERAGE TECHNOLOGY
NUMBER OF CREDITS 3

PRE-REQUISITES	The student should have knowledge of chemistry and microbiology	
OBJECTIVES	1. To acquaint students with the particulars of manufacturing industrial beverages 2. To familiarize students with the quality requirements of bottled beverages	
CONTENT		
1	WATER AS AN INDUSTRIAL BEVERAGE	12 hours
1.1	Status of Beverage Industry in India and globally	
1.2	Types of Bottled Water – <i>Mineral Water, Spring Water, Flavoured Water, Carbonated Water</i>	
1.3	Packaged Drinking Water – <i>Manufacturing Process, Raw and Processed Water, Water Treatment</i>	
1.4	Quality Standards of Bottled and Packaged Water	
2	CARBONATED AND NON-CARBONATED BEVERAGES	12 hours
2.1	Beverage Ingredients and their Functions – <i>sweeteners, bulking agents, acidulants, flavourings, preservatives</i>	
2.2	Concentrated Beverages – <i>ingredients, processing techniques, and standards</i>	
2.3	Carbonated Beverages - <i>ingredients, processing techniques, and standards</i>	
2.4	Fruit- and Vegetable-based Beverages – <i>ingredients, processing techniques, and standards</i>	
2.5	Synthetic Beverages - <i>ingredients, processing techniques, and standards</i>	
2.6	Beverages used in the Sports Industry – <i>types, ingredients, processing techniques, and standards</i>	
2.7	Indigenous Beverages for Domestic and Commercial Use – <i>sugarcane juice, cashew apple extract, coconut palm sap</i>	
3	ALCOHOLIC BEVERAGES	12 hours
3.1	Distillation and Distilled Liquors – <i>whisky, rum, gin, vodka, brandy</i>	
3.2	Fermentation and Fermented Alcohols – <i>wine, ciders, sake</i>	
3.3	Carbonated Alcohols – <i>beer, champagne</i>	
3.4	Indigenous Alcohol Production – <i>urak, feni, toddy</i>	
3.5	Liqueurs and Aperitifs	

PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Hui YH et al 2004. <i>Handbook of Food and Beverage Fermentation Technology</i> . Marcel Dekker.	
	Priest FG & Stewart GG. 2006. <i>Handbook of Brewing</i> . Second Edition. CRC.	
	Richard P Vine. 1981. <i>Commercial Wine Making - Processing and Controls</i> . AVI Publ.	
	Varnam AH and Sutherland JP. 1994. <i>Beverages: Technology, Chemistry and Microbiology</i> . Chapman & Hall.	
	Woodroof JG and Phillips GF.1974. <i>Beverages: Carbonated and Non-Carbonated</i> . AVI Publ.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will gain an understanding of processing techniques used in the beverage industry 2. The student will comprehend the role of ingredients on beverage manufacture 	

COURSE CODE FTO 112

COURSE TITLE LAB IN BEVERAGE TECHNOLOGY

NUMBER OF CREDITS 1

PRE-REQUISITES	The student should have knowledge of chemistry and microbiology	
OBJECTIVES	1. To acquaint students with the production of industrial beverages 2. To familiarize students with the quality control tests of importance in the beverage industry	
CONTENT	24 hours	
1.1	Preparation of Non-Carbonated Beverages	
1.2	Preparation and Evaluation of Wine	
1.3	Estimation of Sulphur Dioxide in Beverages	
1.4	Estimation of Ascorbic Acid Content of Commercial Juices	
1.5	Estimation of Phenolic Content in Beverages	
1.6	Analysis of Mineral Content of Bottled Water	
1.7	Analysis of Nutrient Content in Sports Drinks	
PEDAGOGY	Experiments in the Laboratory	
REFERENCES	As suggested in FTO 111	
LEARNING OUTCOMES	1. The student will be able to analyse the quality of commercial beverages 2. The student will be able to produce different types of beverages	

COURSE CODE FTO 113
COURSE TITLE NUTRACEUTICALS AND HEALTH FOODS
NUMBER OF CREDITS 3

PRE-REQUISITES	The student should have knowledge of food chemistry	
OBJECTIVES	1. To familiarize students with the emerging trend of nutraceuticals with respect to the types, mechanisms of action, and manufacture of selected nutraceuticals 2. To acquaint students with nutraceutical product development, clinical testing and toxicity aspects	
CONTENT		
1	INTRODUCTION TO NUTRACEUTICALS	12 hours
1.1	Definition and Basis of Claims – <i>nutraceuticals, health foods, functional foods</i>	
1.2	Regulatory Issues for Nutraceuticals and Health Foods including CODEX	
1.3	Cereal and Dairy Products as Nutraceuticals	
1.4	Present and Future Prospects of Nutraceuticals – <i>Nutraceuticals as a bridge between foods and drugs</i>	
2	MANUFACTURE OF NUTRACEUTICALS	12 hours
2.1	Flora, Fauna, and Microbes as a source for the Production of Nutraceuticals	
2.2	Production of Select Nutraceuticals such as Isoflavonoids, Prebiotics and Probiotics, Glucosamine, Phytosterols, Vitamins (carotenoids, tocopherols, folic acid, ascorbic acid) , MUFA, PUFA, ω-3 Fatty Acids	
2.3	Formulation of Functional Foods containing Nutraceuticals – <i>stability and analytical issues, labelling issues</i>	
2.4	Nutrigenomics – <i>Golden Rice, Quality Protein Maize (QPM)</i>	
2.5	Clinical Testing of Nutraceuticals and Health Foods	
3	CLINICAL ROLE OF NUTRACEUTICALS	12 hours
3.1	Nutraceutical use in disease and disorder – <i>cardiovascular disease, cancer, diabetes, hypercholesterolemia, obesity, immunity, joint pain, age-related macular degeneration, osteoporosis, gastrointestinal disturbances, menopause, mood disorders</i>	
3.2	Nutraceuticals for Sports Performance	
3.3	Mechanism of their Action, Dosage, Contraindications, and Toxicity	
3.4	Interactions between Nutraceuticals and Prescription Drugs	

PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Brigelius-Flohé, J and Joost HG. 2006. <i>Nutritional Genomics: Impact on Health and Disease</i> . Wiley VCH.	
	Cupp J and Tracy TS. 2003. <i>Dietary Supplements: Toxicology and Clinical Pharmacology</i> . Humana Press.	
	Gibson GR and William CM. 2000. <i>Functional Foods - Concept to Product</i> .	
	Goldberg I. 1994. <i>Functional Foods: Designer Foods, Pharma Foods</i> .	
	Losso JN. 2007. <i>Angi-angiogenic Functional and Medicinal Foods</i> . CRC Press.	
	Manson P.2001. <i>Dietary Supplements</i> . Second Edition. Pharmaceutical Press.	
	Campbell JE and Summers JL. 2004. <i>Dietary Supplement Labelling Compliance</i> .	
	Neeser JR and German BJ. 2004. <i>Bioprocesses and Biotechnology for Nutraceuticals</i> . Chapman & Hall.	
	Robert EC. 2006. <i>Handbook of Nutraceuticals and Functional Foods</i> . Second Edition. Wildman.	
	Shi J. (Ed.). 2006. <i>Functional Food Ingredients and Nutraceuticals: Processing Technologies</i> . CRC Press.	
	Webb GP. 2006. <i>Dietary Supplements and Functional Foods</i> . Blackwell Publ.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will gain an understanding of nutrient components of foods that have health benefits 2. The student will be able to appreciate the role of biomolecules as nutraceuticals 	

COURSE CODE	FTO 114
COURSE TITLE	LAB IN NUTRACEUTICALS AND HEALTH FOODS
NUMBER OF CREDITS	1

PRE-REQUISITES	The student should have knowledge of food chemistry	
OBJECTIVES	<ol style="list-style-type: none"> 1. To acquaint students with extraction procedures of nutrients and functional components from foods 2. To develop food labelling knowledge and competency in students 	
CONTENT	24 hours	
1.1	Market Survey and Classification of Health Foods and Nutraceuticals	
1.2	Extraction and Estimation of Vitamin C from Fruits	
1.3	Extraction and Estimation of Folic Acid from Vegetables	
1.4	Extraction and Estimation of β -carotene from Carrots	
1.5	Extraction and Estimation of Lycopene from Tomatoes	
1.6	Extraction and Estimation of Astaxanthene from Grapes	
1.7	Development of Labels for Health Foods	
1.8	Estimation of Tannins in Cashew Apple	
PEDAGOGY	Experiments in the Laboratory	
REFERENCES	As suggested in FTO 113	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to estimate the nutrient content of fruits and vegetables 2. The student will be able to grade foods in terms of its nutritional quality 	

COURSE CODE	FTO 115
COURSE TITLE	PRE- AND POST-HARVEST TECHNOLOGY OF HORTICULTURE PRODUCE
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should have knowledge of food microbiology and chemistry	
OBJECTIVES	1. To acquaint students with the principles and methods of preserving fruits and vegetables 2. To familiarize students with processing techniques of horticultural produce	
CONTENT		
1	VEGETABLES	12 hours
1.1	Classification, Types, Composition, and Nutritive Value of Vegetables	
1.2	Harvesting Indices	
1.3	Storage of Fresh Produce – <i>principles, methods, and techniques</i>	
1.4	Transportation, Packaging, and Marketing of Fresh Produce	
1.5	Spoilage and Quality Control Measures	
2	FRUITS	12 hours
2.1	Classification, Types (simple and aggregate), Composition, and Nutritive Value of Fruits	
2.2	Harvesting Indices	
2.3	Storage of Fresh Produce – <i>principles, methods, and techniques</i>	
2.4	Transportation, Packaging, and Marketing of Fresh Produce – <i>storage and ascorbic acid drip</i>	
2.5	Spoilage and Quality Control Measures	
3	PROCESSING TECHNOLOGY	12 hours
3.1	Quality Requirements of Raw Material for Processing	
3.2	Primary Processing Techniques – <i>grading, sorting, cleaning, washing, peeling, slicing, blanching</i>	
3.3	Processing for Pulps, Purees, and Concentrates	
3.4	Processing for Pickles, Gravies, Powders, Sauces, Soups	
3.5	Processing for Jams, Jellies, Marmalades, Confectioneries	
3.6	Dehydrated Fruits and Vegetables	

PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Kadar AA.1992. <i>Post-harvest Technology of Horticultural Crops</i> . Second Edition. University of California.	
	Lal G, Siddapa GS and Tandon GL.1986. <i>Preservation of Fruits and Vegetables</i> . ICAR.	
	Pantastico B. 1975. <i>Post-Harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables</i> . AVI Publ.	
	Salunkhe DK, Bolia HR and Reddy NR. 1991. <i>Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables</i> . CRC.	
	Thompson AK. 1995. <i>Post-Harvest Technology of Fruits and Vegetables</i> . Blackwell Sci.	
	Verma LR. & Joshi VK. 2000. <i>Post-Harvest Technology of Fruits and Vegetables</i> . Indus Publ.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will gain an understanding of processing techniques used for horticulture produce 2. The student will comprehend the quality characteristics of importance in fresh and processed horticulture produce 	

COURSE CODE	FTO 116
COURSE TITLE	LAB IN PRE- AND POST-HARVEST TECHNOLOGY OF HORTICULTURE PRODUCE
NUMBER OF CREDITS	1

PRE-REQUISITES	The student should have knowledge of food chemistry	
OBJECTIVES	<ol style="list-style-type: none"> 1. To practically acquaint students with fundamental fruit and vegetable processing techniques 2. To familiarize students with quality control tests specific to the horticulture industry 	
CONTENT	24 hours	
1.1	Preparation of Vegetable Products	
1.2	Preparation of Fruit Products	
1.3	Preparation of Dehydrated Vegetables	
1.4	Preparation of Banana and Potato Wafers	
1.5	Preparation of Dried Figs and Raisins	
1.6	Vegetable and Fruit Maturity Index Determination and Calculation	
1.7	Quality Standard Measurements of Vegetable and Fruit Products	
PEDAGOGY	Experiments in the Laboratory	
REFERENCES	As suggested in FTO 115	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to prepare processed vegetable and fruit products 2. The student will gain an understanding of determining quality characteristics and acceptability parameters of horticulture produce 	

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COURSE CODE	FTO 117
COURSE TITLE	SNACK FOOD TECHNOLOGY
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should have knowledge of types of food	
OBJECTIVES	1. To acquaint students with the principles involved in the manufacture of commercial snack foods 2. To familiarize students with equipment of importance in the snack food industry	
CONTENT		
1	GRAIN-BASED SNACKS	12 hours
1.1	Technology for Whole Grains Snacks – <i>roasted, toasted, puffed, popped, flaked</i>	
1.2	Technology for Coated Grain Snacks – <i>salted, spiced, sweetened</i>	
1.3	Technology for Batter-Based and Dough-Based Products	
1.4	Technology for Formulated Products – <i>chips, wafers, papads, instant pre-mixes</i>	
2	HORTICULTURE PRODUCE-BASED SNACKS	12 hours
2.1	Technology for Fruit-Based Snacks	
2.2	Technology for Vegetable-Based Snacks	
2.3	Technology for Coated Nuts	
3	EXTRUDED SNACKS	12 hours
3.1	Formulation and Processing Technology	
3.2	Colouring and Flavouring	
3.3	Packaging	
3.4	Machinery and Equipment, Use, and Care	
PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Edmund WL. <i>Snack Foods Processing</i> . AVI Publ.	
	Frame ND. 1994. <i>The Technology of Extrusion Cooking</i> . Blackie Academic.	
	Gordon BR. 1997. <i>Snack Food</i> .AVI Publ	
	Samuel AM. 1976. <i>Snack Food Technology</i> . AVI Publ.	
LEARNING OUTCOMES	1. The student will gain an understanding of processing techniques used to make snack foods 2. The student will comprehend the use of additives and packaging requirements for snack foods	

COURSE CODE	FTO 118
COURSE TITLE	LAB IN SNACK FOOD TECHNOLOGY
NUMBER OF CREDITS	1

PRE-REQUISITES	The student should be aware of types of fast foods	
OBJECTIVES	<ol style="list-style-type: none"> 1. To practically acquaint students with processing techniques utilized for snack foods 2. To familiarize students with evaluation methods for the quality of snack foods 	
CONTENT	24 hours	
1.1	Preparation of Snack Foods based on Cereals	
1.2	Preparation of Snack Foods based on Pulses	
1.3	Preparation of Snack Foods based on Nuts	
1.4	Preparation of Snack Foods based on Fruits	
1.5	Preparation of Snack Foods based on Vegetables	
1.6	Development of Instant Food Pre-Mixes	
1.7	Determination of Shelf-Life and Quality Characteristics of Snack Foods	
PEDAGOGY	Experiments in the Laboratory	
REFERENCES	As suggested in FTO 117	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to practically prepare snack foods from a variety of raw material 2. The student will be competent in analysing the shelf life and quality of snack foods 	

COURSE CODE	FTO 119
COURSE TITLE	FOOD ADDITIVES, ADULTERATION AND TOXICOLOGY
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should have knowledge of types of foods, chemistry, and microbiology	
OBJECTIVES	1. To acquaint students with the additives relevant to the processed food industry for shelf life extension, processing support and sensory appeal 2. To familiarize students with microbial, chemical and natural toxicants and allergens indigenously present and developed during food processing	
CONTENT		
1	FOOD ADDITIVES AND ADULTERANTS	12 hours
1.1	Definition, Classification and Functions of Food Additives	
1.2	Types of Adulteration in Food and Methods of Detection	
1.3	Indirect food additives – <i>intentional and unintentional</i>	
1.4	Toxicological Evaluation of Food Additives and Adulterants	
2	FLAVOUR TECHNOLOGY	12 hours
2.1	Types of Flavours - <i>reaction flavours, flavour composites</i>	
2.2	Stability of Flavours during Food Processing	
2.3	Analysis of Flavours	
2.4	Extraction Techniques of Flavours	
2.5	Authentication of Flavours	
3	TOXICOLOGY	12 hours
3.1	Definition, Principles, and Classification of Food Toxicants	
3.2	Toxicants derived from Plants, Animals, Marine, Algal, and Microbial Sources	
3.3	Derived Food Toxicants (from processing and packaging)	
3.4	Factors affecting Toxicity of Compounds	
3.5	Manifestation of Toxic Effects - <i>food poisoning and food-borne infections and disease</i>	
3.6	Methods used in Safety Evaluation	

PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Branen AL, Davidson PM and Salminen S. 2001. <i>Food Additives</i> . Second Edition. Marcel Dekker.	
	Branen AL, Davidson PM and Salminen S. 1990. <i>Food Additives</i> . Marcel Dekker.	
	Concon JM. 1988. <i>Food Toxicology - Principles & Concepts</i> . Marcel Dekker.	
	George AB. 1996. <i>Encyclopaedia of Food and Color Additives</i> . Vol. III. CRC Press.	
	George AB. 2004. <i>Fenaroli's Handbook of Flavor Ingredients</i> . Fifth Edition. CRC Press.	
	Hathcock JN. (Ed.). 1982. <i>Nutritional Toxicology</i> . Vol. I. Academic Press.	
	Madhavi DL, Deshpande SS and Salunkhe DK. 1996. <i>Food Antioxidants: Technological, Toxicological and Health Perspective</i> . Marcel Dekker.	
	Morton ID and Macleod AJ. 1990. <i>Food Flavours</i> . Part A, B, C. Elsevier.	
	Nakai S and Modler HW. 2000. <i>Food Proteins and Processing Applications</i> . Wiley VCH.	
	Rehcgil M Jr. 1983. (Ed.). <i>Handbook of Naturally Occurring Food Toxicants</i> . CRC Press.	
	Shabbir S. 2007. <i>Food Borne Diseases</i> . Humana Press.	
	Stephen AM. (Ed.). 2006. <i>Food Polysaccharides and Their Applications</i> . Marcel Dekker.	
	Steven T. 1989. <i>Food Toxicology: A Perspective on Relative Risks</i> .	
	Tweedy BG. 1991. <i>Pesticide Residues and Food Safety</i> . Royal Society of Chemistry.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will gain an understanding of chemical agents added to enhance the quality of processed foods 2. The student will comprehend the effects of adulterants and toxic products in foods 	

COURSE CODE	FTO 120
COURSE TITLE	LAB INFOOD ADDITIVES, ADULTERATION AND TOXICOLOGY
NUMBER OF CREDITS	1

PRE-REQUISITES	The student should have knowledge of types of foods, chemistry, and microbiology	
OBJECTIVES	<ol style="list-style-type: none"> 1. To familiarize students with isolation of various biopolymers from food resources 2. To acquaint students with the practical aspects of toxin-free foods 	
CONTENT	24 hours	
1.1	Estimation of Preservatives in Foods	
1.2	Estimation of Colours in Foods	
1.3	Isolation of Native and Modified Proteins, Starches and Lipids in Foods	
1.4	Protocol for Detection and Quantification of Toxins in Food	
1.5	Olfactory Analysis of Food Products	
1.6	Demonstration for the Detection of Pesticide Residues in Food	
1.7	Demonstration for the Detection of Antibiotic Residues/ Hormones/ Veterinary Drugs, and Heavy Metals in Foods	
1.8	Analysis of Microbial and Plant Toxins	
PEDAGOGY	Experiments in the Laboratory	
REFERENCES	As suggested in FTO 119	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to practically analyse the presence of additives in foods 2. The student will be able to practically determine the presence of adulterants in foods 	

COURSE CODE	FTO 121
COURSE TITLE	ENTREPRENEURSHIP AND BUSINESS MANAGEMENT
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should have basic understanding of business and marketing	
OBJECTIVES	1. To familiarize students with business models and their planning and development 2. To acquaint students with the principles and intricacies of managing an enterprise	
CONTENT		
1	BEING AN ENTREPRENEUR	6 hours
1.1	Definition and Qualities of an Entrepreneur	
1.2	Types of Industry – <i>cottage and small scale industry</i>	
1.3	Market Structure – <i>macro and micro business</i>	
1.4	Creating a Business Model	
1.5	Brand Creation	
2	FOOD PROCESSING PLANT	6 hours
2.1	Product and Process Designs	
2.2	General and Specific Design and Layout Considerations	
2.3	Selection of Equipment	
3	HUMAN RESOURCE MANAGEMENT	8 hours
3.1	Recruitment	
3.2	Training	
3.3	Performance Appraisals	
3.4	Worker’s Safety and Welfare	
3.5	Employee’s Union	
4	MARKETING MANAGEMENT	8 hours
4.1	Functions of Marketing	
4.2	Market Intelligence - <i>survey techniques, demand & supply</i>	
4.3	Market Forecasting – <i>consumer behaviour and trends</i>	
4.4	Segmentation, Targeting and Positioning	
4.5	Marketing Network	
4.6	E-Marketing and E-Procuring	

5	ADVERTISING AND COMMERCIALIZATION	8 hours
5.1	Objectives of Advertising	
5.2	Advertising Message	
5.3	Budgeting	
5.4	Media Selection	
5.5	Personal Selling and Publicity	
5.6	Sales Promotion	
PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	Chhabra TN and Suria RK. 2001. <i>Management Process and Perspectives</i> . KitabMahal.	
	Jhingan ML. 2005. <i>International Economics</i> . 5th Ed. Virnda Publ.	
	Kotler P. 2000. <i>Marketing Management</i> . Prentice Hall.	
	Reddy SS, Ram PR, Sastry TVN and Bhavani ID. 2004. <i>Agricultural Economics</i> . Oxford & IBH.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will gain an understanding on starting on a new business 2. The student will gain the ability to market, appraise and advertise the business 	

COURSE CODE	FTO 122
COURSE TITLE	LAB IN ENTREPRENEURSHIP AND BUSINESS MANAGEMENT
NUMBER OF CREDITS	1

PRE-REQUISITES	The student should have basic understanding of business and marketing	
OBJECTIVES	1. To familiarize students with the practical development of a business model 2. To make students competent in marketing a business idea	
CONTENT	24 hours	
1.1	Conceptualizing a Business Idea	
1.2	Designing a Business Model	
1.3	Creating Advertisements for the Proposed Business	
1.4	Marketing the proposed Business	
PEDAGOGY	Reports	
REFERENCES	As suggested in FTO 121 and data sources	
LEARNING OUTCOMES	1. The student will gain ability to design a business model 2. The student will gain the ability to advertise and market their business	

COURSE CODE	FTO 123
COURSE TITLE	FOOD PRODUCT DEVELOPMENT AND INTERNATIONAL TRADE
NUMBER OF CREDITS	3

PRE-REQUISITES	The student should have basic understanding of business and marketing	
OBJECTIVES	<ol style="list-style-type: none"> 1. To acquaint students with techniques of Product Development and International Trade for the food sector 2. To equip students with knowledge of intellectual property rights (IPR), related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy 	
CONTENT		
1	INNOVATIONS IN PRODUCT DEVELOPMENT	8 hours
1.1	Definition and Need for Product Development	
1.2	Factors affecting Food Product Development – <i>corporate factors, market factors, technological pressures, government issues and legislations</i>	
1.3	Classes and Characteristics of New Food Products	
1.4	Line Extensions and Repositioning of Existing Products	
1.5	Reformulations	
1.6	New Packaging	
1.7	Ethics in Food Product Development	
2	FOOD PRODUCT DEVELOPMENT PROCESS	8 hours
2.1	Stages/ Phases of New Product Development – <i>idea generation, screening, feasibility studies, consumer research, financial review, product design and formulation</i>	
2.2	Process Development – <i>recipe development and scale-up, consumer trials, market testing</i>	
2.3	Quality Assessment of New Developed Products – <i>sensory evaluation, shelf life testing</i>	
2.4	Packaging and Labelling Protocols	
2.5	Costing/ Pricing and Economic Evaluation of the Product	
2.6	Product Launch	
2.7	Product Life Cycle	
3	SPECIALITY FOOD PRODUCTS	8 hours
	<i>Speciality Product Development with reference to Health and Nutritional Needs for the following:</i>	
3.1	Therapeutic and Medical Foods	
3.2	Infant Foods	
3.3	Geriatric Foods	
3.4	Functional Foods and Nutraceuticals	
3.5	Herbal Foods	
3.6	Sports Drinks	
3.7	Prebiotics and Probiotics	

4	INTERNATIONAL TRADE	8 hours
4.1	Salient Features of International Marketing	
4.2	International Marketing Environment	
4.3	Export Regulation – <i>direct, indirect, licensing and joint ventures</i>	
4.4	Product Promotion and Pricing, Distribution Channels	
4.5	World Trade Organization (WTO)	
5	INTELLECTUAL PROPERTIES (IPs)	6 hours
4.1	Historical Perspectives and Need for the Introduction of Intellectual Property Right regime	
4.2	TRIPs and Provisions in TRIPS Agreement	
4.3	Intellectual Property Rights (IPR) - <i>benefits of securing IPRs</i>	
4.4	Indian Legislations for the protection of various types of Intellectual Properties	
4.5	Fundamentals of Patents, Copyrights, Geographical Indications, Trade Secrets and Traditional Knowledge, Trademarks	
4.6	Protection of Plant Varieties and Farmers' Rights Act (PPV & FRA) and National Biodiversity Board	
4.7	Material Transfer Agreements, Research Collaboration Agreements, License Agreements	
PEDAGOGY	Lectures/ Assignments/ Seminars	
REFERENCE BOOKS	<p>Erbisch FH and Maredia K. 1998. <i>Intellectual Property Rights in Agricultural Biotechnology</i>. CABI, Wallingford.</p> <p>Ganguli, Prabudha. 2001. <i>Intellectual Property Rights: Unleashing Knowledge Economy</i>. McGraw-Hill, New Delhi.</p> <p>India, Ministry of Agriculture. 2004. <i>State of Indian Farmer. Vol. 5. Technology Generation and IPR Issues</i>. Academic Foundation, New Delhi.</p> <p><i>Intellectual Property Rights: Key to New Wealth Generation</i>. 2001. NRDC and Aesthetic Technologies, New Delhi.</p> <p>Rothschild, Max & Newman, Scott (Ed.). 2003. <i>Intellectual Property Rights in Animal Breeding and Genetics</i>. CABI, Wallingford.</p>	
	Saha R. (Ed.). 2006. <i>Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies</i> . Daya, Delhi.	
	The Indian Acts - Patents Act, 1970 & Amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 & amendments; Layout Design Act, 2000; PPV & FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to understand Product Development and International Trade for the food sector 2. The student will gain the ability to understand Intellectual property rights and their value in economy 	

COURSE CODE	FTO 124
COURSE TITLE	LAB IN FOOD PRODUCT DEVELOPMENT AND INTERNATIONAL TRADE
NUMBER OF CREDITS	1

PRE-REQUISITES	The student should have basic understanding of business and marketing	
OBJECTIVES	<ol style="list-style-type: none"> 1. To guide students towards developing a new food product 2. To enable students develop marketing strategies for a new food product 	
CONTENT	24 hours	
1.1	Formulating a New Food Product	
1.2	Preparing the New Food Product	
1.3	Marketing the New Food Product	
1.4	Managing the Export of the New Product	
PEDAGOGY	Experiments in the Laboratory and Reports	
REFERENCES	As suggested in FTO 123	
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to develop their own food products 2. The student will gain knowledge in marketing and managing the sale of their product 	

COURSE CODE FTO 125

COURSE TITLE FIELD TRIPS/ STUDY TOUR

NUMBER OF CREDITS 2

PRE-REQUISITES	The student should have knowledge of food science	
OBJECTIVES	1. To provide students a practical understanding of theoretical concepts 2. To enable students observe, first hand, work flow and processes in food industries and associated enterprises	
CONTENT48 hours		
1.1	Visit to the Food and Drug Administration	
1.2	Visit to a Biotechnology or Pharmaceutical Company	
1.3	Visit to a Fish Processing Unit	
1.4	Visit to a Non-Alcoholic Beverage Processing Industry	
1.5	Visit to an Alcoholic Beverage Processing Industry	
1.6	Visit to Slaughter Houses	
1.7	Visit to ICAR/ CFTRI	
1.8	Visit to a Food Packaging Manufacturing Plant	
1.9	Visit to a Sugarcane Industry	
1.10	Visit to a Bakery and Confectionery Unit	
1.11	Visit to a Dairy Industry	
1.12	Visit to an Oilseed Processing Plant	
1.13	Visit to a Sewage Treatment Plant	
1.14	Visit to a Cereal Processing/ Snack Food Industry	
2	Report Writing of Industrial Visits	
PEDAGOGY	Reports	
LEARNING OUTCOMES	1. The student will be able to appreciate different processing and production technologies in various industrial settings 2. The student will be exposed to the diverse nature of food industries	

COURSE CODE FTO 126

COURSE TITLE INTERNSHIP

NUMBER OF CREDITS 8

PRE-REQUISITES	The student should have knowledge of food science		
OBJECTIVES	1. To provide students exposure to industrial set-up 2. To enable students observe, first hand, work flow and processes in food industries and associated enterprises		
CONTENT			
1.1	Selection of industry relevant to food and allied products		
1.2	Working in department/s within the selected industry		
1.3	Periodic analysis of data and preparation of report		
1.4	Final preparation of internship report		
PEDAGOGY	Hands-on working experience in the industry/ Internship Report		
REFERENCES	As suggested by the in-charge of internship in selected industry		
LEARNING OUTCOMES	1. The student will be able to appreciate different processing and production technologies in various industrial settings 2. The student will be exposed to the diverse setting in food industries		

COURSE CODE	FTD
COURSE TITLE	DISSERTATION
NUMBER OF CREDITS	8

PRE-REQUISITES	Laboratory training
OBJECTIVES	<ol style="list-style-type: none"> 1. To enable students explore, independently, topics of research importance related to the food industry 2. To empower students to design a research study based on the principles of scientific research 3. To train students in interpreting, analysing, and reporting collated data related to a topic of study 4. To endow students with skills required for scientific writing and publication
CONTENT	Review of the state of research in a particular problem involving food, and development of hypothesis
	Planning and conducting the experiment
	Periodic analysis of data and preparation of report
	Final preparation of project report as dissertation to be submitted in partial fulfilment of M.Sc. Programme
PEDAGOGY	Review of Literature/ Experimental Analysis/ Report Writing/ Presentation/Project carried out individually by each student throughout the academic year
REFERENCES	As required for the development of review and methodology
LEARNING OUTCOMES	<ol style="list-style-type: none"> 1. The student will be able to plan and execute experiments or undertake literature surveys independently 2. The student will develop the skills to design experiments for solving problems in food research