

Revised Course Structure of B.Sc. Food Technology prepared in the light of as per Fifth Dean's committee's recommendation to be implemented from 2017-18 batch

Semester-I

S.No.	Course Code	Name of the Course	Credits
1	ME-301	Engineering Drawing	2(0-0-2)
2	ME-304	Workshop Practice & Technology	4(2-1-1)
3	LNG-305	English & Technical Writing	3(3-0-0)
4	EE-303	Elementsof Electrical Engineering	3(2-0-1)
5	AEAB-331	Principles of Economics	2(2-0-0)
6	AGRN-303	Crop Production Technology	3(2-0-1)
7	BAM-401	Cooperation marketing & finance	3(2-0-1)
8	GPT-301	Moral & Value Education	3(3-0-0)
9	DM-301	Fundamentals of Microbiology	3 (2-0-1)
10	<i>BIOL - 201</i>	<i>Elementary Biology (Deficiency course- PCM Group)</i>	<i>3(3-0-0)</i>
	<i>MAS – 312</i>	<i>Elementary Mathematics (Deficiency course -Ag. & Bio group)</i>	<i>3(3-0-0)</i>
Total			26

Semester-II

1	DC-562	Food Chemistry of Macronutrients	3(2-0-1)
2	FST-304	Post-Harvest Management of Fruits & Vegetable	3(2-0-1)
3	FST-301	Introductory Microbiology	3(2-0-1)
4	FST - 302	Principles of Food Processing & Preservation	3(2-0-1)
5	DT-302	Market Milk	4(3-0-1)
6	ABM-402	Agribusiness Management	3(2-0-1)
7	CSIT-401	Computer And Languages	4(2-0-2)
Total			23

Semester-III

1	FST-305	Food Microbiology	4(3-0-1)
2	MBGE – 455	Food Bio-technology	3(3-0-0)
3	DT-508	Processing Technology of Dairy Products	4(3-0-1)
4	ME-503	Heat and Mass Transfer	4(3-0-1)
5	DC-564	Food Chemistry of Micronutrients	3(2-0-1)
6	FST-401	Cereal Processing	3(2-0-1)
7	MAS - 511	Statistical Methods	3(2-0-1)
Total			24

Semester-IV

1	FST-515	Food Additives &Adulterants	3(3-0-0)
2	FST-506	Fruits and Vegetable Processing	3(2-0-1)
3	FST-504	Techniques in Food Analysis	3(2-0-1)
4	DE-401	Refrigeration and Air Conditioning	4(2-0-2)

5	FST-514	Food Biochemistry & Nutrition	4(3-0-1)
6	FST-616	Processing of Spices and Plantation Crops	3(2-0-1)
7	FST-513	Specialty Foods	3(2-0-1)
8	FST-508	Legumes & oilseed technology	3(2-0-1)
		Total	26

Semester-V

1	DE-601	Food Engineering	4(3-0-1)
2	FST-408	Processing of Fish & Marine Products	3(2-0-1)
3	FST-409	Technology of Meat and Poultry Products	3(2-0-1)
4	BAM-501	Marketing Management & International Trade	2(2-0-0)
5	FST-611	Food Packaging Technology	3(2-0-1)
6	FST-402	Beverage Technology	3(2-0-1)
7	FST-509	Sensory evaluation of food Products	3(2-0-1)
8	FST-605	Bakery, Confectionery & Snack Products	3(2-0-1)
		Total	24

Semester-VI

1	CSIT-501	Application of Information Technology	4(2-1-1)
2	FST-510	Food Quality, Safety and Standards	3(2-0-1)
3	FST-511	Food Industry Byproducts & Waste Utilization	4(3-0-1)
4	ENV-417	Environmental Studies	3(3-0-0)
5	FST-604	Extrusion technology	3(2-0-1)
6	FST-403	Industrial Microbiology and fermented foods	4(3-0-1)
7	FST-512	Product Development and Formulation	3(2-0-1)
		Total	24

Semester-VII

1	BAM-502	Entrepreneurship Development and Communication Skill	3(2-0-1)
2	FST-507	Quality Assurance and Certification	3(2-0-1)
3	FST-501	Food Plant Sanitation	3(2-0-1)
4	FST-516	Food Plant Design And Layout	3(2-0-1)
5	FST-695	Student READY-Experiential Learning Programme- I	7(0-0-7)
6	FST-696	Student READY-Experiential Learning Programme- II	7(0-0-7)
7	FST-697	Student READY-Research Projects	3(0-0-3)
8	FST-517	Seminar	1(0-0-1)
		Total	30

Semester-VIII

1	FST-698	Inplant Training	20
2	FST-699	Training Report Evaluation	5
		Total	25

Course Structure of B.Sc. Food Technology

Semester-I

1	ME-301	Engineering Drawing	2 (0-0-2)
	<p>Introduction to the engineering drawing, machine drawing, conventional lines and breaks. Drawing section symbols of various materials Projection, principal planes, orthographic projection, a brief introduction to oblique, perspective and isometric views</p> <p>Practicals</p> <ol style="list-style-type: none"> 1. Drawing elevation, side and plane of simple objects/machine parts to scale in both 1st angle projection and 3rd angle projection systems. 2. Drawing sectional views of various machine parts such as pulleys, bearings keys and couplings, pipe joint, etc. From given pictorial/isometric views. 3. Fastening, temporary and permanent. Helix, screw threads-various forms. 4. Multiple start screw threads rivets and riveted joints. 5. Drawing an isometric view. 6. Exercise on development of surfaces 7. Preparation of working drawing of a simple machine part. 		
2	ME-304	Workshop Practice & Technology	4 (2-1-1)
	<p>Introduction to workshop practice, safety, care and precautions in workshop. Wood working tools and their use, carpentry and pattern making, mould material and their applications. Heat treatment processes: hardening, tempering, annealing, normalizing etc. metal cutting. Soldering & brazing; electric arc welding, gas welding. Smithy and forging operations, tools and equipment. The bench: flat surface filing, chipping, scraping, marking out, drilling and screwing. Use of jigs and fixtures in production. Introduction to: (a) lathe; (b) milling machine; (c) shaper and planer; (d) drilling and boring machines; (e) grinder.</p> <p>Introduction to the engineering drawing, machine drawing, conventional lines and breaks. Drawing section symbols of various materials. Projection, principal planes, orthographic projection, a brief introduction to oblique, perspective and isometric views.</p> <p>Practicals</p> <ol style="list-style-type: none"> 1. Filing, fitting, chipping and hack sawing 2. Chiseling, tapping and smithy practice. 3. Simple exercises in arc, gas and argon welding. 4. Simple exercises in soldering and brazing 5. Basic joints in carpentry 		

3	LNG-305	English & Technical Writing	3(3-0-0)
<p>I–Language:</p> <ul style="list-style-type: none"> i) Tenses ii) Agreement of Subject and Verb iii) Prepositions iv) Use of Articles v) Punctuation <p>II–Written Communication:</p> <ul style="list-style-type: none"> i) Technical Report ii) Introduction to Sound–Vowels, Diphthongs and Consonants iii) Phonetic Transcription iv) Word Stress and Exercises on Pronunciation <p>III–Spoken English:</p> <ul style="list-style-type: none"> i) Group Discussion on current topics ii) Presentation iii) Interview 			
4	EE-303	Elements of Electrical Engineering	3(2-0-1)
<p>Alternating current fundamentals: Electromagnetic induction magnitude of induced E.M.F. Alternating current, R.M.S. value and average value of an alternating current. Phase relations and vector representation. A.C. series and parallel circuits, Concept of resonance, polyphase alternating current circuits, three-phase concept, Star and delta connections, star delta transformation, Energy measurement. Transformers: Fundamental of transformer, Theory, vector diagram without load and with load, Losses, voltage regulation and efficiency of transformer, auto-transformer. Induction motors : Fundamental principles, production of rotating fields, construction, Rotor winding-squirrel cage and phase wound rotors, Analysis of current and torque, starting of induction motors, Motor housing, selection of motor and its controls. D.C. Machines & AC machines : Construction and operation of D.C A. C. Motors, Types of generators, Various characteristics of generator, D.C. motors, torque-speed characteristics of D.C. motors, Starting and speed control of D.C. motors. Electric Power Economics: Electrification and load estimation Maximum demand charge, Load factor and power factor correction. Strength of Material – engineering materials, material science, use of various metals, including plastic glass, etc in food industry, selection and specification – material design, concepts and manufacturing of various equipments and machineries for food processing plant – Characteristics properties and uses of common building materials i.e. stone, brick, lime, cement, paints ad varnishes, etc.</p> <p>Practical: Study of voltage resonance in L.C.R. circuits at constant frequency. (a) Star connection-study of voltage and current relation (b) Delta connection-study of voltage and current relation. Measurement of power in 3-phase circuit. (a) For balanced loads. (b) For unbalanced loads, by wattmeter and energy meters Polarity test, no-load test, efficiency and regulation test of single phase. Voltage and current relation in a 3-phase transformer of various kinds of primary and secondary connection systems. Starting of induction motor</p>			

	by the following starters : (i) D.O.L. (ii) Manual star-delta (iii) Automatic star-delta (iv) Manual auto-transformer. Starting of slip-ring induction motor by normal and automatic rotor starters. Test on 3-phase induction motor, determination of efficiency, line current, speed, slip, power factor at various outputs. To determine relation between the induced armature voltage and speed of separately excited D.C. generator. Magnetization characteristic of D.C. generator. Study the starter connection and starting reversing and adjusting speed of a D.C. motor. Studies of building material, property and characterization. Studies on engineering materials, construction and properties. Studies of machine design of food processing plant.		
5	AEAB-331	Principles of Economics	2(2-0-0)
	Basic terms and concepts of Economics, Meaning and nature of Micro and Macro Economics, nature and scope of Agricultural Economics, its role and importance, characteristics of factors of production, measures to improve land productivity, Government policies Labour – division of labour, problems of unemployment under employment and disguised unemployment, capital formation in agriculture, forms of business organizations, Demand - law of demand – types of supply, law of supply – factors influencing supply, elasticity of supply. Price determination under different market situations. –Government policy Characteristic features of developed and under developed economics. International trade in Agriculture – exim policy – role of W.T.O., International Trade in Agriculture. Financial institutions and their role; RBI, IDBI, IMF, NABARD, SIDBI		
6	AGRN 303	Crop Production Technology	3(2-0-1)
	<p><u>UNIT I</u></p> <p>Soil and its components; Soil morphological, physical, chemical and biological properties; Acidic, saline and alkali soils and their reclamation; Essential plant nutrients: Functions and deficiency symptoms; Soil micro-organisms; Rhizosphere and its domain in soil; Organic manures and inorganic fertilizers.</p> <p><u>UNIT II</u></p> <p>Agriculture; Agronomy and its relation with other sciences; Classification of crops; Tillage and tillage practices, concepts of tillage and objectives; Seed, its characteristics and different sowing methods; Weed management: definition of weed, losses and benefits of weeds, different weed control methods and their suitability under different conditions; Irrigation: Soil water classification, methods of irrigation, approaches for scheduling irrigation.</p> <p><u>UNIT III</u></p> <p>Soil fertility and productivity; Concept of essentiality of plant nutrients; Fertilizers, manures and their types, methods of fertilizer application; Concepts of crop rotation, multiple cropping and intercropping - their principles, advantages and limitations; Cropping intensity; Production technology of major crops: Rice, maize, cotton, soybean, mung bean, mash, wheat, rapeseed and mustard, gram and Egyptian clover.</p>		

	Practical		
	<p>Study of soil profile and its characteristics; Determination of soil particle size distribution, particle density and bulk density; Determination of soil pH, electrical conductivity and organic carbon; Isolation of soil micro-flora (bacteria, fungus and actinomycetes).</p> <p>Land measurement; Practice in seedbed preparation and seeding methods; Identification of crop seeds, crops, weeds and fertilizers; Identification and use of hand tools and implements; Computation of fertilizer doses and their method of application.</p>		
7	BAM-401	Cooperation Marketing & Finance	3 (2-0-1)
	<p>Co-operation–philosophy and principles: History of Indian Co-operative movement, Cooperative credit structures in regional level and their study and singly window systems. Marketing – importance in economic development. Classification of Markets, Marketing functions, Market functionaries. Marketable and Marketed surplus, Marketing costs, margins and price spread, problems in marketing of agricultural commodities – perishables, grains, oilseeds and processed foods. Remedial measures for problems in Agricultural marketing. Agricultural marketing institutions, Regulated markets, Co-operative marketing societies, MARKFED, NAFED, Ware Housing Corporation, Food Corporation of India, Nature of agricultural product prices, Agricultural price policy and need for price stabilization. Methods of fixation of MSP for agricultural commodities. Commission on agricultural costs and prices. Finance–nature and scope: Credit – meaning, definition and classification. Credit analysis and repayment plans. History of financing Agriculture in India. Commercial banks – Nationalization of Commercial banks, Lead Bank scheme, Regional Rural Banks, Scale of finance, Higher financing agencies – RBI, NABARD, AFC, ADB, World Bank. Insurance and credit guarantee corporation of India. Crop Insurance. Contract farming – strategy and scope.</p> <p>Practical: Study of a regulated market, Study of a vegetable market, Study of a fruit market, Study of a cattle market, Computation of market costs, margins and price spread, Study of Andhra Pradesh State Warehousing Corporation, Study of Central Warehousing Corporation, Study of Food Corporation of India, Study of MARKFED, Study of functioning of a commercial bank , Study of a regional rural bank, Study of food processing enterprise, Formulation of project reports for financing food Industry, Working out repayment plans, Study of Primary Agricultural Credit Society, Study of Farmers’ Service Society</p>		
8	GPT-301	Moral Value & Education	3(3-0-0)
	<p>My country and my people, the many Indians, Being and becoming and Indian, nationalism and Internationalism.</p> <p>Some life issues- Love, Sex and Marriage, Men and money- value of time, Meaning of work, Human communication, Human suffering, Addiction, Ecology, Women’s issue.</p> <p>Understanding one’s neighbor. Neighbourhood groups: their structure and function, Patters of social interaction of group dynamics.</p> <p>Preparation for a career, Choice of vocation, Motivation for study and research. The present educational system. Curriculum and Syllabus, Teaching methods, Examination and work experience.</p> <p>Definition of value Education, Moral and ethics, laws and Morale based on Ten Commandments and two great commandments.</p>		

	Discovery of self, self- awareness growth of Intellect- mans spiritual Nature emotions, Will, Respect the Rights of Life, Liberty, property, Truth Reputation. Sin, Origin of sin, manifestation of sin, The results of sin, the remedy of sin, sin as an act, Sin as a state, sin as nature. Conscience- as defined in Oxford Dictionary and Winston Dictionary, Types of consciousness (Such as Evil, convicted, purged, pure, weak, good, void of offence)		
9	DM-301	Fundamentals of Microbiology	3 (2-0-1)
	<p>Microbiology: history and scope; contributions of Leeuwenhock, Pasteur and Koch. Principle of microbiology: Light Microscopy (Bright field, dark field, phase contrast, fluorescence); preparation and staining of specimens; electron microscopy. Microbial taxonomy: principles; numerical taxonomy; major characteristics used in taxonomy; classification according to Bergey's manual of systematic bacteriology. Structure and functions of prokaryotic cells; difference between prokaryotes and eukaryotes. Microbial growth and nutrition: the growth curve; factors affecting growth of microorganisms, estimation of bacterial growth; bacteriostatic and bactericidal agents; the common nutrient requirements and nutritional types of microorganisms. Bacterial genetics; DNA as the genetic material; structure of DNA; bacterial mutations (spontaneous and induced); genetic recombination- (transformation, transduction, conjugation). Micro flora of air, soil and water: methods for controlling microorganisms in air; water as carrier of pathogens.</p> <p>Practical: General instruction for microbiological laboratory. Microscope- simple and compound; Microbiological equipments; autoclave, hot air oven, incubator, centrifuge, colorimeter, laminar airflow, membrane filter. Simple staining- methylene blue; crystal violate; negative staining. Differential staining (Gram, spore, acid fast). Mortality of microorganisms; hanging drop technique. Measurement of microorganisms by micrometry. Preparation of commonly used growth media liquid and solid: simple and differential media. Isolation technique for microorganisms- Streak & pour plate Enumeration of microorganisms in air and soil. Enumeration of microorganisms in water: total viable count, coliform (MPN).</p>		
10	BIOL - 201	Elementary Biology (Deficiency course- PCM Group)*	2 (2-0-0)
	Life; Living and non living; Origin of Life; Oparin's abiotic theory; Evolution; Unicellular Multicellularity Complex Tissue system, Branches of Biology; Cell; Introduction Botany; History of Botany; Brief introduction of branches of Botany; Morphology; Anatomy; Taxonomy; Physiology; Palaeo Botany; Introduction Zoology: Classification of Animal kingdom; Adaptation of animals; External Morphology of Frog; Internal Anatomy of Frog, Internal organs; Different internal systems; Introduction to Lower Botany; Algae, Fungi, Bacteria, Virus; Bryophyte; Pteridophyte; Scope/Application of Biology.		
	MAS – 312	Elementary Mathematics (Deficiency course -Ag. & Bio group)*	3(3-0-0)
	Algebra: Theory of quadratic equations. Binomial index (for positive integral index only), Exponential and logarithm series, partial fractions, theory of matrices, sum, difference and multiplication of matrices, transpose, elementary idea of ad joint, inverse of matrices, solution of linear equations, permutation and combination.		

Trigonometry: Complex numbers, De Moivre's theorem and its simple application.

Coordinate geometry: Equation of standard curves and their identification.

Differentiation tangents and normals, maxima & minima.

Integral calculus: definite integrals, standard methods of integrations, Applications of integral calculus to area enclosed by curve, length of arc, volume and surface of revolution.

Vector analysis: Scalars and vectors, sum and difference of vectors, dot and cross products.

SEMESTER II

1	DC- 321	Food Chemistry of Macronutrients	3 (2+1)
	<p>Nature Scope and development of food chemistry; Moisture in foods, role and type of water in foods, functional properties of water, water activity and sorption isotherm, molecular mobility and foods stability; Dispersed systems of foods: Physicochemical aspects of food dispersion system (Sol, gel, foam, emulations); Rheology of diphase systems; Carbohydrates: Changes of carbohydrates on cooking, modification of carbohydrates, dietary fibres and carbohydrates digestibility; Enzymatic and chemical reactions of carbohydrates; Proteins in foods: Processing induced, physical, chemical and nutritional changes in protein, chemical and enzymatic modification of protein; Lipids in foods: Role and use of lipids/fat, crystallization and consistency, chemical aspects of lipids, lipolysis, auto-oxidation, thermal decomposition, chemistry of frying technology of fat and oil; Oil processing: Refining, hydrogenations, inter esterification, safety use of oils and fats in food formulation; Enzymatic and chemical reactions of fats; Rancidity and its types, detection techniques chemical aspects of lipids, antioxidants;</p> <p>Practical: Determination of moisture content of foods using different methods; Studies of sorption isotherms of different foods; Swelling and solubility characteristics of starches; Rheological properties of food systems; Determination of crude proteins by micro-Kjeldhal method; Determination of essential amino acids i.e. lysine, tryptophan, methionine, etc.; Isolation of egg and milk protein; Preparation of protein isolate and concentrate of proteins; Determination of acid value, saponification value and iodine number of fat/oil; Assay of amylases, papain and lipases.</p>		
2	FST-304	Post Harvest Management and Processing of Fruits & Vegetables	3 (2-0-1)
	<p>Post harvest technology of fruits and vegetables: An over view of concept and science, importance of loss reduction, role in export, economy, and employment generation. Morphology, structure and composition of fruit and vegetable.- Physical, Textural characteristics, structure and composition. Maturity standards; Importance, methods of Maturity determinations maturity indices for selected fruits and vegetables. Harvesting of important fruits and vegetables. Fruit ripening- chemical changes, regulations, methods. Storage practices: Control atmospheric, Bead atmosphere, hypotactic storage, cool store, Zero emerge cool chamber, stores striation. Commodity pretreatments - chemicals, wax coating, prepackaging. Physiological post harvest diseases chilling injury and disease. Handling and packaging of fruits and vegetables ; Post Harvest handling system for citrus, mango, banana, pomegranate, tomato, papaya and carrot packaging house operations. Principles of transport and commercial transport operations.</p> <p>Practical: Studies on morphological features of some selected fruits and vegetables. Studies of maturing indices. Studies of harvesting of fruits and vegetables. Determination of RQ. Studies of export of pre cooling and storage of fruits and vegetables. Studies on wax coating on apples, papaya, citrus, mango, aonla. Studies on use of chemicals for ripening and enhancing shelf life of fruits and vegetables. Studies of regulations of ripening of banana, mango, papaya. Studies on various storage systems and structures. Studies on prepackaging of fruits. Studies on prepackaging of vegetables. Studies on physiological disorders – chilling injury of Banana and custard apple. Visit to commercial packaging house – grape, mango, pomegranate. Visit to commercial storage structures- Onion, garlic, potato.</p>		

3	FST-301	Introductory Microbiology	3(2-0-1)
<p>History and Scope of Microbiology: The discovery of micro-organism, spontaneous generation conflict, germ theory of diseases, microbial effect on organic and inorganic matter. Development of microbiology in India and composition of microbial world. Microscopy and Specimen Preparation: The bright field microscope, fixation, dyes and simple staining, differential staining. Difference between prokaryotic and eukaryotic cells. Prokaryotic cell structure and functions. Types of culture media and pre-culture techniques. Microbial growth in models of bacterial, yeast and mycelia growth curve. Measurement of bacterial growth. General properties of viruses and brief description of bacteriophages. General principle of bacterial genetics, DNA as genetic material. Antibiosis, symbiosis, intra-microbial and extra-microbial association. Sterilization methods – Physical and chemical, Isolation of pure cultures and preservation of cultures, Plant growth promoting microorganisms and mushrooms – Economical importance, Industrially important microorganisms in large scale production and common microbial fermentations. Mushrooms- edible and poisonous types, nutritive values Culturing and production techniques.</p> <p>Practical: Examination of natural infusion and living bacteria; examination of stained cells by simple staining and Gram staining. Methods for sterilization and nutrient agar preparation. Broth culture, agar slopes, streak plates and pour plats, turbid metric estimation of microbial growth, mushroom culture- Spawn production, Culture and production techniques, harvesting, packing and storage.</p>			
4	FST – 302	Principles of Food Processing & Preservation	3 (2-0-1)
<p>Sources of food, scope and benefit of industrial food preservation, perishable, non-perishable food, causes of food spoilage. Preservation by salt & sugar – Principle, Method, Equipment and effect on food quality. Thermal processing methods of preservation – Principle and equipments:Canning, blanching, pasteurization, sterilization, evaporation. Use of low temperature – Principal, equipment and effect on quality. Chilling, cold storage, freezing. Preservation by drying dehydration and concentration – Principle, Methods, Equipment and effect on quality :Difference, importance of drying & dehydration over other methods of drying and dehydration, equipments and machineries, physical and chemical changes in food during drying and dehydration .Need and Principle of concentration, methods of concentration – Thermal concentration, Freeze concentration, membrane concentration, changes in food quality by concentration. Preservation by radiation, chemicals & preservatives. Definition, Methods of Irradiation, Direct & Indirect effect, measurement of radiation dose, dose distribution, effect on microorganisms. Deterioration of Irradiated foods- physical, chemical and biological; effects on quality of foods. Presentation of foods by chemicals, antioxidants, mould inhibitors, antibodies, acidulates etc. Preservation by fermentation- Definition, Advantages, disadvantages, types, equipments.</p> <p>Recent methods in preservation: Pulsed electric field processing, High pressure processing, Processing using ultrasound, dielectric, ohmic and infrared heating. Theory, equipments and effect on food quality.</p> <p>Practical: Demonstration of various machineries used in processing. Demonstration of effect of blanching on quality of foods. Preservation of food by heat treatment- canning. Canning of fruits and vegetables. Preservation of food by high concentration of sugar i.e. preparation of jam. Preservation of food by using salt- Pickle. Preservation of food by using acidulants i.e. pickling by acid, vinegar or acetic acid. Preservation of food by using chemicals. Preservation of Bread, Cake using mold inhibitors. Preservation of coconut</p>			

	shreds using humectants. Drying of pineapple slices, apple slices in cabinet drier. Demonstration on drying of green leafy vegetables. Drying of Mango/other pulp by foam mat drying. Drying of semisolid foods using roller dryers. Drying of foods using freeze-drying process. Demonstration of preserving foods under cold v/s freezing process. Processing foods using fermentation technique i.e. preparation of sauerkraut.		
5	DT-302	Market Milk	4 (3-0-1)
<p>Market milk industry in India and abroad: Distinctive features of tropical dairying as compared to those of the tropical climate of developed countries. Collection and transportation of milk; a) Organization of milk collection routes b) Practices for collection of milk, preservation at farm, refrigeration, natural microbial inhibitors, lactoperoxidase system.c) Microbial quality of milk produced on farm. Effect of pooling and storing on microbial quality of refrigerated milk. Role of psychrotrophs, Role of tropical climate on spoilage of milk.d) Chemical tests for grading raw milk. e) Microbio- logical tests for grading raw milk.</p> <p>Reception and treatment (pre-processing steps) of milk in the dairy plant: a) Reception, chilling, clarification and storage: General practices. b) Homogenisation: Definition, pretreatments, theories, synchronization of homogenizer with operation of pasteurizer (HTST) c) Effect of homogenization on physical properties of milk. d) Bactofugation: Theory and microbiology. Thermal processing of milk: a) Principles of thermal processing: kinetics of microbial destruction, thermal death curve, arrhenius equation, D value, Z value, FO value, Q10 value. b) Factors affecting thermal destruction of micro-organisms. c) Definition and description of processes: Pasteurization, thermisation, sterilization, UHT Processing. d) Microbiology of pasteurised milk, thermozes, sterilized & UHT milk. e) Product control in market milk plant. f) Defects in market milk. g) Manufacture of special milks: toned, doubled toned, reconstituted, recombined, flavoured, homogenized vitaminised and sweet acidophilus milk. h) Manufacture of sterilized milk. i) Distribution systems for market milk.</p> <p>Quality and safety aspectes in dairy food chain, good manufacturing practices (GMP) in dairy processing. UHT processing of milk : a) Relevance of UHT processing in the tropical climate b) UHT plants: Description. Direct, Indirect, with upstream and downstream homogenization, third generation UHT plants. c) Aseptic packaging, types and systems of packaging, sterilizing packages, filling systems. d) Technical control in the UHT plant. Training of personnel. Plant hygiene. e) Shelf life of UHT milk and tests for UHT milk. Nutritive value of milk. Effect of heat processing on nutritive value. Efficiency of plant operation: product accounting, setting up norms for operational and processing losses for quantity, fat and SNF, monitoring efficiency. Maintaining plant hygiene & HACCP.</p> <p>Practical : Familiarization with equipments for reception of milk in plant; Pretreatments: Chilling, clarification, filtration. Standardization and numericals relating to it. Cream separation: parts of separator and the process. Operation of LTLT, HTST pasteurizer, laboratory steriliser. Sampling and chemical examination of pasteurized, sterilized and UHT processed milk. Sampling and routine microbiological examination of microbiological examination of pasteurized and sterilized milk. Preparation of special milks; toned, double toned, standardised, flavoured, sterilised. Cleaning of storage tanks, cream separators, HTST plants; manual cleaning and CIP. Detection of adulterants and preservatives in milk. Assessment of homogenisation efficiency in milk. Strength of common detergents and sanitizers used in market milk plant.</p>			

6	ABM-402	Agri-business Management	3 (2-0-1)
<p>Definition, History, function productive system, operations, decisions, decision frame work, produces of series & goods critical themes, operation strategy, model, objectives, types External factor, international operations, rescued operations, stages, new production introductions, new product development, technology development, quality function development, Value analysis, modular design; Quality management, quality control and improvement, process selection, service operation design, choice of technology, layout of facilities, forecasting.</p>			
7	CSIT-401	Computer And Languages	4 (2-0-2)
<p>Computer Applications in Dairy Industry Programming Concepts and computer languages. Database concepts: Characteristics of Database, approaches to data base, Normalization. dBase Programming: Commands decision making, branching and looping structures, use of functions, writing programmes, Multiple data -file handling. Information systems: Types of Information and information systems(OLTP, MIS, DSS): Characteristics of MIS, Design of MIS, System development life cycle.</p> <p>Applications in Dairy industry: Use of RDBMS, Milk procurement and, Financial accounting system, 'Personnel management system etc. Use of spread sheet: Cost analysis of milk and milk products, Estimation of labour efficiency, Monitoring quality standards of dairy products, Budgeting and forecasting, Estimation of losses in manufacturing and packaging, etc. Use of linear Programming package, formulation of least cost mix for ice-cream, cattle feed, baby-food, etc.</p> <p>Introduction to process control, control systems, process control principles, process description, process control block diagrams, control system evaluation, analog and digital processing, units, standards and definitions, process control diagrams, time response, significance and statistics. Computers in process control, Programmable controllers, data logging, supervisory control, computer based controllers, characteristics of digital data, sampled data system,</p> <p>Development of controller software, Input -data operations, controller modes, Computer controller, examples.</p> <p>Practicals 1. Writing simple programmes with basic, Cobol, FORTRAN, C+ 2. File maintenance programmes 3. MIS report generation programmes 4. Development of MIS case studies 5. Spreadsheet package of case studies 6. Use of LP Packages 8. Use of SPSS Packages 9. Visit to a Dairy Plant: Demonstration of Process description & control system in Dairy Plant</p>			

Semester III

1	FST-305	Food Microbiology	4 (3-0-1)
<p>Microbial spoilage of foods, Chemical changes caused by microorganisms, Principles of Food Preservation. Control of microorganisms by use of low and high temperature. Asepsis, water activity , drying, preservatives, radiation and pressure for control of microorganisms. Microbiology of milk and milk products. Sources of contamination, spoilage and prevention. Microbiology of fruits and vegetables. Sources of contamination, spoilage and prevention. Microbiology of cereal and cereal products. Sources of contamination, spoilage and prevention. Microbiology of meat and meat products. Sources of contamination, spoilage and prevention. Microbiology of fish and other sea foods. Sources of contamination, spoilage and prevention. Microbiology of poultry and eggs. Sources of contamination, spoilage and prevention. Microbiology of sugar and sugar products. Sources of contamination, spoilage and prevention. Microbiology of salts and spices. Sources of contamination, spoilage and prevention. Microbiology of canned foods. Sources of contamination, spoilage and prevention.</p> <p>Practical: Isolation of molds from foods. Microbial examination of cereal and cereal products. Identification, isolation and confirmation. Microbial examination of vegetable and fruits. Identification, isolation and confirmation. Microbial examination of meat and meat products. Identification, isolation and confirmation. Microbial examination of fish and other sea foods. Identification, isolation and confirmation, Microbial examination of Eggs and poultry. Identification, isolation and confirmation. Microbial examination of milk and milk products. Identification, isolation and confirmation. Microbial examination of sugar, salts and spices. Identification, isolation and confirmation. Thermal Death Time determination.</p>			
2	MBGE – 455	Food Bio-technology	3 (3-0-0)
<p>Prospectus of BioTechnology. Molecular genetics i.e. fundamentals of molecular biology with special reference to chemistry and biology and DNA. (Primary secondary and tertiary) structures. Biological role of DNA in cell metabolism. Genetic recombination mechanisms and technique used for improvement in microbial strains. Applications of genetical control mechanism in industrial fermentation process, (Induction, manipulation and recombination). RecombinantDNA technology (plasmids and cloning): Cell and tissue culture. Continuous cultures. Secondary metabolites synthesis. Expression of foreign genes. Promoter (Enzyme). Biomass production by using various micro organisms. Application of Biotechnology in food (Food industries), pharmaceuticals and agriculture. Biogas plant.</p>			
3	DT-508	Processing Technology of Dairy Products	4(3-0-1)
<p>Classification of dairy products; Butter: Definition, composition; processing and production steps, overrun, butter making machines, quality testing of table butter, butter- defects, causes and their prevention, packaging and storage; Butter oil and ghee: Definition, composition, processing, equipment, quality tests; Paneer and Cheese:Definition, composition, types, processing steps, process flow diagram, equipment, quality defects, causes and prevention, packaging and storage; Ice cream and frozen desserts: Definition, composition, types, processing steps and flow diagram, equipment, quality testing, defects causes and prevention, packaging and storage. Condensed and Dried milk: Definition, composition, role of milk constituents in condensed milk, manufacture of condensed milk, types of standards for dried milk, manufacture of SMP and WMP using roller and spray</p>			

	drying, instantization, recent developments in drying, quality testing, defects, causes and prevention, packaging and storage; Traditional Indian Dairy Products: Definitions, compositions, processing, packaging, storage, equipment and quality testing; By- products of dairy industry and their utilization.		
	Practical: Preparation of butter/ table butter, Preparation of ghee, Preparation of paneer; Preparation of selected type of cheese; Preparation of ice-cream and selected frozen desserts; Preparation of condensed milk; Preparation of milk powder; Preparation of selected Indian dairy products; Determination of selected quality parameters of selected dairy products; Visit to dairy plant.		
4	ME-503	Heat and Mass Transfer	4 (3-0-1)
	<p>Basic heat transfer process, thermal conductivity, convective film co-efficient, Stefan Boltzman's constant and equivalent radiation co-efficient, Overall heat transfer co-efficient, physical properties related to heat transfer. Working principles and application of various instruments for measuring temperature. One-dimensional steady state conduction: Theory of heat conduction, Fourier's law, Derivation of Fourier's equation in Cartesian co-ordinates, Linear heat flow through slab, cylinder and sphere. Heat flow through slab, cylinder and sphere with non-uniform thermal conductivity. Concept of electrical analogy and its application for thermal circuits, Heat transfer through composite walls and insulated pipelines. One dimensional steady state heat conduction with heat generation : Heat flow through slab, hollow sphere and cylinder with uniform heat generation, Development of equations of temperature distribution with different boundary conditions. Steady-state heat conduction with heat dissipation to environment :Introduction to extended surfaces (FINS) of uniform area of cross-section. Equation of temperature distribution with different boundary conditions. Effectiveness and efficiency of the FINS. Introduction to unsteady state heat conduction. Convection: Forced and free convection, use of dimensional analysis for correlating variables affecting convection heat transfer, Concept of Nusselt number. Prandtl number, Reynolds number, Grashoff number, Some important empirical relations used for determination of heat transfer coefficient. Heat Exchangers: General discussion, fouling factors, jacketed kettles, LMTD, parallel and counter flow heat exchangers, Shell and tube and plate heat exchangers, Heat exchanger design. Application of different types of heat exchangers in dairy and food industry. Fick's Law of diffusion, steady state diffusion of gases and liquids through solids. Equimolal diffusion. Mass transfer co-efficient and problems on mass transfer.</p> <p>Practical : Determination of thermal conductivity: milk, solid dairy & food products. Determination of overall heat transfer co-efficient of : Shell and tube, plate heat exchangers and Jacketed kettle used in Dairy & Food Industry. Studies on heat transfer through extended surfaces. Studies on temperature distribution and heat transfer in HTST pasteuriser. Design problems on heat exchangers. Study of various types of heat exchangers. Design problems on Mass Transfer.</p>		
5	DC-321	Food Chemistry of Micronutrients	3 (2-0-1)
	Chemistry of food flavour; Philosophy and definitions of flavour, flavourmatics/flavouring compounds, sensory assessment of flavour, technology for flavour retention; Pigments in		

	<p>animal and plants kingdoms: Heme pigments, chlorophyll, carotenoids, phenolic and flavonoids, betalins, effect of processing on pigment behaviour; Technology for retention of natural colours of food stuffs; Food colorants; Regulatory use of regulatory dyes; Colour losses during thermal processing; Vitamins and minerals: Requirements, allowances, enrichment, restorations, fortifications, losses of vitamins and minerals, optimization and retention of vitamins and minerals; Chemistry of anti-nutritional factors.</p> <p>Enzymes in food industry: Carbohydrases, protease, lipases; Modification of food using enzymes: Role of endogenous enzymes in food quality, enzymes use as processing aid and ingredients</p> <p>Practical: Preparation of mineral solution by using ash and tri-acid method (dry and wet oxidations); Estimation of calcium; Determination of phosphorus; Determination of iron; Estimation of magnesium; Estimation of tannins and phytic acid from food; Determination of vitamin A (Total carotenoids); Determination of ascorbic acid by dye method; Determination of thiamin and riboflavin; Determination of food colors; Assessment of hydrocolloids as food additives; Assessment of various pectinases from fruits and vegetables.</p>		
6	FST-401	Cereal Processing	3 (2-0-1)
	<p>Present status and future prospects of cereals (Rice, Wheat, Corn, Sorghum, Rye); Morphology of Rice: Physical properties; Density, Bulk density, Angle of repose, Hardness, asperity, porosity, stack of milling and moisture on physical properties. Chemical composition, Distribution of nutrients and Aroma of rice. Drying of paddy: general principles and methods of drying, cracking phenomenon prevention. Methods of drying, batch type, continuous type driers. Milling of rice: i) Conventional Milling ii) Modern milling iii) Advantages and disadvantages of milling machineries. iv) By products of rice milling. Parboiling of rice: Aging of rice: Enrichment: Need of Enrichment, Methods of enrichment, Enrichment levels, fortification of amino acids. Processed Foods from rice: Breakfast cereals, flakes, puffing, canning and instant rice. Wheat: Morphology, Physicochemical properties, Wheat Quality, Wheat Milling. Corn: Morphology, Physicochemical properties, Corn milling, Milling fractions and modify starches. Barley: Morphology, Physicochemical properties and processing (Malting) Sorghum: Morphology, Physicochemical properties, Milling, Malting, Pearling and industrial utilization. Millets – Oat / Rye: Importance of Millet, composition, processing of millets for food uses.</p> <p>Practical: Morphological characteristics of cereals. Physical properties of cereals. Chemical properties of cereals. Determination of colour of cereals. Parboiling of Paddy. Cooking quality of rice, Milling of rice, Conditioning of wheat. Production of sorghum flakes. Production of Popcorns Preparation of sorghum Malt. Determination of Gelatinization Temp. By amylograph. Extraction of oil from rice bran. Visit to Cereal processing unit.</p>		
7	MAS-511	Statistical Methods	3 (2-0-1)
	<p>Definition and scope; Statistics. Methods of condensation of data, frequency distribution Graphical representation Measures of central tendency Measures of dispersion Moments, skewness and kurtosis. Elementary notions of probability</p>		

Laws of addition and multiplication probability.
Theoretical frequency distributions
Binomial distributions and its applications
Poisson distribution and its applications
Normal distribution and its applications
Concept of sampling
Simple random sampling with replacement
Simple random sampling without replacement
Introduction to testing of hypotheses and Tests of Significance
'Z' and 'T' test for one sample problems
'Z' and 'T' test for two sample problems
'Chi-square' test for independence of attributes and goodness of fit. Simple correlation coefficient and its test of significance
Lines regression, Rank correlation

Practicals

1. Formation of frequency distribution and graphical representation.
2. Measures of central tendency.
3. Measures of dispersion.
4. Applications of 'Z' test for one and two sample problems
5. Applications of 't' test for one and two sample problems.
6. Applications of Chi-square test.
8. Rank correlation coefficient.

SEMESTER- IV

1	FST-515	Food Additives and Adulterants	3 (3-0-0)
<p>Intentional and unintentional food additives, their toxicology and safety evaluation. Naturally occurring food additives. Food colour (natural and artificial). Pigments their importance and utilization as food colour. Taste and flavour inducer, potentiater. Food preservatives and their chemical action. Role mode of action salt, chelating agents stabilizers and thickeners, polyhydric alcohol, anticaking agent, firming and colouring agent, flour bleaching agent, antioxidants, nonnutritional sweetness and antimicrobial agents.</p> <p>Practical: Evaluation of GRAS aspect of food additives. Identification of food colour by TLC. Isolation and identification of naturally occurring food pigments by paper and TLC. Spectrophotometric method of total chlorophyll (A&B). Determination of diacetyl content of Butter. Role mode of action of chelating agent in fruit juice. Role and mode of action of stabilizer and thickener in frozen dairy products. (Icecream). Role and mode of clarifying agent in fruit juices. Role and mode of antioxidant in frozen fish. Role of leaving agent in baked food product.</p>			
2	FST-506	Fruits and Vegetables Processing	3 (2-0-1)
<p>Production and processing scenario of fruits and vegetables in India and world; Scope of fruit and vegetable processing industry in India; Overview of principles and preservation methods of fruits and vegetables; Supply chain of fresh fruits and vegetables; Primary processing and pack house handling of fruits and vegetables; Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables; Minimal processing of fruits and vegetables; Blanching operations and equipment; Canning: Definition, processing steps, and equipment, cans and containers, quality assurance and defects in canned products; FSSAI specifications and preparation and preservation of juices, squashes, syrups, sherbets, nectars, cordials, etc.; Processing and equipment for above products; FSSAI specifications; Preparation, preservation and machines for manufacture of crystallized fruits and preserves, jam, jelly and marmalades, candies, Preparation, preservation and machines for manufacture of chutney, pickles, sauce, puree, paste, ketchup; toffee, cheese, lather, dehydrated, wafers and papads, soup powders; Production of pectin and vinegar; Commercial processing technology of selected fruits and vegetables for production of various value added processed products.</p> <p>Practical: Primary processing of selected fruits and vegetables; Canning of Mango/Guava/Papaya; Preparation of jam from selected fruits; Preparation of jelly from selected fruits; Preparation of fruit marmalade; Preparation of RTS; Preparation of squash; Preparation of syrup; Preparation of raisins, dried fig and dried banana; Preparation of anardana; Preparation of papain; Preparation of pickles; Preparation of dried ginger; Preparation of dried onion and garlic; Preparation of banana and potato wafers; Preparation of dehydrated leafy vegetables; Visit to fruits and vegetables pack house, canning plant, vegetable dehydration plant.</p>			

3	FST-504	Techniques in Food Analysis	3 (2-0-1)
<p>Nature and concepts of food analysis; Rules and regulations of food analysis, Safety in laboratory, sampling techniques. Principles and methodology involved in analytical techniques: PH Meter and use of ion selective electrodes –Spectroscopy, Ultra violet visible, fluorescence, Infrared spectro, Atomic absorption and emission, Mass spectroscopy, Nuclear magnetic resonance and electron spin resonance. Chromatography –Adsorption, Column, Partition, Gelfiltration, Affinity, Ionexchange, Sizeexclusion method, Gas liquid, High performance liquid chromatography. Separation techniquesDialysis, Electrophoresis i) Paper ii) DS gel electrophoresis iii) Immuno electrophoresis Sedimentation, ultrafiltration, ultracentrifugation, Isoelectric focusing, Isotopic techniques, Manometric techniques. Principles and methodology involved in analysis of foods ; Rheological analysis, Textural profile analysis of foods. Immuno assay techniques in food analysis; Isotopic and Nonisotopic immuno assay, Enzymeimmuno assay. Evaluation of analytical data ; Accuracy and precision, Statistical significance, Corelations regression, Computers for data analysis and result interpretation. Sensory analysis of food; Objective method, Objective method.</p> <p>Practical: Analysis of heavy method using atomic absorption spectrophotometer. Estimation of physic acid using spectrophotometer. Separation of amino acids by towdimensional paper chromatography. The identification of sugars in fruit juice using TLC. Separation of pralines by Ionexchange chromatography. Molecular weight determination using sephadoxgel. Identification of organic acids by paper electrophoresis. Gelectrophoresis for analytic techniques. Quantitative determination of sugars and fatty acid profile by GLE. Quantitative makeup of water and fat soluble vitamins using HPLC.</p>			
4	DE-401	Refrigeration and Air Conditioning	4 (2-0-2)
<p>Basic refrigeration cycles and concepts : Standard rating refrigerating machines, Elementary vapour compression refrigeration cycle with reciprocating, rotary and centrifugal compressors. Theoretical vapour compression cycle, Departure from theoretical vapour compression cycle, representation on T- and p-h diagrams, Mathematical analysis of vapour compression refrigeration system. Refrigerants: Primary and secondary refrigerants, common refrigerants (Ammonia, Freon), Brine, their properties and comparison. Multiple evaporator and compressor systems: Applications, One compressor systems: dual compression, comparison of system, Control of multiple evaporator system, Working and mathematical analysis of above systems. Refrigeration equipments: Compressor, Condenser, evaporator, Cooling tower, spray pond, Basic elements of design, Construction, operation and maintenance, balancing of different components of the system. Refrigeration Controls: Low side and high side float valves, capillary tube, thermostatic expansion valve, automatic expansion valve, solenoid valve, High pressure and low pressure cutouts, thermostat, overload protector, common defects and remedies. Refrigeration Piping: Purpose, materials, joint and fittings, water and brine pipe size selection. Absorption Refrigeration Systems: Simple vapour absorption refrigeration systems, Practical absorption system, Refrigerant absorbent combinations Absorption cycle analysis. Psychrometry: definition, properties of air-vapour mixtures, Psychrometric charts, Processes involving air vapor mixtures, Dehumidification, humidifiers, Humidity measurements, humidity control. Wet bulb, dry bulb temperature dew point temperature. Cooling load calculations: Types of loads, design conditions for air cooling, air conditioning loads. Cold storage: Types of cold storage, Types of loads in cold storage, Construction of cold storage. Insulating materials</p>			

	<p>and vapour barriers.</p> <p>Practical : Study of tools used in installation of a refrigeration plant including charging and detection of leaks. To study different parts and learn operation of bulk milk cooler. Study of different parts and learn the operation of a refrigeration plant/ice plant using ammonia refrigerant. Study of different parts and learn the operation of a vapour absorption refrigeration plant. Dismantling and assemble an open compressor and a sealed unit. Study different parts and refrigeration controls of the following (a) Refrigerator (b) Water cooler (c) Deep Freezer (d) Compare their cooling coils and other systems. To find out the rating (cooling rate) at different suction temperatures (temperature differences) and air handling capacity of the air cooling unit. Plotting the practical refrigeration cycle on a pressure enthalpy diagram and to compare it with a theoretical refrigeration cycle. Study different parts and operation of a (a) Air washer, (b) Room cooler, (a) Air conditioner, (d) Chemical dehumidifiers, (e) Cooling. Plotting of psychrometric process: Sensible heating & cooling. Dehumidification & cooling and heating & humidification. Study of different humidity indicating, recording and controlling devices. Problems on cold storage. Visit to cold storage.</p>		
5	FST-514	Food Biochemistry & Nutrition	4(3-0-1)
<p>Biochemistry and its scope, cellular biochemistry; Carbohydrates: Occurrence, classification and structures, physicochemical and metabolic functions, metabolism; Proteins: Occurrence, classification and structures, physicochemical and metabolic functions, metabolism; Lipids: Occurrence, classification and structure, physicochemical and metabolic functions, metabolism; Nucleic acids: Properties, structure and metabolism; Vitamins and minerals: Chemistry and metabolic functions; Enzymes: Chemical nature and nomenclature, classification, sources and properties, mechanism of action, coenzyme and prosthetic groups; Concepts and content of nutrition: metabolic function of nutrients; Water and energy balance, water intake and losses, basal metabolism; Formulation of diets, classification of balanced diet, preparation of balanced diet for various groups; Recommended dietary allowances for various age groups; Malnutrition; Assessment of nutritional status; Food fad and faddism; Potentially toxic substance in human food; Functions of food; Basic food groups; nutrients supplied by food; Mechanism of enzyme action: Introduction to enzymes, coenzymes, regulation of enzymatic activity, enzyme kinetics, inhibition effects of pH, allosteric enzymes, derivation of Michaelis-Menten equation; Nucleic acids; Nutrients: Sources, functions, digestion, absorption, assimilation and transport of carbohydrates, proteins and fats in human beings; Metabolism of carbohydrates: Biological role of carbohydrates, glycolysis and respiration, production of ATP, brief description of electron transport chain, oxidative and substrate phosphorylation; Metabolism of lipids: Biological role of lipids, breakdown of triglycerides and phospholipids, β-oxidation of long chain fatty acids, ketosis, biosynthesis of fatty acids, triglycerides and phospholipids; Metabolism of proteins: Breakdown of proteins, transamination, deamination, decarboxylation, nitrogen fixation, urea cycle; Minerals: Functions, sources, factors affecting absorption of minerals, absorption promoters, absorption inhibitors, effect of deficiency; Vitamins and hormones: Classification, functions, sources, effects of deficiency, fat soluble vitamins, water soluble vitamin; Relationship between vitamins and hormones in terms of their biological role; Physico-chemical and nutritional changes during processing: Changes during food processing treatment of drying and dehydration,</p>			

	irradiation, freezing, fermentation, canning, restoration, enrichment, fortification and supplementation of foods.	
	<p>Practical: Preparation of various solutions and buffers; Qualitative and quantitative determination of carbohydrates; Qualitative and quantitative determination of amino acids; Qualitative and quantitative determination of proteins; Qualitative and quantitative determination of lipids; Qualitative and quantitative determination of vitamins; Isolation of enzymes from various sources; Measurement of energy using bomb calorimeter; Determination of pka of acid; Determination of pl for casein; Estimation of sugars by Anthrone method; Estimation of protein by Lowry method; Estimation of amino acid using Biuret reaction; Separation of amino acids using paper chromatography; Separation of amino acids using thin layer chromatography; Separation of amino acids using electrophoresis; Estimation of phosphorus in food sample. Estimation of iron content in foods; Determination of calcium in food samples; Estimation of β-carotene using column chromatography; Estimation of ascorbic acid using dye method; Effects of acids and alkali on pigments.</p>	
6	FST-616	Processing of Spices and Plantation Crops
	3 (2-0-1)	
	<p>Production and processing scenario of spice, flavour & plantation crops and its scope. Major Spices: (1) Post Harvest Technology composition, processed products of following spices (2) Ginger (3) Chill (4) Turmeric (5) Onion and garlic (6) Pepper (7) Cardamom (8) aercanut, cashew nut, coco nut. Minor Spices, herbs and leafy vegetables : tea rubber and oil palm. Spartans, Processing and Utilization All spice, Annie seed, sweet Basil. Caraway seed, Cassia, Cinnamon. Clove, Coriander, cumin, Dill seed. Fern seed nutmeg, malt, mint marjoram. Rose merry, saffron, sage. Savory, Thyme, Ajowan. Asartida, curry leaves. Tea Types, Processing, quality control. Coffee& Cocoa: Processing. Vanilla and annatto processing. Flavours of minor spices. Flavour of major spices. Spice oil and oleoresins. Flavours of soft drinks Baking and confectionery. Standards specification of spices. Functional packaging of spices and spice products.</p> <p>Practical: Identification and characterization of flavouring compounds of spices. Valuable oil determination. Extraction of oil from clove, pepper, cardamomchili. Extraction of oleoresinsTurmeric, ginger, pepper, clove. Piperine estimation in pepper oleoresin. Steam distillation of spices. Determination of curumin content in turmeric. Chemical analysis of spices moisture, valuable oil, specific gravity, refractive index ,acid value. Study of standard specification of spices. Packaging study of spices. Preparation of curry powder. Visit to spice Industry.</p>	
7	FST-513	Specialty Foods
	3 (2-0-1)	
	<p>Need and scope of specialty foods: Specialty food based on ease in preparation cost health benefits; Functional foods, Convenience food, Health care and medical benefits, Nutritional status, Low cost foods. Specialty foods based on sources ; Cereals and millets, Legumes and pulses, Fruits and vegetables, Animal food sources, By product based, Non conventional foods. Specialty foods based on process; Innovative process technology, Food additives basis, Bioactive components, Novel neutraceuticals products, Packaging techniques, Adaptable technology basis, Fast and PET foods. Specialty food based on genetics ; Genetically modified foods, Transgenic foods, Biotechnological aspects of detoxification. Proprietary foods. Supplementary foods. Therapeutic foods ; Modification of diets in disorders, feeding purposes Disease oriented of different organs ex: digestive tract, liver,</p>	

	<p>cardiovascular system, kidney , metabolic disorders, allergy, endocrine disorders. Specific consumer oriented foods; Defence persons, Space / astronought, High altitude mountain climbers, Disaster situation – crises, care, maintenance. Specialty foods based on growing condition organic , inorganic farming.</p> <p>Practical: Preparation of specialty foods based on; Functionality, Convenience, Low cost, Nutritional purpose. Preparation of specialty food using locally available foods crops, fruit and vegetables few products. Assessment of byproduct for preparation of value added specialty food. Isolation of phytochemical/ bioreactive agent of plant sources and their utilization in proprietary foods. Preparation of specialty food as per requirement of; Location, Nature of work, Status of worker. Evolution of food cultivated under organic conditions.</p>		
8	FST-508	Legumes & oilseed technology	3 (2-0-1)
<p>Present status and future prospectus of Legumes and Oil seeds Morphology of legume. Classification and types of legumes and pulses. Chemical composition and nutritional value. Antinutritional factors, their chemistry, methods of removal of antinutritional factors. Processing of legumes of Food uses: Home scale, Cottage Scale and commercial methods of dehulling. Modern techniques in Dal mills. Processing of Red gram,. Bengal gram, Green gram, Black gram. Dal milling – Principle, methods, equipments and effect on quality. Principle products, Dry and Wet milling of pulses, Fermented Products of legumes. Soaking – Principles, Methods of socking Sprouting, Puffing, Roasting & Parboiling of Legumes, Physical and Biochemical changes during these processes. Cooking quality of dhal – methods, factors affecting quality of dhal and cooking of dhal. Quick cooking dhal, Instant dhal. Introduction, Present and future prospects of oil seeds, chemical composition and characters of oil seed and Oils, Antinutritional factors, elimination Methods. Post Harvest Technology of Oil seeds, Handling Drying, Storage, Grading, Pretreatments, cleaning, Dehulling, Size reduction and flaking. Oil extraction: Traditional Methods, Ghani, Power Ghans, Expellers Principle of Expeller, structure design of expeller. Solvent extraction process: Principle, Pretreatment Breaking, Cracking, flaking. Extraction principles, factors affecting the extraction process. Desolventization. Refining of Oils Degumming, neutralization, bleaching, filtration, deodorization, their Principles and process controls. New Technologies in oil seed processing, utilization of oil seed meals of different food uses. High protein Product, like protein concentrate and isolates.</p> <p>Practical : Physical properties of Legumes and Oil seeds. Estimation of protein. Estimation of Fat Methods and Principles of dehulling; Application Oil & Application Red Earth slurry. Dal Milling Process. Antinutritional factors, Methods of Elimination. Soaking studies Sprouting of legumes. Cooking quality of Dal. Fermented product of legumes Dosa, Idli, Wada, Dhokala, etc. Extraction of oil by expeller press. Production of protein rich product. Visit to Dal Mill and oil extraction plant.</p>			

SEMESTER – V

1	DE-601	Food Engineering	4 (3-0-1)
	<p>Rheology of processed food, properties of fluid foods, Rheological method, Measurement of rheological parameters, properties of granular food and powders, Properties of solids foods, Visco-clastic models. Measurement o food texture. Food Freezing : Thermal properties of frozen foods. Predication of freezing rates. Plank’s equation, Neumanna problem and Tao solution. Design of food freezing equipment, Air blast freezers, Plate freezers and immersion freezers, storage of frozen foods. Food dehydration : Estimation of drying time for food products, constant rate period and falling rate period dehydration. Diffusion controlled falling rate period. Use of heat and mass balanced in analysis of continuous dryers, fixed tray dehydration, cabinet drying, tunnel drying. Freeze Dehydration : Heat and mass transfer, Calculation of drying times, Industrial freeze drying. Equipment for pulping, Fruit juice extraction, Balanching, Dehulling, Size reduction and distillation.</p> <p>Practical: Study of rheological properties of foods. Study of freezers and freeze dryers. Design problems on batch freezers. Design problems for continuous freezers. Design problems on dryer. Visit to cold storage. Visit to food processing plant.</p>		

2	FST- 408	Processing of Fish and Marine Products	3 (2-0-1)
	<p>Fisheries resources, global and Indian scenario; Types of fish and other marine products; Classification of fish (fresh water and marine), composition of fish, characteristics of fresh fish, spoilage of fish- microbiological, physiological, biochemical; Relationship between chilling and storage life, MAP, general aspects of fish freezing, changes in quality during chilled and frozen storage; Principles of canning, effect of heat processing on fish, storage of canned fish, pre-process operations, post-process operations, cannery operations for specific canned products; Fish products: Introduction, fish muscle proteins, surimi process, traditional and modern surimi production lines, quality of surimi products, comparison of surimi and fish mince products; Fish protein concentrates (FPC), fish protein extracts (FPE), fish protein hydrolysates (FPH); Preparation protocols of indigenous products: Fish sauce and paste. Novel methods; Low dose irradiation; High pressure treatment, MAP, vacuum packaging, gas packaging; Oxygen absorbents and CO₂ generators, ethanol vapour generation, hurdle barrier concept, value added fish products, packaging; Sea food quality assurance, HACCP, EU hygienic regulations and ISO 9000 standards; New kinds of quality and safety problems emerging in sea food processing and preservation.</p>		

	<p>Practical: Study of anatomy and dressing of fish; Study of anatomy and dressing of prawn and other marine products; Identification of different types of fish - Selection and grading; Identification of different types of prawn and other marine products - Selection and grading; Quality evaluation of fish; Preparation of sun dried and salt cured fish, fish sauce; Chilling and freezing of fish; Preparations of fish protein concentrate; Preparation of fish meal; Preparation of marine fish oils and various fish products; Utilization of fish by-products; Preparation of marine algal products; Preservation of fish: Drying, pickling; Preservation of marine products using fermentation process; Preparation of value added sea products: Cutlets, bullets, wafers; Processing of fish oils; Canning methods for marine fishery products; Estimation of TVB and TMA; Determination of iodine value; Protein estimation by Folin-Lowrey's method; Visit to fish and prawn processing industry.</p>
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3	FST- 409	Technology of Meat and Poultry Products	3(2-0-1)
	<p>Sources and developments of meat and poultry industries in India and importance of meat and meat industries in national economy. Muscle structure, chemical composition and physico-chemical properties of meat muscle. Abattoir design and layout. Pre-slaughter transport and care and ante-mortem inspection. Slaughtering of animals and poultry, postmortem inspection and grading of meat. Factors affecting post-mortem changes, properties and shelf life of meat. Egg structure: Composition, quality characteristics, processing and preservation of eggs. Processing and preservation of meat- mechanical deboning, aging or chilling, freezing, pickling, curing, cooking and smoking of meat. Meat tenderization. Meat emulsions. Technology of manufacture of meat and poultry products. Meat plant sanitation and safety. By-products utilization</p> <p>Practical: Pre-slaughter operations of meat animals and poultry birds. Slaughtering and dressing of meat animals. Study of post-mortem changes. Meat cutting and handling. Evaluation of meat quality. Preservation of meat by different methods and preparation of meat and poultry products. Evaluation of quality and grading of eggs. Preservation of shell eggs. Experiments in by-products utilization.</p>		

4	BAM-501	Marketing Management & International Trade	2 (2-0-0)
<p>Concept of marketing; Functions of marketing; concepts of marketing management; scope of marketing management ; marketing management. Process; concepts of marketing- mix, elements of marketing- mix. Market Structure and Consumer Buying Behaviour: Concept of market structure, marketing environment, micro and macro environments. Consumers buying behaviour, consumerism. Marketing Opportunities Analysis: Marketing research and marketing information systems; Market measurement- present and future demand ; Market forecasting; market segmentation, targeting and positioning. Allocation and Marketing resources. Marketing Planning Process. Product policy and planning : Product-mix; product line; product life cycle. New product development process. Product brand, packaging, services decisions. Marketing channel decisions. Retailing, wholesaling and distribution. Pricing Decisions. Price determination and pricing policy of milk products in organized and unorganized sectors of dairy industry. Promotion-mix decisions. Advertising; How advertising works; Deciding advertising objectives, advertising budget and advertising message; Media Planning; Personal Selling, Publicity; Sales Promotion. Food and Dairy Products Marketing. International Marketing and International Trade. Salient features of International Marketing. Composition & direction of Indian exports; International marketing environment; Deciding which & how to enter international market; Exports- Direct exports, indirect exports, Licensing, Joint Ventures, Direct investment & internationalization process, Deciding marketing Programme; Product, Promotion, Price, Distribution Channels. Deciding the Market Organization; World Trade Organization (WTO)</p>			
5	FST-611	Food Packaging Technology	3 (2-0-1)
<p>Introduction to subject, Packaging situations in World, India, need of packaging, plastic consumption/use in World, India etc. Package requirements, package functions, Hazards acting on package during transportation, Storage and atmospheric package, labeling laws. Package Materials: classification packages, paper as package material its manufacture, types, advantages corrugated and paper board boxes etc. Glass as package material, Manufacture, Advantages, disadvantages. Metal as package material manufacture, Advantages, disadvantages, Aluminum as package material,. Its advantages and disadvantages, plastic as package material classification of polymers, properties of each plastics, uses of each plastics, chemistry of each plastic such as polyethylene, Polypropylene, polystyrene, polycarbonate, PVC, PVDC, Cellulose acetate, Nylon etc. Lamination Coating and Aseptic packaging. Lamination, need of lamination, types, properties, advantages & disadvantages of each type. Coating on paper & films, types of coatings : Need of coating, methods of coatings. Aseptic packaging Need, Advantaged, process, comparison of conventional & aseptic packaging system of aseptic packaging and materials used in aseptic packaging. Machineries used in Packing foods. Packaging of Specific Foods. Packaging of specific foods with its properties, Like bread, Biscuits, Coffee, Milk powder, egg powder, carbonated beverages. Snack foods etc. Mechanical and functional tests on Package. Various mechanical and functional testes perform in laboratories on package boxes and package materials.</p> <p>Practical: Classification of various packages based on material and rigidity. Measurement of thickness of paper, paper boards. Measurement of basis weight of paper and paperboards. Measurement of grammage and water absorption of paper, paper boards. Measurement of bursting strength of paper of paper boards. Measurement Tear resistance of papers.</p>			

	Measurement of puncture resistance of paper and paperboard. Measurement of tensile strength of paper of paper boards. Measurement of grease resistance of papers. Determination of gas transmission rate of package films. Determination of WVTR and QTR of films. Determination of coating on package materials. Identification of plastic films. Finding chemical resistance of films. Prepackaging practices followed for packing fruits, vegetables.		
6	FST-402	Beverage Technology	3 (2-0-1)
	<p>Beverage: Introduction, Classification & scope, Beverage Industry in India, Manufacturing technology of different beverages.</p> <p>Alcoholic beverages concept of fermentation for production of beer, wine and distilled beverages including their packaging and maturation. Non-alcoholic beverages, carbonated and non-carbonated beverages. Preparation and preservation of unfermented fruit beverages, (RTS, squash, syrup, nectar, cordial)</p> <p>Practicals: Preparation of different beverages, preparation of syrup, sensory evaluation of beverages, Visit to Beverages industry.</p>		
7	FST-509	Sensory evaluation of food Products	3 (2-0-1)
	<p>Introduction, definition and importance of sensory evaluation in relation: to consumer acceptability and economic aspects; factors affecting food acceptance. Terminology related to sensory evaluation. Design and requirements of sensory evaluation laboratory. Basic principles: Senses and sensory perception and the way we perceive them, Physiology of sensory organs, Classification of tastes and odours, determination of threshold value. Factors affecting senses, visual, auditory, tactile and other responses. Introduction to sensory techniques. Fundamental rules for scoring and grading of food and food products. Procedure: Types of tests –overall difference tests, attribute difference tests, affective tests, Panel selection, screening and training of judges. Requirements of sensory evaluation, sampling procedures. Factors influencing sensory measurements. Guidelines for choice of techniques. Judging and grading of milk and milk products.. Judging and grading of food and food products –sensory evaluation of beverages, baking and confectionary products, meat and poultry products Consumer acceptance studies: Objectives. Methods, types or questionnaires, development of questionnaires, comparison of laboratory testing and Consumers studies, limitations. Interrelationship between sensory properties of food and dairy products and various instrumental and physicochemical tests. Preparation of food and dairy products with defects, techniques for simulation.</p>		
8	FST -605	Bakery, Confectionery and Snack Products	3 (2-0-1)
	<p>History, Traditional confectionary goods, Types of confectionary, classification. Basic Technical considerations, TS, TSS, pH, acidity, ERH, Sugar, Invert Sugar, Glucose syrup, RH, Crystallization. Raw Materials: Sugar, Sugar qualities, Physical, Chemical, Optical properties. Sugar grinding, Dextrose, Fructose, Lactose, caramel, maltose, Honey, sorbitol, xylitol, Iso malt, soy maltose, Polydextrose, Lactitol, Maltitol. Whipping, Release agent, thickeners, Acidulents, Flavours, for confectionery, emulsifiers and other additives, starch derivatives, colours used in confectionary. Production of glucose syrup, Acid hydrolysis, enzyme hydrolysis. Cocoa Processing: Cocoa bean, processing, roasting, Fermentation, Production of Cocoa butter Cocoa powder, its quality. Chocolate Processing: Ingredients,</p>		

Mixing, Refining, Conching, Tempering, Molding, Cooling, Coating, Fat bloom. High Boiled Sweets: Introduction, Composition, Properties of high boiled sweets, preparation of high boiled sweets, Traditional, batch and continuous Method of preparation. Different types of higher boiled sweets, Recipes. Caramel: Definition, Composition, Factors affecting quality of caramel, caramel Manufacture process, batch type, continuous types, checking of faults in caramel. Toffee: Definition, Composition, types of toffee Ingredient and their role. Batch and Continuous method of toffee. Fondant: Fudge/Creamy: ingredients, Methods, Productivity. Lozenges: Definition recipe, Method of Manufacture, Compositions, factors affecting quality, Industrial production, checklist of faults. Tablets: Definitions, recipe, composition, wet granulation, Slugging, Manufacture of Tablet, and Checklist of tablet faults. Marshmallow and. Nougat: Definition, composition, recipe, and method of manufacture. Nougat. Panning: Process, types of Panning, soft and hard panning. Quality of confectionery, Standards and regulations, Packaging requirements of confectionary, economics and marketing of confectionary goods. Bakery Products, Role of Bakery ingredients (major and minor), From Hard Wheat: Bread: Processes of bread making mainly straight and sponge, role of each ingredient, quality control. Testing of raw material. Testing of final product. Bread faults, staleness, ropyness. Baked Products from soft wheat: Cookies, crackers, Biscuits, Cakes: Types, ingredients, Process, Causes, remedy. Other bakery Products: Pizza, Pastry and its Types. Macaroni Products: Including spaghetti, Noodles, Vermicelli Process. Nutritional improvement of bakery Products. Setting of bakery Unit, Bakery norms. Specifications for raw materials. Packaging. Marketing of Products. Project report on bakery. Visit to wheat milling Industry. Visit to Bakery.

Practical: Classification of wheat based on physicochemical properties. Conditioning of wheat. Milling of wheat. Quality Testing of flour: Falling number and α amylase activity, Sedimentation value, Pelshenke value, Farinograph, Mixograph, Extensiograph, Alveograph. Manufacture of Bread, Types, Faults, remedies, shelf life bread, quality of bread Biscuits, cookies, crackers, buns: Types and quality. Other baked products Pastry, pizza. Extruded Products from wheat: Vermicelle, noodles etc. Physical properties of sugar. Production of invert sugar. Determination of Moisture in Sugar. Determination of Reducing Sugar

SEMESTER – VI

1	CSIT-501	Application of Information Technology	4 (2-1-1)
<p>UNIT – 1:</p> <p>Information and Processing Concepts: Definition of Information, Need of Information, Quality of Information, Value of Information, concept of Information, Entropy Category and Level of Information in Business Organization, Data Concepts and Data Processing, Data Representation.</p> <p>Information Representation: Information Contents, Introduction to Information Representation in Digital Media, Elementary Concepts in Information Perseverance. Data Compression – Huffman coding, LZW Coding. Text, Image Compression. Introduction to JPEG, MPEG, MHEG.</p> <p>UNIT – 2:</p> <p>Database Concepts: Definition of Database, Importance of Database, Overview of Database, Models, Schemas and Instances, DBMS architecture, Database languages, Relational Database. Database applications (MS ACCESS).</p> <p>UNIT – 3:</p> <p>Programming Language Classification & Program Methodology: Overview of Programming Languages, generations and programming techniques, Software Development Methodology, Life Cycles, Software Coding, Testing, Maintenance, Industry Standards. Introduction to ISO, SEI-CMM Standards for IT Industry.</p> <p>UNIT – 4:</p> <p>Data Communications and Computer Networks:Data Transmission, Need for Data Transmission over Distances, Types of Data Transmission, Media for Data Transmission. Computer Networks, Network Classification and Network Topologies.</p> <p>UNIT – 5:</p> <p>Internet: WWW, Gopher, FTP, Telnet, Web Browsers, Net Surfing, Search Engines, Email. Basic Concepts in E-Commerce, Electronic Payments, Digital Signatures, Network Security, Firewall. Web Technologies: introduction to HTML, DHTML, Java Script, ASP.</p> <p>IT Industry Trends, Careers and Applications in India: Scientific, Business, Educational and Entertainment applications. Industry Automation. Weather forecasting. Awareness of ongoing IT projects in India: NICNET ERNET. e-governance.</p> <p>Reference Texts:</p> <ol style="list-style-type: none"> 1. D.S. Yadav, “ Foundation of Information Technology”, New Age Publication 2. Raja Raman, V. “Introduction To Computers”. 3. Nelson, “Data Compression”, BPB. 4. Leon & Leon “Fundamental of Information Technology”, Vikas. 5. Cistems “Internet, An Introduction”, Tata McGraw Hill. 6. Elmasri & Navathe, “Fundamentals of Database systems”, PE <p>List of Practicals</p> <ol style="list-style-type: none"> 1. Working with MS ACCESS: <ul style="list-style-type: none"> ▪ Creating tables, relating tables, inserting, deleting and updating records of a table. ▪ Designing User Interface screens ▪ Generating reports 2. Creation of web pages using HTML <ul style="list-style-type: none"> ▪ Program to illustrate operation of tables. ▪ Ordered & unordered lists ▪ Working with frames 			

	<ul style="list-style-type: none"> ▪ Hyperlinks <ol style="list-style-type: none"> 3. Practicing with Web site designing tools like Microsoft FrontPage, Adobe's Dreamweaver. 4. Internet concepts: www, Internet surfing, live demo on websites, web Browser, file transfer Protocol. 5. Connecting remote machines using Telnet. 6. Working with search engines. 		
2	FST-510	Food Quality, Safety and Standards	3(2-0-1)
	<p>Food quality and its role in food industry; Definition of Food quality, Role of food quality in Food Industry. Quality attributes; Classification of quality attributes, Color and gloss: Definition, Different colors, color measurement by spectrophotometer, muncell color system, lovibond tintometer, role in food qualities. Role of viscosity and consistency in food quality. Size and shape: Production, role in Food industry Measurements: weight, volume, weightvolume ratio, length, width, diameter, symmetry, curvature, area. Defects: Classification, Genetic physiological defects Structural, off color, character, Entomological Defects: holes, Scars, lesions, off coloring, curled aves, pathological defects. Mechanical defects, Extraneous or foreign material defects. Measurement of defects: Improving visibility by dilution, white background, color differences, standardization of conditions, reference standards, counts and measures, isolation of defects by floatation, elution, electronic sorting, Internal defects. Flavour: Definition and its role in food quality, Taste, classification, taste qualities, relative intensity, reaction time, effect of disease, temperature, and taste medium on taste, basic tastes, interaction of tastes. Odour : definition, Classification, neutral mechanisms, Olfactory abnormalities, odor testing, techniques, thresholds, odor intensities, olfaction. Visual, Auditory, Tackle and other senses, Vision, audition, oral perception other than taste. Factors influencing sensory measurements: Attitudinal factors, motivation pscological errors in Judgment, relation between stimulus and perception adaptation. Correlation of sensory and instrumental analysis. Quality Measurements: Laboratory measurement: types of tests, panel selection and testing environment, serving procedures, instruction to judges, Difference tests, directional difference tests, classification of difference tests, two sample tests, three sample tests, multisampling tests, comparison of procedures, ranking, scoring, hedonic scaling, dilution procedures, descriptive sensory analysis, contour method, other procedures, Consumer measurement: Factors influencing acceptance and preference, objectives of consumer preference studies, information obtained from consumer study, factors influencing results from consumer surveys, Methods of approach, development of the questionnaire, types of questionnaires, serving procedures. Comparison of laboratory panels with consumer panels. Limitations of consumer survey. Quality of raw materials: Physical, Chemical and microbial quality. Quality of products during processing & after processing color, taste, texture, flavour, appearance. Factors influencing the Food qualities: Soil, field practices, harvesting practices, procedures, packaging, transportation, storage, conditions, processing conditions, packaging and storage conditions of finished products. Recording and reporting of quality.</p>		
3	FST-511	Food Industry Byproducts & Waste Utilization	4(3-0-1)
	<p>Industrial Byproducts and Waste: Potentials and prospects of developing byproducts industry in India. Agricultural waste and agro based industrial waste management. By products of cereals. By products of legumes. By products of oil seeds. By products of dairy. By products of fruit and vegetables processing industries. By products of meat, poultry and eggs. By products of fish processing units. By products of plantation crops and spices. Uses of by-products of agro based industries in various sector. Byproducts of fermentation industries. By products of sugar and bakery industries.</p>		

	Practical: Extraction of banana fiber. Extraction of leaf proteins. Alcohol production from molasses. Use of crop residues for the production of cellulose. Use of mango kernels for starch manufacture. Pectins from organic waste. Extraction of volatile oils from organic waste.		
4	ENVS-417	Environmental Studies	3 (3-0-0)
	<p>1. Definition, Scope and Importance of Environment and Environmental Studies Multidisciplinary Nature of Environmental Studies.</p> <p>2. Eco-system Concept, structure and function of an ecosystem(Producers, consumers and decomposes) Introduction, types, characteristics features, structures and function of the following ecosystem: (a) Forest Ecosystem (b) Grassland Ecosystem (c) Desert Ecosystem (d)Aquatic Ecosystem (Ponds, streams, lakes, rivers, oceans, estuaries)</p> <p>3. Social Issues and the Environment Water conservation, rain water harvesting, Water shed Management, Climate Change, global warming, acid rain, ozone layer depletion, wasteland reclamation Environment Protection Acts</p> <p>4. Natural Resources Forest resources (b) Water Resources (c) Mineral Resources (d) Food Resources (e) Energy Resources (f) Land resources, Role of and individual in conversation of natural resources for sustainable life style.</p> <p>5. Biodiversity and its conservation Introduction- Definition: genetic, species and ecosystem diversity, bio-geographical classification of India, vale of diversity: consumptive use, productive use, social and ethical aesthetic values, Bio-diversity at global, national and local levels, India as mega-diversity nation, Hot-spots of biodiversity, conservation of biodiversity:in-situ and ex-city conversation of bio-diversity.</p> <p>6. Environmental pollution Definition, causes, effects and controlling measures of Air pollution (b) Water pollution (c) Pollution (d) Noise pollution Solid waste Management: causes, effect and control measures of urban and industrial wastes</p>		
5	FST-604	Extrusion Technology	3 (2-0-1)
	<p>Food proteins; Types, sources, Availability, need, properties etc. Food problems, Role, Means for increasing food supply. Amino acid fortification of foods ; Cereals, infant foods, bread, baked products. Legumes and oilseed foods ; Isolate, concentrate, and substitute to milk, variation in composition and nutritive value. Meat Analog; Commercial development, nutritional aspect, marketing aspect. New protein foods; TOFU, Miso, Texturized vegetable protein, hydrolyzed vegetable protein, formulation and quality control. Extrusion Technology; Importance, principles of extrusion cooking, methods of extrusion cooking. Extruders; Types of extruders, single screw, twin screw their applications, effect of dependent and independent variables on the product quality. Extruded products; Raw materials, process of manufacture, properties, quality, evaluation, packaging requirement, marketing.</p>		

	Practical: Physicochemical properties, functional properties of proteins, protein rich products, weaning foods, beverages, Texturized Products, Protein rich bakery products, Type of food extruders, preparation of extruded products, Factors affecting extrusion cooking, Moisture content, Diameter, Temperature, Pressure, screw speed, time, quality evaluation of these products.		
6	FST-403	Industrial Microbiology and Fermented Foods	4(3-0-1)
	<ol style="list-style-type: none"> 1. Industrial Microbiology: Definition & Scope, Historical developments, the range, components and types of fermentation (i.e. submerged, surface and solid state); criteria for selection of industrially important microorganisms; preservation and improvement of industrially important micro-organisms using metabolic engineering/genetic engineering; media for industrial process; upstream and downstream processing. 2. Types of fermenters: Fermenters: types (batch, fed batch and continuous), functions, design and control; sterilization; growth rate analysis, estimation of biomass; difference in chemostat and turbidostat. 3. Microbial production of industrial products: Immobilization of enzymes/cells; Microorganisms and processes involved in the production of single cell protein and industrial alcohol, beer and wine; organic acids (citric and lactic), enzymes (protease, lipase and rennet), vitamin (B₁₂), antibiotics and bacteriocins; and fermented whey beverages. 4. Fermented Food Products: Food fermentation, stock culture and inoculum preparation. Lactic acid fermentation, Alcoholic fermentation of fruit juices, sugar and starch substrates. Vinegar, mixed fermentation of cereal legumes and milk. Malting, brewing, steeping, germination, kilning and curing. Chemical and biochemical changes during malting and mashing. Separation of wort, wort boiling and hops addition. Fermentation, separation, maturation, carbonation and packaging. <p>Practicals:</p> <ol style="list-style-type: none"> Lactic acid fermentation of milk. Alcoholic fermentation of fruit juices. Acetic acid fermentation and alkaline fermentation. Barley steeping. Germination, malting mashing and brewing; Preparation of wine and distillation of wine. Production of lactic acid from whey. Production of nisin and assaying the antimicrobial activity of the culture. Design and control of a table-top and 10 liter lab fermenter (Demonstration). Production of ethyl alcohol from molasses and whey by yeasts. Production of fermented whey beverages. Educational tour to food processing/ fermentation industries. 		
7	FST -512	Product Development and Formulation of Foods	3 (2-0-1)
	Need, importance and objectives of formulation for new product development. Ideas, business philosophy and strategy of new product. Formulation based on sources availability and cost competitiveness for concept developments of new products. Standardization of various formulation and product design. Adaptable technology and sustainable technology for standardized formulation for process development. Process control parameters and scaleup, production trials for new product development at lab and		

	<p>pilot scale. Quality assessment of new developed products. Market testing and marketing plan. Costing and economic evaluation. Commercialization / product launch.</p> <p>Practical: Market survey of existing various products. Formulation of new products based on corporate decision; Proteinenergy rich, Low calorie (fat replacer), Low sodium content, Glycemic index based, Cholestrolemic index based, Phytochemical based. Product development based on above formulation depending on local sources/ technology. Quality assessment. New product development for; Infant / weaning foods, Geriatric, Physiological status, Athletes.</p>
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SEMESTER VII

1	BAM-502	Entrepreneurship Development and Communication Skills	3 (2-0-1)
<p>Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalisation and the emerging business / entrepreneurial environment. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to horticulture sector. Venture capital. Contract farming and joint ventures, public private partnerships. Overview of food industry inputs. Characteristics of Indian food processing industries and export. Social Responsibility of Business. Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.</p> <p>Practical: Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations.</p>			
2	FST-511	Quality Assurance and Certification	3 (2-0-1)
<p>Quality inspection, quality control, quality management and Quality Assurance. Total quality management; Good Manufacturing Practices, Good Agricultural Practices, Good Laboratory Practices, Quality Management systems QSS. Quality Circles, SQC., ISO System. HACCP, Principles, Implementation. Plan Documentation, types of records. Auditing, Surveillance; Audit, Mock audit, third party quality certifying audit, Auditors and Lead auditors. Certification, Certification procedures, Certifying bodies, Accrediting bodies, International bodies.</p> <p>Practical: Quality Assurance procedure. T&M, GMP, GAP documentation. Preparation Quality Policy & documentation (Quality Manuals). Preparation of Laboratory manuals. Application of HACCP to Products. Preparation of documentation and records. Auditing Surveillance, Mock audit. Visit to units implementing GMP, GAP. Visit to units with ISO systems. Visit to units with HACCP certification.</p>			
3	FST-516	Food Plant Design and Layout	3 (2-0-1)
<p>Overall design of an Enterprise: Plant design, sales planning for plant design. Plant Location, levels of Plant location. Location of layout : location factors, plant site selection. Location theory and models, industrial buildings and grounds. Classification of Dairy and Food Plants, farm level collection and Chilling center. Space requirement. Preparation of a Plant Layout : Plant Layout problem, importance, objectives, classical types of layouts. Evaluation of Plant</p>			

	<p>Layout. Advantages of good layout. Organizing for Plant Layout, Data forms. Development and Presentation of Layout: Development of the pilot layout, constructing the detailed layout: Functional design: Siting of different sections in a plant, Layout installations. Quantitative analysis for Plant Layout: Engineering economy. Linear programming. Queing theory. Common Problems in Plant Layout and Process scheduling. Siting of Process sections, Equipment selection and capacity determination, Arrangement of process, and service equipment. Estimation of Services and Utilities. Office layout, line balancing, Flexibility. Practical Layouts. Common materials of construction of Food plant, building. Maintenance of Food Plant Building, Illumination and ventilation, Cleaning & sanitization, painting and colour coding, Fly and insect control.</p> <p>Practical: Preparation of project report. Preparation of feasibility report. Layout of Food storage wares and godowns. Layout and design of cold storage. Layout of preprocessing house. Layout of Milk and Milk product plants. Low shelf life product plant. Bakery and related product plant. Fruits processing plants. Vegetable processing plants. Layout of multi product and composite food Plants Evaluation of given layout. Waste treatment and management of food plant.</p>		
4	FST-501	Food Plant Sanitation	3 (2-0-1)
	<p>Good manufacturing practices, current good manufacturing practices; Standard operating procedures, good laboratory practices, sanitation; Sanitation and the food industry: Sanitation, sanitation laws and regulations and guidelines, establishment of sanitary, potential risks of food borne bioterrorism, bioterrorism protection measures, role of pest management in bio-security; Relationship of microorganisms to sanitation, allergens, allergen control; Food contamination, protection against contamination; Personal hygiene and sanitary food handling: Role of HACCP in sanitation, quality assurance for sanitation cleaning compounds, handling and storage precautions; Sanitizers, sanitizing methods, sanitation equipment, waste product handling, solid waste disposal, liquid waste disposal; Pest control: Insect infestation, cockroaches, insect destruction, rodents, birds, use of pesticides, integrated pest management; Sanitary design and construction for food processing: Site selection, site preparation, building construction considerations, processing and design considerations, pest control design; Low-moisture food manufacturing and storage sanitation: Sanitary construction considerations, receipt and storage of raw materials, cleaning of low-moisture food manufacturing plants; Dairy processing plant sanitation: Role of pathogens, sanitary construction considerations, soil characteristics in dairy plants, sanitation principles, cleaning equipment; Meat and poultry plant sanitation: Role of sanitation, sanitation principles, cleaning compounds for meat and poultry plants, sanitizers for meat and poultry plants, sanitation practices, sanitation procedures; Sea food plant sanitation: Sanitary construction considerations, contamination sources, sanitation principles, recovery of by-products; Fruit and vegetable processing plant sanitation: Contamination sources, sanitary construction considerations, cleaning considerations, cleaning of processing plants, cleaners and sanitizers, cleaning procedures, evaluation of sanitation effectiveness; Beverage plant sanitation: Mycology of beverage manufacture, sanitation principles, non-alcoholic beverage plant sanitation, brewery sanitation, winery sanitation, distillery sanitation;</p>		

	Practical: Estimation of BOD (Biological Oxygen Demand); Estimation of COD (Chemical Oxygen Demand); Determination of hardness of water; Good Manufacturing Practices (GMPs) and personal hygiene; Sewage treatment: Primary, secondary, tertiary and quaternary; Aerobic and anaerobic sludge treatment; Lab demonstration on state of water; Study of CIP plant; Isolation and identification of Actinomycetes; Enrichment and isolation of cellulose degrading bacteria; Biodegradation of phenol compounds; Bacteriological examination of water: Coliform MPN test; Sampling of airborne microorganisms; Sampling of surfaces - equipment and physical plant; Aerosol sampling and measurement guidelines.		
5	FST-695	Student READY-Experiential Learning Programme- I	7(0-0-7)
6	FST-696	Student READY-Experiential Learning Programme- II	7(0-0-7)
7	FST-697	Student READY-Research Projects	3(0-0-3)
8	FST-517	Seminar	1(0-0-1)

Semester-VIII

1	FST-698	Inplant Training	20
2	FST-699	Training Report Evaluation	5