M. Tech in Food Technology (**Food Safety & Standards**)

Basic Supporting Courses:

	Course Code	Course Title	L	T	P	Credit
1.	COMP 805	Computer Programming	2	0	1	3
2.	MAS 713	Advanced Engg. Statistics	3	0	0	3
3.	APFE 705	Optimization Techniques in Food Technology	3	0	0	3
4.	CHEM 717	Advanced Food Chemistry	2	0	1	3

Core Courses:

	Course Code	Course Title	L	T	P	Credit
1.	APFE 706	International Food Legislations & Standards	2	0	0	2
2.	APFE 707	Food Quality Control	2	0	1	3
3.	APFE 708	Meat & Marine Technology	2	0	1	3
4.	APFE 802	Modern Fruits & Vegetables Processing Techniques	2	0	1	3
5.	APFE 803	Advanced Food Packaging	2	0	0	2
6.	APFE 811	Advanced Beverage Technology	3	0	0	3
7.	APFE 823	Modern Baking & Confectionary Technology	2	0	1	3
8.	DT 820	Processing of Milk & Milk Products	2	0	1	3
9.	MBMT811	Food Microbiology	2	0	2	4

E. Food Safety & Standards:

Course Title	L	T	P	Credit
Sensory & Consumer Science	2	0	0	2
Risk Analysis in Food Safety	2	0	0	2
Hygienic Design of Food Processing Equipment	2	0	0	2
Food & Nutritional Security	2	0	0	2
Control of Food Borne Micro-organism	2	0	1	3
Hazard Analysis Critical Control Point Planning and Implementation	3	0	0	3
Food Safety Assessment	2	0	1	3

Basic Supporting Courses:

COMP 805 Computer Programming 3(2-0-1)

Algorithms & Flow Charts, C. Programming, Preliminaries, Constant & Variables, Arithmetic Expressions Input-Output Statements, Control Statements, Do-Statements, Subscripted Variables, Elementary Format Specifications, Logical Statement & Decision Tables, Functions & Subroutines, Arrays & structure, Computer Oriented Numerical Methods, Solution of Non Linear Equation. Bisection Method, Newton Method, Numerical Integration, Trapezoidal Method, Simpson's 1/3 & 3/8 rule, Curve Fitting, Construction of forward, backward, backward difference table, Interpolation, Application of Statistical packages.

MAS 713 Advanced Engineering Statistics 3(3-0-0)

Sample size, data collection, design of experiments, LSD, RBD, split plot design, factorial design, CRD, CCRD, testing of hypothesis, Analysis of variance, t-test, z-test, f-test, X^2-test.

APFE 705 Optimization Techniques in Food Technology 3 (3-0-0)

Principles of modelling; Linear programming-concepts, graphical and algebraic solution; Simplex method; Duality theory; Post-optimality analysis; Sensitivity analysis; Transportation and assignment models; Computer applications to LP, queuing theory; Project scheduling and management by PERT-CPM; Integer programming; Non-linear programming; Simulation; Goal programming; Decision theory; Markov chains; Sequencing problem.

CHEM 717 Advanced Food Chemistry 3(2-0-1)

Water:- Water binding and chemical mediated water.Food protein: Classification, physico-chemical properties. Reactions involved in processing. Reactions with alkali. Enzyme catalyzed reactions involving hydrolysis and proteolysis. . theories of formation of texturiesed proteins.

Lipids :- Reactions involved during deep frying of foods viz., autoxidantion of saturated acyl lipids and polymerization. Lipopotein and membrane; definition, classification and involvement in the formation of biological membrane. Unsaponsifiable matter contents in various fats and oils. Edible oil classification and chemical composition.

Carbohydrates:- Legumes jam and jellies polysaccharide. Viz., liner, branched and modified. Properties and utilization of common polysaccharides, viz. Cellulose, glycogen, hemicellulose and pectin. Enzymatic degradation of polysaccharides, viz. agar, alginate, carrageenam, gums and starch. Production of dextrans and malto dextran.

Food Enzymes:- Hydrolases and lipases, utilization in food industry, effect of inhibitors, pH and temperature.

Minerals in food :- Main elements, trace elements in eggs, cereal and cereal products vegetables and fruits.

Aroma compounds in foods:- Threshold value, off flavours.

Food additives:- Vitamins, amino acids, minerals, Aroma substance flavour enhancers-monsodium glutamate, 5-nucleotides. Sugar substitutes, sorbital. Sweeteners-saccharin, cyclamate. Food colour. Anti-nutritional factors and food contaminant: Toxic-trace elements, radio nuclides.

Cereals and cereal products:- Individual constituents, like proteins, lipids carbohydrates and vitamins in cereals flour and their relationship in dough making. Types of flours, bread making and non-bread making chemical composition influence of additives/minor ingredients on baking properties.

Legumes:-Classification composition and physio-chemical properties.

Vegetables and fruit: Classification general composition, chemical changes during ripening and storage. Jams, jellies and pickles: Classification, composition and preservation.
Beverages: Classification, coffee, tea and cocoa-gradation, composition, chemical changes during processing, volatile compounds. Preservation of foods: General principles of food preservation, chemical preservation, preservation through irradiation.

Core Courses

APFE 706 International food Legislation & Standards 2 (2-0-0)
Concepts and trends in food legislation. International and federal standards: Codex alimentarious, ISO series, food safety in USA. Legislation in Europe: Directives of the official journal of the EU, council regulations, food legislation in UK. Regulating methods for food analysis, case studies. Enforcers of Food Laws Approval Process for Food Additives Nutritional Labeling.

APFE 707 Food Quality Control 3(2-0-1)
Quality factos: appearance, texture and flavor, Apperance factors – size and shape, colour ad gloss, consistency. Textural Factors – measuring texture, texture changes. Flavour Factors – influence of colour and texture on flavor. Taste Panels. Food – related azards – biological hazards, chemical hazards, physical hazards, trace chemicals. Microbiological considerations in food safety. Food additives – preservatives, atioxidats, sequestrants, surface active agents, stabilizers and thickeners, bleaching and maturing agents, starch modifies, buffers, acids, alkalis, food colours, artificial sweteners, nutritional additives, flavouring agents. Food laws: Federal Food Drug and Cosmetic Act (1938), Good Manufacturing Practices (Code of GMP), Fair Packaging and Labeling Act (1966), Federal Meat Inspection Act (1906), International Food, Standards and Codex Alimentarius, HACCP and ISO 9000 series.

APFE 708 Meat & Marine Technology 3(2-0-1)
Sources of meat and meat products in India, its importance in national economy. Chemical composition and microscopic structure of meat. Effect of feed, breed and management on meat production and quality. Slaughtering of animals and poultry, inspection and grading of meat. Factors affecting post-mortem changes, properties and shelf-life of meat. Meat quality evaluation. Mechanical deboning, meat tenderization. Aging, pickling and smoking of meat. Meat plant sanitation and safety, Byproduct
utilization. Recent trends in meat processing. Structure, composition, nutritive value and functional properties of eggs and its preservation by different methods. Factor affecting egg quality and measures of egg quality. Types offish, composition, structure, post-mortem changes in fish. Handling of fresh water fish. Canning, smoking, freezing and dehydration of fish. Fish sausage and home making. MMPO, MFPO, radiation processing meat safety.
Practical: Slaughtering and dressing of meat animals, Study of post-mortem changes, Meat cutting and handling, Evaluation of meat quality. Experiments in dehydration, freezing, canning, curing, smoking and pickling offish and meat, Shelf-life studies on processed meat products, Evaluation of quality and grading of eggs, Preservation of shell eggs, Estimation of meat: bone ratios, Preparation of meat products, canned, dehydrated, barbecued sausages, loaves, burger, fish finger.

APFE 802 Modern Fruits and Vegetables Processing Techniques 3(2-0-1)
Principles and methods of fruit and vegetable preservation. Composition and related quality factors for processing. Principles of storage of fruits and vegetables. Types of storate: natural, ventilated low temperature storate, DA and MA storages. Preservation of fruits and vegetables by

heat, chemicals, sugar, salt, fermentation, drying etc. Canning of fruits and vegetables, tin cans, glass containers seaming technology, aseptic canning technology. Fruit and vegetable juices, preparation of syrups, cordials and nectars, juice concentrates, pectin and related compounds, jams, jellies, marmalades, preserves. Theory of gel formation, quality control, pickles, chutneys and vinegar production, tomato products. Drying and dehydration of fruits and vegetables, problems related to storage of dehydrated products. Freezing and freeze-drying of food and frozen products, Fruit product order and quality control.

Practicals: Equipment for fruits and vegetable processing, plant-layout, can seaming operation, preparation of fruit juices, squashes, syrups and ready-to-serve beverages. Canning of fruits and vegetables. Preparation of jams, jellies, marmalade, preserves, and candies. Preparation of pickles, chutneys, and tomato products, Drying of fruits and vegetables, quality control of processed products. Visit to fruit and vegetables processing factories, freezing of foods, Processing of mushroom.

APFE 803 Advanced Food Packaging 2(2-0-0)

Introduction to principals of Food Packaging, Types of packaging , Special packaging methods (vacuum, gas and shrink packaging), Function of a package, packaging materials, their structural qualities and performance including moisture and gas transmission, interaction of food and the packaging material, methods of package testing, performance evaluation and design of packaging systems for plant and animals products. Food packaging and law, shelf life testing, modern and traditional packaging material, physical and chemical properties, production, storage and recycling of packaging materials, regulation and equipment analysis of various existing packaging system and standards.

APFE 811 Advanced Beverage Technology 3(3-0-0)

Introduction: classification, production and consumption f beverages. 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. Raw materials, equipment, quality control and legislation of beverage products. Mini-projects on traditional production of beverages.

APFE 823 Modern Baking & Confectionary Technology 3(2-0-1)

Introduction: Status of bakery and confectionery industries in India- Raw materials for bakery and confectionery products-Essential and optional. PFA Specification of raw materials. Bakery products technology: Dough rheology – Bread making- methods-process- specification for various types of breads- Biscuit manufacturing process-Cookies- Crackers- Cakes- Buns- preservation of bakery products. Bakery machinery and equipment: Weighing Equipment- Manual scale, Automatic weigh, liquid measuring. Mixing- blenders, Horizontal and vertical planetary, continuous. Make up equipment-Divider, Rounder, Proofer, moulder. Baking equipment – different oven, slicer.

Confectionery products: chocolate, fondant, caramels, fudge and toffee. Equipment and process. Safety and sanitation: Health and safety- safety rules- safe practices in the work places- sanitation-duties of the sanitation equipments- Code for hygiene condition in bakery and biscuit manufacturing unit.

DT 820 Processing of Milk and Milk Products 3(2-0-1)

Sources, and composition of milk, processing of market milk, standardization, toning of milk, homogenization, pasteurization, sterilization, storage, transportation and distribution of milk. Milk product processing-cream, butter, , condensed milk, evaporated milk, whole and skimmed milk powder. Instantization of milk and milk products, ice cream, khoa, channa, paneer, milk sweets. Judging and grading of milk and its products. Fermented milk products. cheese, cheese spread, Youghurt, dahi shrikhand and similar products. Dairy equipments and sanitization.

MBMT 811 Food Microbiology 4(2-0-2)

History of microbiology of food. Microbial growth pattern, physical and chemical factors influencing destruction of micro-organisms. Types of micro-organism normally associated with food-mold, yeast, and bacteria. Micro-organisms in natural food products and their control. Contaminants of foods-stuffs, vegetables, cereals, pulses, oilseeds, milk and meat during handling and processing. Biochemical changes caused by micro-organisms, deterioration of various types of food product. Food poisoning and microbial toxins, microbial food fermentation, standards for different foods. Food borne intoxicants and mycotoxins.

Practicals : Microscopy and micrometry. Preparation of nutrient media, sterilization and inoculation techniques, Isolation of pure culture, microbial examination of natural food products, identification of food pathogen in water, milk, cereals, pulses, oilseeds, meat and poultry. Microbial production of alcohol (cereal based), acetic acid and lactic acid.

Specialized Courses

APFE 831 Sensory and Consumer Science 2(2-0-0)

Introduction to Sensory Science and Consumer Evaluation, Panel Selection, Training and Performance Monitoring, Bias in Sensory Analysis, Food Flavours & texture profile analysis, Methods of Sensory Analysis, Measurement of Colour by sensory and instrumental methods, Flexible Packaging Materials – Special Reference to their Odour Permeability, Statistical Analysis of Sensory Data & Multivariate analysis Taints and Off-FlavoursBasic Tests, Basic taste identification, Odour, Identification of Few Common Flavour Compounds, Colour identification, Finger feel test for texture, Threshold test: (a) sweet (b)sour, Paired Comparison / Test / Data Analysis, Ranking test, Quantitative Descriptive Analysis, Hedonic Test (Consumer research), Data Analysis-Nose & E-Tongue Demonstration, Consumer's choice towards newly developed food products like GM foods.

APFE 833 Risk Analysis in Food Safety 2 (2-0-0)

Risk analysis definitions, Context of definitions, Definitions of risk analysis terms related to food safety, current practices in the codex alimentarius commission and related expert committees ,Food additives, Chemical contaminants, Pesticide residues, Veterinary drug residues, Biological agents, Other Codex Committees, risk assessment of chemical agents in food ; Introduction, Hazard identification, Epidemiological studies, Animal studies, Hazard characterization, Dose-

response extrapolation, Dose-scaling, Genotoxic and non-genotoxic carcinogens, Threshold approaches, Non-threshold approaches, Exposure assessment, Risk characterization, risk assessment of biological agents in food : Introduction, Risk assessment of biological hazards, Risk assessment of bacterial hazards, Hazard identification, Hazard characterization, Exposure assessment, Risk characterization, uncertainty and variability in the risk assessment process : introduction, Uncertainty versus variability, Model uncertainty versus input (parameter) uncertainty, Nature of models, Methods for addressing model uncertainty, Methods for representing and propagating input variance, Uncertainty and variability in hazard identification.

APFE 834 Hygienic Design of Food Process Equipment 2 (2-0-0)

Microbiologically safe continuous pasteurisation of liquid foods, method for assessing the in-place cleanability of food processing equipment. Microbiologically safe aseptic packing of food products, method for the assessment of in-line pasteurisation of food processing equipment, method for the assessment of in-line sterilisability of food processing equipment, microbiologically safe continuous flow thermal sterilisation of liquid foods. Method for the assessment of bacteria-tightness of food processing equipment. Hygienic equipment design criteria, Welding stainless steel to meet hygienic requirements, Hygienic design of closed equipment for the processing of liquid food, Hygienic design of equipment for open processing, method for the assessment of in-place cleanability of moderately sized food processing equipment. Hygienic pipe couplings, Hygienic design of pumps, homogenisers and dampening devices, Passivation of stainless steel, method for assessing the bacterial impermeability of hydrophobic membrane filters. Hygienic design and safe use of double-seat mixproof valves, Challenge tests for the evaluation of the hygienic characteristics of packing machines, General hygienic design criteria for the safe processing of dry particulate materials, Production and use of food -grade lubricant s, prevention and control of *Legionella* spp (incl Legionnaires Disease) in Food Factories, Design of Mechanical Seals for hygienic and aseptic applications,
Hygienic Engineering of Plants for the Processing of Dry Particulate Materials, Safe Storage and Distribution of Water in Food Factories, Safe and hygienic water treatment in food factories, Packing systems for solid foodstuffs, Air Handling in the Food Industry, Hygienic Engineering of fluid bed and spray dryer plants, Materials of construction for equipment in contact with food, Hygienic Engineering of Discharging Systems for Dry Particulate Materials, Integration of Hygienic and Aseptic systems.

APFE 843 Food & Nutritional Security 2(2-0-0)

The history of food and hunger, and the global nature of our food systems focusing on the impact of our food decisions on the environment, agricultural production, world population relative to food supply, hunger, biotechnology, and safety of our food supply. Definition of food security and insecurity; World food supply; World food demand; Globalisation and impact on food security; Agricultural and rural development as key to food security; Food and Nutrition security and infections (including HIV); Food and Nutrition security in emergencies; Ethical considerations regarding food security; Care and Food Security; Millenium Development Goals and food security.

APFE 844 Control of Food Borne Microorganism 3(2-0-1)

Foodborne Pathogens: Host Invasion; Pathogenesis; Molecular approaches for detection, identification, typing and analysis of foodborne pathogens; Biosensor –based detection of foodborne pathogens. Staphylococcal Gastroenteritis: Incidence in Foods, Staphylococcal Enterotoxins: Types and Incidence, The Gastroenteritis Syndrome, Prevention of Staphylococcal and other Food-Poisoning Syndromes Botulism: Analysis of Dairy Products for *C. botulinum* and Botulinal Toxin, Clinical Manifestations, Outbreaks, Prevention; *Bacillus Cereus* food poisoning: Analysis of Food Products for *B. cereus* and Toxin, clinical manifestation, outbreaks, prevention. V Brucellosis: Clinical Manifestations, Outbreaks, Prevention; Foodborne Listeriosis, Clinical Manifestations, Thermal Properties, Virulence

Properties, Animal Models and Infectious Dose, Listeriosis Syndromes, Prevention. Salmonellosis: Isolation and Detection Methods, Clinical Manifestations, Outbreaks, Prevention. Foodborne Gastroenteritis Caused by *Escherichia coli*, Enteropathogenic *E. coli*, Enterohemorrhagic *E. coli* O157:H7, Clinical Manifestations, Outbreaks, Prevention. Campylobacteriosis: Isolation and Identification, Clinical manifestations, Outbreaks, Prevention. Yersiniosis: Isolation and Identification, Clinical manifestations, Outbreaks, Prevention.

APFE 845 Hazard Analysis Critical Control Point planning and Implementation 3 (3-0-0)

INTRODUCTION ,FAO/WHO guidance document Objectives Scope Target audience The HACCP system The food safety burden Codex guidelines on HACCP Role of government and potential benefits Role of food businesses and potential benefits Exploring approaches for HACCP in SLDBs Interdependency between HACCP systems and good hygienic practices, Basic hygiene Staff-related challenges Awareness and expertise Education and training Technical support Human resources Psychological factors Challenges due to inadequate supporting environment Financial issues Government infrastructure and commitment Legal requirements Business awareness and attitude of industry and trade associations Customer awareness Communication development of a haccp strategy for sldbs within a national food safety policy Development of strategy for HACCP implementation Gather information Define barriers and identify causes Develop and select possible solutions Conduct assessment of potential impact of strategy Modify and publish strategy Implement strategy Review and revise Criteria for measuring success of strategy HACCP implementation Indicators of successful HACCP implementation strategic activities to facilitate haccp implementation in sldbs Support activities Provision of financial support Provision of guidance and explanatory information Mandatory provisions and enforcement HACCP certification Provision of technical expertise by consultants and other advisors HACCP-based approaches Codes and standards documents Generic HACCP-based plans Evolving HACCP-based methodologies .

APFE 846 Food Safety Assessment 3(2-0-1)

The importance of food safety, Food safety management procedures,The principal causes of food borne illness,The principal symptoms of food borne illness,How food borne illness affects consumers and retailers,,How poor safety practices affect food products,Food

safety procedures in retail stores, Preventing food borne illness, Food hazards, The four c's, Record keeping, Due diligence, Reporting procedures, Legal responsibilities, The food business, the responsibilites of the managers, Penalties applicable to poor food handlers, Enforcement officers, Enforcement powers, The importance of personal hygiene, The principal food safety hazards on the human body, Basic rules regarding personal hygiene, Appropriate protective clothing, When to change protective clothing, Effective personal hygiene practices Good Manufacturing Practice. Metal contaminants- Sources of health hazard of metallic contaminants – Assessment of food safety – General and acute toxicity – Mutagenicity and carcinogenicity. Additives (Intention – direct) – Preservatives – antioxidants, sweeteners, flavors, colours, vitamins, stabilizers – indirect additives – organic resides – inorganic residues and contaminants. Food allergy, food intolerance, contaminants of processed foods, solvent residue, contaminants of smoked foods. Cleaner production is food industry-fruit and vegetable processing, sea food processing, brewing and wine processing..