

## M. Tech in Food Technology (Food Quality Management)

### Basic Supporting Courses:

	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
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:

	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
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

### C. Food Quality Management :

	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
	APFE 826	Food Production Technology	3	0	0	3
	APFE 830	International Economics & Policies	3	0	0	3
	APFE 831	Sensory & Consumer Science	2	0	0	2
	APFE 832	Food Process Synthesis, Optimization & Product Quality	3	0	0	3
	APFE 833	Risk Analysis in Food Safety	2	0	0	2
	APFE 834	Hygienic Design of Food Process Equipment	2	0	0	2
	APFE 835	Physical & Chemical Changes in Food Quality	2	0	1	3
	APFE 875	Quality Management	3	0	0	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,  $\chi^2$ -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 texturised proteins.

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

Carbohydrates:- Legumes, jam and jellies, polysaccharide. Viz., linear, branched and modified. Properties and utilization of common polysaccharides, viz. Cellulose, glycogen, hemicellulose and pectin. Enzymatic degradation of polysaccharides, viz. agar, alginate, carrageenan, 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-sodium glutamate, 5-nucleotides. Sugar substitutes, sorbitol. 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 physico-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 alimentarius, 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 factors: appearance, texture and flavor, Appearance factors – size and shape, colour and gloss, consistency. Textural Factors – measuring texture, texture changes. Flavour Factors – influence of colour and texture on flavor. Taste Panels. Food – related hazards – biological hazards, chemical hazards, physical hazards, trace chemicals. Microbiological considerations in food safety. Food additives – preservatives, antioxidants, sequestrants, surface active agents, stabilizers and thickeners, bleaching and maturing agents, starch modifiers, buffers, acids, alkalis, food colours, artificial sweeteners, 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 of fish, 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 of fish 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 storage: natural, ventilated low temperature storage, 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 of 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 826 Food Production Technology****3(3-0-0)**

Fundamentals of Operational Procedures in Food production, Management Procedures and Recordkeeping, Food Service Sanitation, Purchasing and Storage, Bakery Production and Management, Catering Management, Menu Planning and Cost Control, Nutrition, Food Service Management, Food Production and Management Technology.

**APFE 830 International Economics and Policies****3(3-0-0)**

Introduction , Ricardian Model and the Theory of Comparative Advantage , Heckscher-Ohlin Model of International Trade International Factor Movements Trade Theories in Action, Trade Barriers, Commercial Policy and Economic Integration, The Instruments of Trade Policy, The Objectives of Trade Policy . Quotas ,Strategic Trade Policy ,Antidumping Policies ,World Trade Organization International Economic Integration.

**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-

Flavours Basic 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 832 Food Process Synthesis, Optimization & Product Quality 3(3-0-0)**

Introduction, Process synthesis and Process Analysis, Process plant Simulation, Mathematical Models of food process Engineering Systems with example Numerical Methods, Modular Approaches & Equation Solving, Approaches, Decomposition of Networks, Algorithms, simulation software's like HysysPlant and Mathematical tools like MATLAB and Poly Math. Optimization: Objective function and its properties; Optimization of one dimensional unconstrained function: Analytical methods, Region elimination methods. Newton, quasi-Newton and secant methods; Polynomial approximation methods; Unconstrained multivariable optimization: Direct and indirect methods; Linear programming and applications; Introduction to dynamic programming.

**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 835 Physical & Chemical Changes in Food Quality 2 (2-0-0)**

Thermodynamic stability of foods (phase equilibria, chemical equilibria). Kinetic description of changes in foods with special attention to studies of stability and quality changes. Specific physical and chemical processes (lipid and protein oxidation, Maillard reactions, crystallizations, collapses, migration of water). Control of physical and chemical changes in foods (freezing, antioxidants and pro-oxidants, packaging). The use of chemical and physical principles for the description of changes in foods will throughout the course be illustrated by real examples. Theoretical and practical experience with several experimental methods for characterization and studying the physical and chemical stability of foods.

**APFE 875 Quality Management 3(3-0-0)**

Quality concept, Service quality; quality planning, control and improvement; quality gurus, ISO 9000 standards, Malcolm baldrige award; quality and financial performance, quality failure, Design of quality control system, Process quality control, attribute control, variables control, control charts, continuous improvement, six sigma, lean and six sigma, quality control and improvement in industry.