National institute of Food Technology,
Entrepreneurship and Management, Thanjavur (NIFTEM-T)

Syllabus for
MTech Entrance Examination- 2025

MTech (Food Technology) in Food Process Engineering; Food Process Technology; and Food Safety and Quality Assurance

Unit 1: Basics of Food Preservation and Processing

Methods of food preservation: Drying, Dehydration, Pasteurization, Sterilization, Freezing, Freeze drying, Spray drying, Aseptic preservation, Hurdle Technology, Microfiltration, Bacteriofugation, high voltage and Pulse electric fields, High pressure processing, Irradiation, Ohmic heating, Dielectric heating, microwave, RF, Infrared technologies, and Chemical Preservation.

Cryogenic grinding, granulation, crystallization, membrane separation processes; Evaporation, Distillation, Mixing, coagulation, mechanical separation processes, *viz.* sedimentation, clarification, filtration, pressing, expelling, leaching, extraction, extrusion.

Modified and Controlled Atmospheric Storage. Intermediate moisture food products, low & high acid foods and shelf stable foods. Food grain storage practices and structures – Traditional, improved and modern. Cold Preservation: Cold storage design & operations and cooling load calculations. Aseptic packaging, Vacuum packaging, MAP, and CAP.

Unit 2: Food Chemistry and Nutrition

Carbohydrates: classification and structure and functional properties of mono-, oligo- & polysaccharides. Starch gelatinization and retrogradation. Proteins: classification and structure of proteins in food, essential and non-essential amino acids. Functions of proteins, and protein efficiency ratio. Lipids: classification and structure of lipids, essential fatty acids, rancidity, polymerization and polymorphism. Vitamins: Water soluble and fat-soluble vitamins. Minerals. Pigments: carotenoids, chlorophylls, anthocyanins, and tannins. Enzymes: Specificity, simple and inhibitive kinetics, coenzymes, enzymatic and non-enzymatic browning. Food additives: Colours, flavours, and preservatives: Terpenes, esters, aldehydes, ketones and quinines. Role of food in human nutrition and nutritional disorders

Anti-nutrients. Chemical and biochemical changes during processing and storage. Nutraceuticals, functional foods, Probiotic and prebiotic foods, organic foods, designer foods, nutrigenomics.

Unit 3: Food Microbiology

Microorganisms: Types: bacteria, yeast, mold and actinomycetes. Pathogens and non-pathogens. Morphology and characteristics of microorganisms. Gram-staining: spores and vegetative cells. Role of microorganisms in food preservation. Sources of microorganisms, intrinsic and extrinsic parameters affecting microbial growth in food. Microbial growth: growth curve, death kinetics, D, Z and TDT value, and process time calculations. Fermented foods and beverages: Curd, yoghurt, cheese, pickles, soya-sauce, sauerkraut, idli, dosa, vinegar, alcoholic beverages and sausage. Food spoilage: microorganisms in different food products including milk, fish, meat, egg, cereals and their products. Assessing, enumeration and screening of microbial load: Serial dilution technique, pour plate, plate method, spread plate, MPN. Food borne infection diseases and safety. Food Borne intoxication: Food borne Toxins from microbes including *Staphylococcus, Salmonella, Shigella, Escherichia, Bacillus, Clostridium,* and *Aspergillus* genera – aflatoxins.

Unit 4: Food Properties

Physical characteristics: Moisture content: Dry basis and Wet basis, Shape, Size, Volume, Density, Porosity, Surface areas. Frictional Properties: Angle of repose. Properties of bulk particulate solids*:* Flow rate, Hausner ratio. Aerodynamics characteristics *viz*. Drag coefficient and terminal velocity. Thermal properties, *viz*. Specific heat, Thermal conductivity, Thermal diffusivity. Dielectric properties *viz*. Dielectric constant, radiation, transmission and absorption. Optical properties; Transmittance and Reflectance. Rheological properties: Newtonian and Non-Newtonian fluids, viscosity, viscoelasticity, stress-strain-time relationship and rheological models.

Unit 5: Heat, Mass and Momentum Transfer

Heat transfer: Conduction, convection, and radiation. Steady and unsteady state heat transfer. Heat transfer in conduction, convection involving laminar and turbulent flow, radiation. Heat exchangers. Mass Transfer: Molecular diffusion and Fick's law, conduction and convective mass transfer, permeability through single and multilayer films. Mass Transfer

Operations: Psychometry, humidification and dehumidification operations. Dimensionless numbers. Momentum Transfer: Flow rate and pressure drop relationships, continuity equation.

Unit 6: Processing of Food Grains, Spices and Plantation Crops

Structure and composition of wheat, rice, maize, oat, pulses, millets, oil seeds, Spices and plantation crops. Cereals, grains and oilseeds processing: Cleaning, washing, sorting, drying, Grading, shelling, dehusking, decortication, milling, polishing, pearling, cyclone separation, parboiling, Oil expelling, solvent extraction, refining and hydrogenation. Spices and plantation crops processing: Cleaning, washing, sorting, drying, processing of tea, coffee, cocoa, coconut, cashew and oil palm. Extraction of essential oils & oleoresins and encapsulation technologies. By-products utilization.

Unit 7: Processing of Fruits and Vegetables

Types of fruits and vegetables. Maturity, harvesting, post-harvest handling and storage of fruits and vegetables. Dehydrated fruits and vegetables. Processing fruit juice, jam, jelly, marmalade, squash, candies, tomato sauce, ketchup, and puree, chips, pickles. Technology of preservation by sugar, salt, and chemicals. Fermented foods and beverages from fruit and vegetables. Aerated drinks, frozen fruits and vegetables, IQF products. By-products utilization of fruits and vegetable processing industry. Primary, secondary, value addition of fruits.

Unit 8: Dairy Technology

Definition of Fluid milk and whole milk. Sources of Milk. Milk composition, physical and chemical properties of milk. Processing of Milk: judging, grading, testing of milk, receiving, cooling separation, clarification, ultra filtration, pasteurization, standardization, homogenization, sterilization, packaging of milk, storage, transport and distribution of milk. Milk products: Standardized, toned, double toned, UHT, fortified, reconstituted and flavoured milk, and fermented milk. Technology of Milk products:cream, butter, ghee, cheese, condensed milk, evaporated milk, whole and skimmed milk powder, ice cream, khoa, channa, and paneer. Dairy plant sanitation and waste disposal and CIP.

Unit 9: Processing of Meat, Fish and Poultry Products

The nutritional value of meat, poultry, and fish. Ante mortem inspection, principle and methods of slaughtering of various animals and poultry. Postmortem

examination and Rigor mortis. Factors affecting meat quality. Meat tenderization, meat preservation like curing, smoking, freezing, canning and dehydration of meat. Poultry processing: Slaughtering, scalding, defeathering, evisceration, and chopping. Egg: Structure and composition of egg, factors affecting egg quality. Quality measurement of egg. Preservation methods of shell eggs and egg products freezing- pasteurization-desugarisation. Egg products viz. egg powder. Fish processing: Stunning, Grading, Slime removal, Scaling, Deheading, Gutting, Filleting, Brining, Storage. Preservation of fish: Smoking, Freezing, Canning, Pickling. Handling and transportation of Fish, Cold chain management. Utilization of by-products from fish processing industries.

Unit 10: Bakery, Confectionery and Extruded Products

Bakery: Types of flours, Bakery products: Bread making- Kneading, Proofing, Knock back, Baking (ingredients, different methods); Biscuits and Cookies. Confectionery products: Cakes- Mixing, Baking, Cooling, Frosting, ingredients, different methods); Candies; Caramel; Fudge; Fondant; Chocolates- Fermentation, Drying, Roasting, Grinding, Conching, Refining, Tempering and Molding. Extrusion: Types of extrusion (Single Screw Twin Screw), Principle. Extruded products: Pasta, Breakfast Cereals, Snacks New Product development *viz.* to conceive ideas, evaluation of ideas, developing ideas into products, test marketing and commercialization. Sensory evaluation.

Unit 11: Food Conveying, Packaging and Labelling

Bulk conveying equipment, viz. belt conveyors, screw/auger conveyors, bucket elevators, drag/chain Conveyors and Pneumatic conveyors. Packaging terminologies. Functions of food packaging. Packaging requirements for different environments. Selection of packaging material. Metal, Glass. Paper and polymers films, biodegradable packaging materials. Nano composite as packaging materials: Properties, Manufacturing, and their applications. Machines for filling of liquid, wet products and dry solids. Form, Fill and Seal machines. Active and Intelligent Packaging, Oxygen and Ethylene Scavengers, Antimicrobial packaging, Time-temperature indicators. Printing and Labelling: Labels and bar coding. Testing of packaging materials and instruments- Bursting Strength, Tear Resistance, Tensile Strength, Thickness, Water Vapour Transmission Rate, Oxygen Transmission Rate, Drop Test.

Unit 12: Plant Layout, Design, Instrumentation and Process Control

Plant design concepts and general design considerations, plant location, product and process design, process flow charts, equipment selection, Plant layouts. Design and selection of machinery. Resistor, Capacitors, Transducers elements, intermediate elements, indicating and recording elements. Progammable Logic Controller, SCADA. Measurement of motion, force, torque, power, temperature, humidity, pressure and flow. Physical and Chemical Sensors, Biosensor. Computers aided design and analysis of machines and machine components.

Unit 13: Principles of Food Safety and Quality Management

Food Sanitation and safety: Factors contributing to physical, chemical and biological contamination in food chain, prevention and control of food borne hazards, definition and regulation of food sanitation, sources of contamination, personal hygiene-food handlers, cleaning compounds, sanitation methods, and pest control. Food adulteration: common adulterants, simple tests for detection of adulteration. Food additives- classification, functional role and safety issues. Quality systems and tools used for quality assurance including control charts, acceptance and auditing inspections, critical control points, reliability, safety, recall and liability. Food adulterations & detection techniques. Measurement techniques and instruments for food quality determination. National Food laws and standards - FSSAI, PFA, FPO, BIS, AGMARK, APEDA.International standards and organizations – FDA, ISO, GRAS, EU, CAC, TQM, GMP, GAP, HACCP.