35 FOOD TECHNOLOGY

Unit 1: Introductory Food Technology

Introduction to food technology, Food processing industries/institutions/food scientists of importance in India, Food attributes *viz*. colour, texture, flavour, nutritive value and consumer preferences, Causes of food spoilage, sources of microbial contamination of foods, food borne illnesses, water activity and its relation to spoilage of foods, Spoilage of processed products and their detection, Principles and methods of food preservation. Food fortification, Composition and related quality factors for processing. Methods of food preservation such as heat processing, pasteurization, canning, dehydration, freezing, freeze drying, fermentation, microwave, irradiation and chemical additives. Refrigerated and modified atmosphere storage. Aseptic preservation, hurdle technology, hydrostatic pressure technology and microwave processing. Use of non-thermal technologies (microfiltration, bacteriofugation, ultra high voltage electric fields, pulse electric fields, high pressure processing, irradiation, thermosonication), alternate-thermal technologies (ohmic heating, dielectric heating, infrared and induction heating) and biological technologies (antibacterial enzymes, bacteriocins, proteins and peptides) in food processing. Role of Food additives and processing aids.

Unit 2: Technology of Foods of Plant Origin

Fruits and Vegetable Processing: Post harvest handling and storage of fresh fruitsand vegetables. Preparation of fruits and vegetables for processing.Minimally processed products.Cold chain logistics. ZECC (Zero Energy Cool Chambers), CCSR (Charcoal cool storage Rooms). Thermal processing and process time evaluation for canned products, process optimization, aseptic canning, methods for canning of different fruits, and vegetables; Dehydration and associated quality changes during drying and storage of dehydrated products. Solar drying. Intermediate moisture foods. Preparation and utilization of fruits and vegetables juices in non-fermented/fermented/ aerated beverages, health drinks. Role of membrane technology in juice processing.Chemistry and manufacture of pectin, role of pectin in gel formation and products like jellies, jams and marmalades.
Technology of Preserves, Pickles, Chutneys and Sauces. Nature and control of spoilage in these products, Re-structured fruits and vegetables, Byproducts utilization infruits and vegetable processing industry, Processing methods of frozen fruits and vegetables, IQF products, packaging, storage and thawing, Role of Pectinases. Tomato products such as juice, puree, paste, soup, sauce and ketchup, Other convenience foods from fruits and vegetables. Beverages, tea, cocoa and coffee processing. Spent coffee ground. Medicinal and aromatic plants: their therapeutic values. Spice processing viz. cleaning, grading, drying, grinding, packaging and storage. Oleoresins and essential oils.

Food grain Processing: Structure, composition of different grains like wheat, rice,barley, oat, maize and millets, Anti-nutritional factors in food grains and oilseeds, Milling of grains. Wheat flour/semolina and its use in traditional/non-traditional foods like breads, biscuits, cakes,

doughnuts, buns, pasta goods, extruded, confectionary products, breakfast and snack foods. Rheology of wheat and rice flour, Preparation of vital wheat gluten and its utilization, Instant ready mixtures, Enzymes (amylases and proteases) in milling and baking, Milling and parboiling of rice; by-products of rice milling and their utilization, Processed products from rice, Pearling, malting, brewing and preparation of malted milk feeds from barley, Significance of β-glucans, Milling of oats and its processing into flakes, porridge and oatmeal, Wet and dry milling of corn, manufacture of corn flakes, corn syrup, corn starch, corn steep liquor and germ oil, Structure and composition of pulses and their importance in Indian diet. Milling and processing of pulses viz. germination, cooking, roasting, frying, canning and fermentation. Use in traditional products, protein concentrates and isolates. Modified starches and proteins. Oilseeds: edible oilseeds, composition and importance in India. Oilseed processing.Oil extraction and its processing, byproducts of oil refining. Production, packaging and storage of hydrogenated vegetable fat (Vanaspati), peanut butter, protein concentrates, isolates and their use in high protein foods. Soybean protein concentrates and isolates.Soy lecithin extraction.Export of oilseed cakes. International market and consumer preferences for quality in cakes for use in textured vegetable proteins. Millets: composition, nutritional significance, structure and processing. Dairy analogues based on plant milk.

Unit 3: Technology of Foods of Animal Origin

Technology of Milk and Milk Products: Milk and Milk production in India.Importance of milk processing plants in the country.Handling and maintenance of dairy plant equipment.Dairy plant operations viz. receiving, separation, clarification, pasteurization, standardization, homogenization, sterilization, storage, transport and distribution of milk. Problems of milk supply in India. UHT, toned, humanized, fortified, reconstituted, recombined and flavoured milks.Technology of fermented milks. Milk products processing viz. cream, butter, *ghee*, Cheddar and mozzarella cheeses, condensed milk, evaporated milk, whole and skimmed milk powder, malted food, ice-cream, butter oil, *khoa*, *channa*, *paneer*and similar products. Concept of composite dairy foods.Judging and grading of milk products. Cheese and dairy-based fat spreads. EMC (Enzyme modified cheese), Enzymes in dairy processing. Sanitization *viz*. selection and use of dairy cleaner and sanitizer.In plant cleaning system. Scope and functioning of milk supply schemes and various national and international organizations. FSSAI specifications and standardsof milk and milk products.Dairy plant sanitation and waste disposal.

Technology of Meat / Fish / Poultry Products: Scope of meat, fish and poultryprocessing industry in India, Chemistry and microscopic structure of meat tissue, Ante mortem inspection, Slaughter and dressing of various animals and poultry birds, Post mortem examination, Rigor mortis, Retails and wholesale cuts, Factors affecting meat quality. Curing, smoking, freezing, canning and dehydration of meat, poultry and their products.Sausage making. Microbial factors influencing keeping quality of meat. Processing and preservation of fish and its products.Handling, canning, smoking and freezing of fresh water fish and its products.Meat tenderization and role of enzymes in meat processing.Utilization of by-products.Zoonotic diseases.Structure and composition of egg and factors affecting quality.Quality

measurement.Preservation of eggs using oil coating, refrigeration, thermo stabilization and antibiotics.Packing, storage and transportation of eggs.Technology of egg products viz. egg powder, albumen, flakes and calcium tablets. Industrial and food uses.Physiologicalconditions and quality of fish products.

Unit 4: Food Quality Management

Objectives, importance and functions of quality control. Quality systems and tools used for quality assurance including control charts, acceptance and auditing inspections, critical control points, reliability, safety, recall and liability. The principles and practices of food plant sanitation. Food and hygiene regulations.Environment and waste management. Total quality management, good management practices, HACCP and codex in food. International and National food laws including food recall regulations. US-FDA, EFSA, ISO-9000 and FSSAI.Food adulteration.Sensory evaluation, panel screening, selection methods.Sensory and instrumental analysis quality control.Quality control of food at all stages and ofpackaging materials.Non-destructive food quality evaluation methods.Biosensors and their use in quality evaluation of food products.Aspects of food safety.

Unit 5: Food Engineering/Packaging and Labeling

Unit operations of food processing viz. grading, sorting, peeling and size reduction machineries for various unit operations, energy balance in food processing.Functions and levels of food packaging.Packaging materials: properties and testing procedures.Metal cans: types, mechanism of corrosion and protective coatings. Packaging requirements and practicesof fresh and processed foods. Shelf life studies. Recent trends in packaging, aseptic, modified atmosphere, vacuum and gas packaging, active and intelligent/smart packaging, antimicrobial packaging, edible films and coatings, biodegradable and nanocomposite materials for food packaging. Food packagingand labeling requirements as per FSSAI regulations.Principles of package design.

Unit 6: Food Microbiology & Biotechnology

Fermentation technology, fermented food products (animal and plant based including cereal), microbial spoilage of foods, bacterial growth curve, hurdle technology.Role of biotechnology in productivity of plants, livestock and microbes of improved nutrition and quality. Use of biotechnology in production of food additives viz. preservatives, colorants, flavours. Use of biotechnologically improved enzymes in food processing industry, biomass production using industrial wastes.Single cell proteins, Single cell oils, Food contaminants viz. aflatoxins.Food intoxication and infection. Consumer concerns about risks and values, Biotechnology and food safety.

Unit 7: Flavour Chemistry Technology

Flavour composition of foods/beverages (identification and quantitative analysis of the flavour precursors and their products, characterization of the staling reaction using stable isotopes).Flavour composition of foods/beverages in relation with maturation and microbial activity/or the processing conditions (e.g. fermented dairy products, beer, wine, honey, fruits). Analysis of odour-active compounds of food/beverages (Charm analysis).Synthesis of flavour by microorganisms and plant cells. Lipid derived flavours. Investigation of equilibrium of key flavour compounds that govern the flavour stability of beverages.Natural antioxidant constraints in spices.Role of microorganisms in flavour development.Flavor emulsions, flavour composites, essential oils and oleoresins.

Unit 8: Consumer Sciences/Food Product Development/Health Foods

Socio-cultural, psychological and economical consideration for food appearance, domestic and export marketing.Consumer trends and their impact on new product development.Product development viz. to conceive ideas, evaluation of ideas, developing ideas into products, test marketing and commercialization.Role of food in human nutrition. Nutritional disorders, natural contaminants and health hazards associated with foods. Diet therapy.Therapeutic / Engineered / Fabricated and Organic foods/ Nutraceutical and functional foods.FSSAIregulations related to food fortification,nutraceuticals and organic food.