

13. FOOD TECHNOLOGY

UNIT 1: FOOD CHEMISTRY & NUTRITION

Food Chemistry: Structure and functional properties of carbohydrates, proteins, lipids, and nucleic acids. Functional properties of macronutrients in food systems. Intermediary metabolism: glycolysis, TCA cycle, and energy metabolism. Energy balance and role of macro and micronutrients in human nutrition. Pigments- chlorophyll, anthocyanin, tannins and myoglobin, food flavours, enzyme activity, enzymatic and non-enzymatic browning. Detailed mechanisms of Maillard reaction, caramelization, and lipid oxidation.

Food flavors: Terpenes, Esters, Aldehyde, Ketones and Quinines, chemistry of flavor compounds, flavor formation, flavor enhancement, off-flavors. Flavor encapsulation and controlled release mechanisms.

Nutrition: Balanced diet, Protein efficiency ratio, essential amino acids and essential fatty acids, water-soluble and fat-soluble vitamins, role of minerals in nutrition, cofactors, anti-nutrients, nutraceuticals, and functional foods. Moisture relations in food, chemical and biochemical changes during processing and storage. Nutritional disorders and diet therapy. Probiotic and prebiotic foods, therapeutic foods, organic foods.

UNIT 2: FOOD MICROBIOLOGY, SAFETY & QUALITY MANAGEMENT

Food Microbiology: Characteristics and morphology of microorganisms, Microbial growth and death kinetics, Importance of microorganisms in food, primary sources in food, intrinsic and extrinsic parameters affecting microbial growth. Microbial spoilage of foods, Fermented and microbial foods.

Food Safety & Quality Management: Food-borne diseases and safety, microbial toxins, natural contaminants and health hazards associated with foods. Food safety management systems (HACCP, ISO 22000, GMP, GHP, FPO, PFA, AGMARK, ISI, CIP), risk assessment and traceability. Emerging pathogens, antimicrobial resistance in food systems. Rapid and molecular methods of microbial detection (PCR, ELISA, biosensors). Shelf-life studies and predictive microbiology.

UNIT 3: FOOD ENGINEERING

Fluid mechanics: Classification of fluids, fluid statics and dynamics, flow patterns, flow through pipes, fixed and fluidized beds, pumps and turbines. Dimensional and non-dimensional analysis (Reynolds, Nusselt, Prandtl numbers).

Heat transfer: Conduction, Convection, Radiation; Heat exchangers.

Mass transfer: Diffusion, Evaporation, Drying, Distillation. Momentum Transfer principles, Psychrometric, humidification and dehumidification operations.

Thermodynamics: Laws, properties of systems, Refrigeration principles and applications, Cold chain logistics.

Process calculations: Material balance and energy balance, Stoichiometry, heat capacity of solids, liquids, gases and solutions.

Mechanical operations: Size reduction of solids, High pressure homogenization, Filtration, Centrifugation, Settling, Sieving, Mixing and Agitation. Engineering properties of foods (Thermal, Rheological, Physical).

UNIT 4: FOOD PROCESSING & PRESERVATION TECHNOLOGY

Low temperature processing - chilling, freezing, High temperature processing, drying, canning, and preservation principles. Intermediate moisture foods, hurdle technology. Use of non-thermal technologies for preservation. Processing and preservation of: Milk and milk products; Meat, fish, and egg products; Fruits and vegetables; Cereals, pulses, and oilseeds; Spices and

plantation crops. Fermented foods and beverages, aerated drinks, value addition and by-product utilization. Extraction of essential oils & oleoresins and encapsulation technologies. Emerging processing technologies (HPP, PEF, cold plasma, ultrasound, irradiation). Minimal processing and ready-to-eat/ready-to-cook foods. Sustainability in food processing and waste valorisation.

UNIT 5: FOOD ADDITIVES, FOOD ANALYSIS & FOOD PACKAGING

Food additives: Definition, classification, chemical structure, and functional roles in food systems. Types of additives: acidity regulators, antioxidants, antimicrobial agents, emulsifiers, stabilizers, and thickeners. Role of JECFA in safety assessment of food additives.

Food analysis: Food analytical methods, statistical evaluation of analytical data. Principles and methods for subjective and objective quality evaluation of foods. Measurement techniques and instruments, destructive and non-destructive quality evaluation. Advanced analytical techniques (HPLC, GC-MS, spectroscopy, chromatography). Sensory evaluation methods and consumer preference analysis.

Food Packaging: Materials and their properties, packaging equipment, testing, applications. Recent trends in packaging, labelling requirements. Active and intelligent packaging systems. Biodegradable and sustainable packaging materials, Aseptic packaging, Modified atmosphere packaging (MAP) and vacuum packaging.