

XE	Engineering Sciences
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XE6	Food Technology
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Section XE6.1:	Food Chemistry and Nutrition
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Food Components Characterization and quantification techniques

Carbohydrates: Structure and functional properties of mono-, oligo-, & poly- saccharides including starch, cellulose, pectic substances and dietary fibre, gelatinization and retrogradation of starch.

Proteins: classification and structure of proteins in food, Protein denaturation, functional properties of proteins and starch.

Lipids: Classification and structure of lipids, rancidity, polymerization and polymorphism.

Pigments: carotenoids, chlorophylls, anthocyanins, tannins and myoglobin. Curcumin, betalains.

Food Flavours: Terpenes, esters, aldehydes, ketones and quinines. Enzymes: specificity, simple and inhibition kinetics, coenzymes, enzymatic and non- enzymatic browning, Food enzymology.

Nutrition: Balanced diet, essential amino acids and essential fatty acids, protein efficiency ratio, water soluble and fat soluble vitamins, role of minerals in nutrition, co-factors, anti-nutrients, nutraceuticals, nutrient deficiency diseases. Food Supplements, Concept of nutrigenomics.

Food adulteration (types of adulterants and their detection)

Chemical and Biochemical Changes: Changes occurring in foods during different processing. Changes occur in foods and food biopolymers (carbohydrates, proteins, lipids) during different processing.

Section XE6.2:	Food Microbiology
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Characteristics of Microorganisms: Morphology of bacteria, yeast, mold and actinomycetes, spores and vegetative cells, gram-staining, Resistant bacteria.

Microbial Growth: D-value, Z-value, F-value, Growth and death kinetics, serial dilution technique.

Food Spoilage: Spoilage microorganisms in different food products including milk, fish, meat, egg, cereals and their products.

Toxins from Microbes: Pathogens and non-pathogens including Staphylococcus, Salmonella, Shigella, Escherichia, Bacillus, Clostridium, and Aspergillus genera, Food borne diseases.

Fermented Foods and Beverages: Curd, yoghurt, cheese, pickles, soya-sauce, sauerkraut, idli, dosa, vinegar, alcoholic beverages, and sausage.

Probiotic foods: probiotic microorganisms, their benefits, prebiotics, synbiotics.

Section XE6.3:	Food Products Technology
	Processing Principles: Food Components Characterization and quantification techniques. Quality analysis of raw and processed food products. Thermal processing (blanching, pasteurization, sterilization), chilling, freezing, dehydration, addition of preservatives and food additives, Microwave, radiowave, and Infrared processing, irradiation, fermentation, hurdle technology, intermediate moisture foods. Non thermal technologies: Ultrasonication, HPP, Pulse Electric Field, Cold plasma. Food packaging and storage: packaging materials and their properties, aseptic packaging Active and Intelligent packaging, controlled and modified atmosphere storage. Microplastics in food. Cereal processing and products: milling of rice, wheat, and maize, Pulse processing, parboiling of paddy, bread, biscuits, extruded products and ready to eat breakfast cereals. Meat Analogue and Plant-based milk alternatives Oil Processing: Expelling, solvent extraction, refining and hydrogenation. Fruits and Vegetables Processing: Extraction, clarification, concentration and packaging of fruit juice, jam, jelly, marmalade, squash, candies, tomato sauce, ketchup, and puree, potato chips, pickles. Plantation crops processing and products: Tea, coffee, cocoa, spice, extraction of essential oils and oleoresins from spices. Milk and Milk Products Processing: Pasteurization and sterilization, cream, butter, ghee, ice-cream, cheese and milk powder. Processing of animal products: Processing of frozen, canned, and dried products, ready to eat products of fish and meat. Curing, smoking, poultry processing, animal slaughtering Waste Utilization: Pectin from fruit wastes, uses of by-products from rice milling. Edible films and packaging materials from waste Food standards and Quality Maintenance: FPO, PFA, A-Mark, HACCP, food plant sanitation and cleaning in place (CIP). FSSAI, BIS, Codex Alimentarius, ISO, Food Safety and Management System (FSMS).
Section XE6.4:	Food Engineering
	Mass and energy balance. Momentum Transfer: Flow rate and pressure drop relationships for Newtonian fluids flowing through pipe, Reynolds number. Heat transfer: heat transfer by conduction, convection, radiation, heat exchangers. Mass Transfer: Molecular diffusion and Fick's law, conduction and convective mass transfer, permeability through single and multilayer films. Mechanical Operations: Size reduction of solids, high pressure homogenization, filtration, centrifugation, settling, sieving, mixing & agitation of liquid. Thermal operations: Thermal blanching, pasteurization, sterilization, sterilization, evaporation of liquid foods, hot air drying of solids, spray and freeze-drying, freezing and crystallization. Mass Transfer Operations: Psychometric, humidification and dehumidification operations.