37 DAIRY TECHNOLOGY

Unit 1: Technology of Milk and Milk Products

Status of dairy industry in India. Clean milk production, Milk procurement processes, Raw milk quality assessment and preservation, Physical properties and chemical composition of milk of cow, buffalo and other species of milch animals; their importance in milk processing. Principles, processes and advances of unit operations in milk and milk products processing, Special milks; Principles and processes of manufacture of fat rich dairy products, cheese and fermented dairy products, ice cream and frozen desserts, traditional Indian dairy products, concentrated and dried milks and dairy products, infant foods, dairy byproducts; Cleaning and sanitizationof dairy equipments.

Unit 2: Advances in Dairy Food Packaging

Status of current packaging; types of packaging materials; criteria for selection of proper packaging; testing of packaging materials; Adhesives; graphics; coding, and labeling used in food packaging; Protective packaging of foods; packaging of food products sensitive to oxygen, light, moisture; Active packaging; special problems in canned foods; Packaging of dairy products; packaging of convenience foods; Packaging of fats and oils; Modified atmosphere packaging, Controlled atmosphere packaging, Shrink and stretch packaging; Retort pouch technology, microwavable, biodegradable, and edible packages; Industrial packaging: unitizing, palletizing, containerising, distribution systems for packaged foods including prevention of shock damage to articles during transportation; Safety aspects of packaging materials; sources of toxic materials and migration of toxins into food materials.

Unit 3: Advances in Dairy Processing

Concentration processes and their impact on quality of finished products; Dehydration: advances in drying of milk and milk products; Freeze dehydration: physico-chemical changes and industrial developments; Glass Transition Temperature and its relevance to dried milks; Water activity; sorption behaviour of foods, energy of binding water, control of water activity of different milk products in relation to their chemical; microbiological and textural properties; hurdle technology and its application in development of shelf-stable and intermediate-moisture foods, Use of carbonation in extending the shelf life of dairy products. Alternate processes for dairy processing: Radiation preservation, microwave heating, ohmic heating, high pressure processing, pulse electric field, infra red heating, ultrasonic heating etc.; Current trends in cleaning and sanitization of dairy equipment; Automation, Ultrasonic techniques in cleaning; Bio-films; Bio-detergents, innovations in sanitizers - chemical, radiation; Mechanism of fouling and soil removal; Assessing the effectiveness of cleaning and sanitization of dairy equipment, Water conservation methods.

Unit 4: **Membrane Processing**

Classification of membrane processes, membrane hardware, design of membrane plants, modeling of ultrafiltration (UF) processes, mass transfer model, resistance model; membrane flouling-problem and treatment, cleaning and sanitization of different types of membranes. Factors affecting permeate flux during UF and reverse osmosis; energy requirements for processing of milk and whey. Preparation of special foods like lactose, low lactose powder and dairy whiteners, whey protein concentrates, casein and coprecipitates. Demineralisation: Importance, principles and processes; Functional properties of whey proteins (WPC & WPI), casein, co-precipitates and UF milk retentate and their modifications; Evaluation of functional properties of proteins.

Unit 5: **Rheology of Dairy Foods**

Principles of rheology; Rheological classification of Fluid Foods; Instruments for measuring rheological properties; Rheology of semi-solid and solid food; Rheological characterization of foods in terms of stress-strain relationship; Viscoelasticity; Transient tests - Creep Compliance and Stress Relaxation; mechanical models for viscoelastic foods: Maxwell, Kelvin, Burgers and generalized models and their application; Dynamic measurement of viscoelasticity. Large Deformations and failure in foods: Definitions of fracture, rupture and other related phenomena; Texture Profile Analysis; Instrumental measurements – Empirical and Fundamental methods; Rheometers and Texture Analyzers; Measurement of Extensional viscosity; Acoustic measurements on crunchy foods. Rheological and textural properties of selected dairy products: Measurement modes and techniques; Effect of processing and additives (stabilizers and emulsifiers) on food product rheology; Relationship between instrumental and sensory data.

Unit 6: **Functional Foods and New Product Development**

Definition, classes of functional foods; Dietary and therapeutic significance of dairy nutrients, bioactive components in dairy products; Food fortification, techniques for fortifying dairy foods with minerals and vitamins, High protein foods prospective nutraceuticals for fortification of dairy foods, Nutritional significance of dietary fibers, classes of dietary fibers, fortification techniques for fibers in dairy foods; Designing foods for different populations: Infant, geriatric, sports nutrition, foods for specific diseases; Principles and processes for reduced calorie and reduced sodium foods; Bio-flavours and flavour enhancers; Nutritional and therapeutic potential of herbs, phytochemicals, pre- and probiotics and technological interventions for their incorporation in dairy foods

Unit 7: **Biotechnology for Dairy Applications**

Development and impact of biotechnology on dairy and food industry; Principles of recombinant DNA technique; Microbial rennet and recombinant chymosin - characteristics and applications in cheese making; exogenous free and microencapsulated enzymes; Immobilized enzymes - their application in continuous coagulation of milk in cheese making; Enzyme modified cheeses (EMC) - their utilization in various food formulations; technological requirements of modified

micro-organisms for applications in cheese, Physiologically active bio-peptides/ nutraceuticals; protein hydrolysates - production, physico-chemical, therapeutic properties and application in food formulations; Enzymatic hydrolysis of lactose- batch and continuous; Microbial polysaccharides - their properties and applications in dairy foods; Production of alcoholic dairy beverages; Bio-sweeteners - Types, properties and their applications in dairy and food industry. Bio-preservatives - characteristics and their applications in enhancing the shelf life of dairy and food products.

Unit 8: **Technology of Food Emulsions, Foams and Gels**

Food dispersions; Food emulsions; Emulsifiers and their functions in foods; HLB concept for food emulsifiers; Emulsion formation and stability; Surfactants; Dairy based foams and their applications, structure of foams; Foam formation and stability; Theory of gel formation; carbohydrate and protein based gels; Gelled milk products. Structure of dairy based emulsions, foams and gels; Techniques for evaluating the structure of food emulsions, foams and gels; Advances in food gels (organogel, hydrogel and nanogel); Effect of stabilizers and/or emulsifiers on functional properties of dairy foods; Aerosols and propelling agents in foamed dairy products.

Unit 9: Legal and Quality Aspects for Milk and Milk Products

Safety aspects of milk with reference to mycotoxins, antibiotics, pesticides, weedicides and heavy metals. PFA, BIS and Agmark standards for milk and milk products. Quality systems such as HACCP, ISO certification, etc.