

TAMIL NADU PUBLIC SERVICE COMMISSION
SYLLABUS
Dairy Science
(PG Degree Standard)

UNIT I:

CODE: 458

Market Milk

Status and prospects of dairy industry in India. Operation flood program. Technology mission on dairying. Milk production trends and dairy development through successive national plans. Recent policy changes to dairy sector (WTO/GATT) and their impact on dairy industry in the country. National Dairy Plan, National Livestock Mission and DDF. Importance of various milks in milk processing. Impact of milk processing on major and minor constituents of milk. Methods of milk procurements, payments for quality assessment, handling and transportation of milk to processing dairies. Milk preservation, methods of chilling milk, centrifugal separation, clarification and bactofugation and factors affecting their efficiency. Homogenization process and its implications in dairy industry. Theories of homogenization and factors affecting it. Thermal processing of milk. Principles and methods of thermalization, pasteurization and sterilization and UHT. Refrigeration and its uses. Special milks-principles of production, processing and marketing of toned, doubletoned, reconstitute and recombined sterilized, flavoured and filled milk. Standardization of milk.

UNIT II:

Dairy Technology-I

Indigenous Milk Products: Significance of role of indigenous dairy products in Indian dairy industry and economy. Characteristics and composition of various indigenous milk products, their prospects and constraints. Status of organized and unorganized sectors in the manufacture of these products. Methods of production, Physico-chemical changes during manufacturing; quality attributes shelf life, preservation, packaging and latest processing innovation of khoa, chhana and paneer. Fat rich Dairy Products: Basic principles of manufacture and quality aspects of cream. Manufacture of butter by batch method. Continuous butter manufacture. Factors influencing churning. Churning theories. Grading of butter. Defects and remedies, problems of butter storage. Over run in butter. Cost of butter production. Recent technological advances in butter industry. low fat spread. Methods of ghee making. Innovation in ghee production procedure, packaging, preservation, changes during manufacture, shelf life and defects in ghee.

Frozen milk Products: Definition, classification, composition of ice cream and other frozen desserts, status, trends and projection of frozen milk products industry in India. Role of mix constituents and other ingredients, process steps, packaging and storage on ice cream quality. Technological aspects of ice cream manufacture. Recent advances in ice cream industry and their impacts. Indigenous frozen desserts kulfi, Malai ka Baraf, filled and Imitation ice cream, their production and quality.

UNIT III: Dairy Microbiology of milk products

Bacteriological Techniques, Basic principles underlying the routine and research methods for enumeration, isolation, cultivation and study of micro-organism, microscopy (including elementary principles of phase-contrast and electron microscopes) and staining procedures, preparation of nutrient media, methods used for identification of organism and taxonomic studies, methods of detection (estimation wherever necessary) and testing of metabolic products of bacteria; Micro-biological assay Routine bacteriological tests for milk, detection of bovine mastitis, general methods and principles involved for efficiency of cleaning and sterilization, methods of checking the conditions of milk-production for efficiency of processing (different tests).

Micro-organism in milk and milk products, micro-organisms in milk:milk as a nutrient medium for bacterial growth, inhibitory substances in milk, sources of contamination during production, handling and distribution of milk, important groups of bacteria occurring in milk, thermoduric and thermophilic bacteria, activities of different species in milk and sequence of fermentation Processing of milk, methods of processing commonly employed, bacteria surviving pasteurization and boiling. Microbiology of milk products. Role of lactic acid bacteria and other micro- organisms in manufacture of butter, cheeses and fermented milks, spoilage of various milk products by micro-organisms. Bacteriology of starter cultures: Preparation and maintenance of starter culture, Types, tests for checking their purity and efficiency, bacteriophage, contamination of starters. Dairy Sanitation, Public Health and Microbiology of sewage and Environment: Clean milk production general principles of sanitary milk production, cleaning and sterilization of dairy utensils. Milk and public health:Transmission of diseases of bovine and human origin through milk products. Safe milk and methods to ensure supply of safe milk.

UNIT IV:

Dairy Technology- II:

Cheese and fermented milk products: Technology of cheese. Status and scope of cheese in dairy industry. Definition, classification and standards of cheese. Milk in relation to modern cheese making process. Treatment of milk for cheese manufacture and their consequences. Manufacture of cheddar, Gouda, Mozzarella, Swiss, Cottage and Roquefort cheese. Role of starter culture in cheese quality. Status of calf and microbial rennets for cheese manufacture. Yield optimization. Physical chemical changes during cheese ripening. Manufacture of process cheese and cheese spread. Packaging, storage and defects of cheddar cheese, their causes and prevention. Manufacture of low fat and low sodium cheese and process cheese. Advance in processing, manufacturing, storage and packing of Dahi, Yoghurt, Shrikhand, MistiDahi, Lassi, khefir, acidophilus and bifido milk. Probiotic – Prebiotic, postbiotic and synbiotics milk products.

Concentrated and Dried milk products. Newer concepts in milk quality relation to processing and manufacture of concentrated and dried milks. Role of milk constituents in condensed milk. Principles and methods of manufacture, packaging and storage defects in SCM, EMand, RSCM, REM and dried milks WMP, SMP and instant milk powder. Heat stability and its control. Special problems in handling buffalo milk for manufacture of concentrated and dried milk and infants milk foods. Utilization of Whey for WPC, WPI, WPH and uses.

UNIT V:

Dairy Chemistry

Chemistry of Lactose, Significance of lactose in milk and milk products. Chemical properties, fermentation of lactose, manufacture of lactose, use of lactose. Estimation of lactose in milk. Chemistry of Proteins- General description, amino acid contents of milk proteins, caseins, lactalbumins, lactoglobulins, other proteins in milk, physical and chemical properties of milk proteins, separation of milk proteins, Estimation of proteins in milk.

Chemistry of Milk Lipids - General description, classification, distribution of lipids in milk, composition of milk, milk fat constants, phospholipids, unsaponifiable matter, milk fat hydrolysis, milk fat oxidation, hydrogenation of fat, biosynthesis of fat.

Mineral constituents of milk- General description, Importance, distribution, variation, effect of incineration and souring of milk on its mineral constituents, factors affecting the composition of mineral matter, effect of various

treatments on salt equilibrium

Vitamins and enzymes- General description, classification and importance. Chemical changes occurring during storage of milk.

UNIT VI: Rheology and Packaging of milk products

Rheology of Dairy Foods – Introduction to rheology to foods, physical consideration (Stress –strain relationship) in the study of foods, viscoelasticity - importance and practical application in selected dairy products, type of texture in food rheological determination indifferent food stuffs hydrocolloids and influence of food additives (stabilizer+emulsifier) on rheology of different food products.

Critical review of the existing knowledge of identification of gaps and problems in current packaging of products and adhesive, graphics and labeling used in food packaging. Protective packaging (MAP, Vacuum Packaging, Active and intelligent packaging) of food, packaging of food products sensitive to oxygen, light, moisture and insect resistant packaging, retention of volatile flavours in food through packaging and special problems in canned foods, packaging of dairy products, fluid milk, cream, butter, cheese, Indian milk products, dried and frozen dairy products.

UNIT VII: Dairy Plant Management:

Location, design, arrangement of floor space and constructional details. Metal and materials used in dairy utensils and machinery. Selection and purpose of equipment. Inspection of premises and protection from contamination. General cleanliness and sanitation of plant. Washing and sterilization of dairy equipment, bottles and cans. Construction, operation and maintenance and technical control methods of equipment: such as heat exchangers, pasteurizers, homogenizers, bottle filler, bottle washer and can washer. Constructional and technical control methods and equipment used for manufacture of different milk products. Methods of disposal of dairy effluents.

Evaluation of Sanitizers and Brine: Controlling the alkalinity and P^H of detergent solutions. Preparation and evaluation of chlorine sanitizers. Maintenance and checking the strength of brine solution. Role of hardness of water in the dairy and methods of overcoming the problem.

**UNIT VIII:
Dairy Quality Control**

Legal standard for market milk and milk products. Procedure of sampling. Good laboratory practices, Calibration of glass wares, Regulatory institutions involved in quality assurance of milk and milk products, Examination and testing for chemical and bacteriological qualities. LP System and its use in preservation of milk. Quality control of butter and ghee and its grading under AGMARK. PFA and BIS and legal aspects of various indigenous milk products. Milk preservatives and their detection. Adulterants of milk and milk products and their detection. Rapid platform tests and tests for detection and control of bovine mastitis. Quality systems such as HACCP, ISO.

**UNIT IX:
Dairy husbandry**

Breeds of Dairy cattle. Indigenous, Exotic and Cross bred Cattle breeds. Lactogenesis and Galactopoiesis. Let down of milk. Milking procedure and practices for clean milk production: Methods of milking. Economic traits of Dairy cattle. Systems of Dairy cattle breeding. Breeding systems suitable to enhance milk production in India. Diseases of Dairy cattle – bacterial, viral, parasitic, nutritional and metabolic deficiency diseases and their control. Significance of mastitis and other diseases of economic importance. Management of milch animals, pregnant animals, dry animals, heifers and calves. Milk secretion, its theories and biosynthesis of milk constituents. Detailed composition of colostrums and milk of cattle and buffalo and factors affecting the same. Determination and significance of colour, specific gravity, refractive index, surface tension, viscosity, specific heat, electrical conductivity, osmotic pressure, boiling point, freezing point, acidity, pH, buffering capacity, oxidation and reduction potential.

**UNIT X:
Utilization of milk by-products**

Status, availability and utilization of dairy by products. Associated economic and pollution problems. Manufacture of casein, sodium and calcium-caseinate, edible casein, hydrolysate, co-precipitates, whey protein concentrate and whey beverages. Use of buttermilk.