Tamil Nadu Public Service Commission

Syllabus

Dairy Science, Dairy Technology, FoodTechnology, Food Processing

(Degree Standard)

Code:579

Unit I: Dairy Science (20 Questions)

Status of Indian dairy industry- Operation flood program - Anand pattern - Milking systems – clean milk production - Milk composition and factors affecting composition of milk - Nutritive value - Platform tests, Adulteration of raw milk - Milk procurement and pricing policy - Operation and maintenance of primary milk co-operative society (PMCS) – milk analysers, estimation of milk fat and SNF –Chilling of raw milk and BMC operation - Milk transportation and surveillance system, Raw milk - FSSAI specifications.

UNIT II: Processing of Fluid Milk (20 Questions)

Unit Operations in Dairy Processing Plant: Homogenisation - Standardization of milk – Pearson square and algebraic methods - Thermal processing of milk - Defects in market milk - Manufacture of special milk: toned, double toned, reconstituted, recombined, flavoured, homogenized, vitaminised and acidophilus milk –Storage of raw milk and Processed milk. Manufacture of sterilized milk: UHT-Cleaning and Sanitation – CIP System - Distribution systems for market milk - Effect of heat processing on nutritive value.

UNIT III: Fat Rich Dairy Products (20 Questions)

Cream: Definition & Legal standards, efficiency of cream separation and factors affecting Cream separation – control off at percentage in cream - Neutralization, standardization, pasteurization and cooling of cream - Preparation and properties of different types of cream – sterilized cream, frozen cream - Factors affecting quality of cream - ripening of cream - Packaging, storage and distribution - defects in cream and prevention.

Butter: Theory of churning, legal standards - Technology of butter manufacture: batch and continuous methods - Over run in butter; control of fat loss in buttermilk - packaging and storage – transportation - defects in butter - rheology of butter - uses of butter. Care and maintenance of cream separator, coolers, vacreator, factory butter churn and continuous butter making machine.Special butter and related products: Manufacture, packaging, storage and properties of whey butter, flavoured butter, whipped butter, renovated butter/fractionated and polyunsaturated milk fat products, vegetable oil- blended products and low-fat spreads - Manufacture, packaging, storage and characteristics of margarine of different types.

Ghee and butter oil: Methods of ghee making: batch and industrial processes - innovations in ghee production - procedure, packaging and preservationofghee -utilizationofsubstandardmilk – Composition of ghee and changes during manufacture - fat constants. Manufacture of butter oil - packaging and storage.

Unit IV: Ice-cream and Frozen Desserts (20 Questions)

Definition - classification - composition and standards of ice cream and other frozen desserts - calculation and figuring of ice cream mix and yield -Stabilizers and emulsifiers – classification, properties and role in quality of ice cream - Thermodynamics of freezing and calculation of refrigeration loads - Types of freezers - refrigeration control/instrumentation - Hygiene, cleaning and sanitation of ice cream plant - Effect of process treatments on the physico-chemical properties of ice-cream mixes and ice cream - Processing and freezing of ice-cream mix and control of over run - Packaging, hardening, storage and transportation of ice-cream - Defects in ice cream, causes and prevention.

Unit V: Traditional Indian Dairy Products and Fermented Dairy Products (25 Questions)

Khoa and Khoa based sweets:Peda, Burfi, Kalakhand, Gulabjamun and Milk cake - Compositional profile and manufacture process. Rabri and Basundi:Channa and Channabased sweets:Rasogolla,Rasomalai, Sandesh,Paneer. ChakkaandShrikhand - MistiDahi–Kheer, Payasam and kulfi.Bio preservative principles in enhancing the shelf-life of indigenous milk products – packaging.

Preparation of Dahi, Yogurt, Lassi, Buttermilk.Cheese Technology - Definition - standards and classification of cheese - Action of rennet on milk in relation to cheese making -Manufacture of different varieties of cheese: Cheddar, Swiss, Mozzarella, Gouda and Cottage Cheese - Enzyme Modified Cheese (EMC) – flavourings - Application of membrane processing in cheese manufacture - Factors affecting yield of cheese – Packaging - storage and distributionofcheese - Acceleratedripeningofcheese.Manufactureof processed cheese and cheese spread - Mechanization and automation in cheese processing.

Unit VI: Condensed and Dried Milks (15 Questions)

Condensed Milk: Definition and legal standards - Condensed milk, sweetened condensed milk and evaporated milk - manufacturing techniques - Recombined sweetened condensed milk - Grading and quality of raw milk for condensed and evaporated milk, physico-chemical changes taking place during manufacture of condensed milk - heat stability of milk and condensed milk and role of stabilizers in the stability of condensed milk - defects in condensed milk, causes and prevention.

Dried Milk: Grading and quality of raw milk for dried milks - Manufacture of whole milk powder (WMP), skim milk powder (SMP), and heat classified powders - composition of dried milks, recovery of milk powders- manufacture of infant foods, malted milk foods and other formulated dried products - Cheese spread powder, ice cream powder, cream powder, butter powder, whey powder.

Unit VII: Dairy Chemistry (20 Questions)

Milk Sampling Techniques from different sources for Chemical Analysis - Chemistry of Lactose, Significance of lactose in milk and milk products - 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, unsaponifiablematter,milkfathydrolysis,milkfatoxidation,hydrogenationof fat - Mineral constituents of milk.

Unit VIII: Microbiology of Milk and Milk products (20 Questions)

Common microbes in milk and their significance, Microflora of mastitis milk, Sources of microbial contamination of raw milk during collection, transport and storage; Microbial changes in raw milk during long storage, Microbiological grading of raw milk; Microbiological aspects of processing techniques - bactofugation, thermization, pasteurization, sterilization, boiling, UHT and non-thermal processes including membrane filtration; Role of psychrotrophic, mesophillic, thermophilic and thermoduric bacteria in spoilage of processed milks, their sources and prevention; Microbiological quality of dairy products - fat rich, frozen, concentrated, dried milks, fermented, and indigenous dairy products; Legal standards; Sources of contamination and factors affecting microbial quality of these products during processing, storage and distribution; Microbiological defects associated with milk products and their control; Food poisoning; infections and their public health significance; Sources of pathogens and their prevention.

Environmentally transmitted microbial pathogens (*Salmonella, E. coli, Campylobacter, Yersinia* etc.) and viruses (enteric and respiratory); indicator microorganisms - total and faecal coliforms, faecal streptococci, bacteriophage etc; Biofouling and biofilms; microbial toxicants and bio-organicpollutants; Current trends in cleaning and sanitization of dairy equipment; Enumeration of composite microflorain milk and dairy products - aerobic & anaerobic; Quality requirements of water for dairy plant operations.

Principles of quality and safety functions in dairy processing unit; FSSAI - regulations and guidelines; ISO standards; principles of QMS and HACCP, SAFE, GMP, SSOP, FSMS, personnel hygiene and food handling in dairy industry; Bio-safety concepts - Sampling plan as per International council for microbiological standards for foods (ICMSF); Guidelines and specifications for different dairy foods as recommended by ICMSF, CODEX.

Unit IX: Dairy Process Engineering (20 Questions)

Canning, dehydration, freezing, freeze drying, fermentation, microwave, irradiation and chemical additives-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).

Refrigeration – principles - refrigeration effect – coefficient of performance – units of refrigeration - vapour compression system-different types Refrigeration components – compressor, condensers, evaporators, expansion device – types, construction, principle and working- Refrigerants – properties – classification, nomenclature – comparison and advantages – alternate refrigerants – Azeotropes - vapour absorption system- Electrolux refrigerator –construction and principles -Cooling load estimation.

Fuels: Renewable energy sources:- Operation and maintenance of different types of boilers - Properties of steam - Use of steam tables and Mollier charts, Analysis of energy input in steam generation and heat gain insteam consumption. Steam generators - Introduction to Indian Boiler Regulation Act. Boiler Draught - Air Compressors.

Unit X: Dairy Process Equipment Design and Automation (20 Questions)

Principles and design of shell and its component, stresses from local load and thermal gradient, mountings and accessories - Principles and design of fermenter vessel and design problems - Hazards and safety considerations - Principles and design of agitators and separators. Heat exchangers - Principles and design of shell and tube heat exchanger - plate heat exchanger - scraped surface heat exchanger - tubular heat exchanger - sterilizer and retort - single effect and multiple effect evaporators- rising film and falling film evaporators. Design of crystallizer, centrifugal separator, freezing equipment- Types of freezers – Principles and design of ice-cream freezers and refrigerated display system - Principles and design of tray dryer, tunnel dryer, vacuum dryer, spray dryer and freeze dryer- Principles and design of screw conveyor, bucket elevator and pneumatic conveyor - Principles and design of extruders - Cold and hot extruder design, single and twin screw extruder.

Machines for filling of liquid and wet products - to predetermined level and predetermined volume-filling of dry solids- by count- volume-weight - methods of wrapping and bagging -Form, fill and seal machines-various forms of packaging – Cartoning systems – Printing and Labelling – Container handling. CAS and MAP, shrink and cling packaging, vacuum and gas packaging - Aseptic packaging, Active packaging, Smart packaging, intelligent packaging - Retort packaging, principles, application.

Dairy plant automation –principles- role of programmable Logic controller (PLC) and Supervisory control and Data Acquisition (SCADA)-automation tools-sensors-flow meters-actuators-and robotic system.

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