

**Syllabus in module-wise for conducting examination for selection of
Manager (Quality Control) in KCMMF Ltd.,**

Category No.372/2024

Total : 100 Marks

Module 1

CHEMISTRY OF MILK AND ITS COMPONENTS (15 Marks)

Definition and structure of milk, Casein: fractionation and chemical composition, Micelles: definition, critical micelle concentration, formation and stability; Colloidal stability of casein micelles in milk, Kinetics of denaturation of whey proteins, non-proteins nitrogen constituents of milk, Milk enzymes. Chemical properties of lactose: hydrolysis; Pyrolysis; Oxidation; Reduction; Degradation with strong bases; Maillard browning. Classification of milk lipids. role of major milk lipids in milk and milk products and biological significance of milk lipids; hydrogenation, halogenation, transesterification, inter-esterification and fractionation. Factors affecting the fatty acid composition. Milk phospholipids and their role in milk products, Unsaponifiable matter and fat soluble vitamins, Minerals: major and minor minerals; Factors affecting variation in salt composition of milk; Distribution and importance of trace elements in milk.; Partitioning of salts and factors affecting them.. Salt balance and its importance in the processing of milk; Protein-mineral interactions. Water soluble vitamins: molecular structure, levels in milk

Module 2

CHEMISTRY OF PROCESSED DAIRY PRODUCTS (15 Marks)

Role of biologically active components in human milk; Standards, composition and properties of infant milk and infant food formulations. Heat induced changes in milk leading to coagulation; Heat stability of concentrated milk as affected by different process variables, Milk constituents and additives; Age gelation: Mechanism and control. Process induced changes in milk constituents during preparation and storage of concentrated and dried milks. Biochemical changes during ripening of different varieties of cheese; Lactic acid Fermentation in cheese and other fermented dairy products; chemical defects in cheese. Storage stability of cream, butter and ghee. Physico-chemical properties of ghee; Ghee flavour, texture (grains) and colour in ghee. Role of different ingredients during processing and storage of ice cream/ frozen desserts; Concept of antifreeze protein/ice structuring protein in ice cream

Module 3

QUALITY ASSURANCE AND QUALITY MANAGEMENT TOOLS (10 Marks)

Concept of quality assurance and quality control in relation to dairy industry; Quality management systems - good manufacturing practices (GMP); HACCP certification; ISO

9001, ISO 22000, FSSC, total quality management (TQM); Lean and Six sigma, Five –S, Kaizen, Kanban and other quality tools; Good laboratory practices (GLP), laboratory accreditation. Role of international organisations such as ISO, IDF, CAC, AOAC, WTO and national organisations like BIS, FSSAI, AgMark and APEDA in dairy industry, Quality Council of India (QCI), Export Inspection Council (EIC); Guidelines for setting up quality control laboratory and chemical safety aspects; sampling of milk and milk product; Food labelling guidelines.

Module 4

QUALITY ASSESSMENT METHODS

(10 Marks)

Calibration of milk testing glassware; Preparation of standard reagents; Detection of adulterants in milk and milk products; Quality of packaging material for dairy products; Instrumentation in analysis of milk and milk products. Agro-chemicals/veterinary drug residues; occurrence of pesticide residues, antibiotic residues, heavy metals etc. in dairy products and their testing methods, Laboratory auditing, Food traceability systems, Spectrophotometry: UV, visible, IR and flame photometry; Immuno based analytical techniques such as ELISA and Lateral flow assay. Chromatographic techniques: TLC, GLC, HPLC, gel-permeation, ion-exchange, affinity.

Module 5

MICROBIOLOGY OF FLUID MILK AND DAIRY PRODUCTS (15 Marks)

Common microbes in milk and their significance, Microflora of mastitis milk and its importance in dairy industry, Sources of microbial contamination of raw milk and their relative importance in influencing quality of milk during production, collection, transportation and storage; Clean milk production and natural antimicrobial systems in raw milk, Microbial changes in raw milk during long storage, Microbiological grading of raw milk. Microbiological aspects of processing techniques like bacto-fugation, thermization, pasteurization, sterilization, boiling, UHT, non-thermal processes (pulsed electric field) and membrane filtration of milk; Role of psychrotrophic, mesophilic thermophilic and thermotolerant bacteria in spoilage of processed milks, their sources and prevention; Heat induced damage in bacteria and role of resuscitation in recovery of injured microbial cells. Microbiological standards (BIS/ FSSAI) of heat-treated fluid milks. Microbiological quality of dairy products; fat rich (cream and butter), frozen (ice cream), concentrated (evaporated and condensed milk), dried milks (roller and spray dried), infant dairy foods and legal

standards; Sources of contamination and factors affecting microbial quality of these products during processing, storage and distribution; Microbiological defects associated with these products and their control. Food poisoning- Food intoxications, Food infections and Toxi-infections, pathogens associated with fluid milks, dairy products and their public health significance; Sources of pathogens and their prevention;

Module 6

MICROBIOLOGY OF PROCESSED DAIRY FOODS

(15 Marks)

Microbial ecology of processed foods and food ecosystem, factors influencing microbial growth in foods; High temperature food preservation, factors affecting heat resistance in microorganisms, thermal destruction of microorganisms, low temperature food preservation, food preservation by irradiation, food preservation by drying and fermentation, modern processing techniques-ohmic heating, high pressure processing, infra-red heating, cold plasma, pulsed electric field, ultra sound etc., bio preservation of foods - concepts: metabolites of lactic acid bacteria; Bacteriocins, Antifungal substances etc., protective cultures and other antimicrobials (herbs, spices and other natural antimicrobial compounds), Nanoscience in food preservation; microencapsulation. Microbial stress response in the food environment; Stress adaptation, sublethal stress and injury, antibiotic resistance in food bacteria, predictive modelling for food spoilage, industrial strategies for ensuring safe foods, HACCP; GMP, GHP. Antimicrobial packaging; concepts and development, modified atmosphere packaging (MAP), intermediate moisture foods (IMF), and hurdle technology in processed foods.

Module 7

DAIRY STARTER CULTURES

(10 Marks)

Classification of starters: Single, mixed and multiple strain, mesophilic and thermophilic starter cultures; propagation and preservation of starter cultures; factors affecting propagation of starter, functional starters producing exopolysaccharides, vitamins and antimicrobial compounds, commercial starter preparations: concentrated and super concentrated starters; Production systems for bulk cultures: Lewis, Jones and Tetra-pack systems; growth media: nutritional requirements of lactic acid bacteria, growth media formulations; PIM/PRM, Ph control during culturing- external and internal pH control systems; preservation of bulk starter cultures- frozen and freeze dried, spray dried cultures;

direct vat starter cultures. Growth inhibition of lactic acid bacteria by antibiotics, bacteriocins, bacteriophages, cleaning and sanitizing agents and naturally occurring antimicrobial systems in raw milk;

Module 8

MICROBIOLOGICAL SAFETY AND QUALITY

(10 Marks)

Principles of quality and safety functions in dairy processing unit: Introduction to ISO standards– ISO: 9000:2000; ISO: 9004:2000; ISO: 9001:2000: Brief concept and principles of QMS and standard requirements for certification HACCP, Hazard Analysis and Risk-Based Preventive Controls (HARPC), SAFE, GMP, SSOP, FSMS, personnel hygiene and food handling in dairy industry. Principles of safety in a food microbiological laboratory- Bio-safety concept, Biosafety level-1-4 containment design and layout; Standard microbiological practices for safe handling in food laboratory, safety equipment, facility design. Conventional and rapid methods for detection of safety indicators; definition, selection criteria of indicator Organisms as an index of food safety; Conventional detection methods for detection of pathogenic organisms as per ISO protocol specified by FSSAI – Staphylococcus aureus; Bacillus cereus; Pathogenic E. coli; Salmonella; Shigella; Listeria monocytogenes; Enterobacter sakazakii; Sulphite reducing clostridia (SRC), Campylobacter jejuni; Rapid techniques like–VIDAS, SPR, RT-PCR including commercial kits, for monitoring safety indicators.

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.