

DIPLOMA IN DAIRY TECHNOLOGY

Semester wise Distribution of Courses

I Semester		
Basic Courses	Course No.	Credit hours
Physics	PHY-111DD	3 +1
Chemistry	CHM-111DD	3 +1
Mathematics	MAT-111	3 +1
Introduction to English Grammar & Soft Skills	ENG-111DD	2 +1
Basics of Computer Science	CS-111	2 +1
Introduction to Dairying	DX-111	2 +0
Physical Education	PE-101	0+1
Total		20
II Semester		
I Semester Courses of B.Tech (DT)		
Physical Chemistry of Milk	DC-121D	2+1
Milk Production Management and Dairy Development	ES-121D	2+1
Engineering Drawing	DE-123D	0+2
Workshop Practice	DE-121D	1+1
Fluid Mechanics	DE-122D	2+1
Economic Analysis	ES-121D	2+1
Fundamentals of Microbiology	DM-121D	2+1
Environmental Studies	EN-121D	2+1
Physical Education	PE-102	0+1
Total		22
III Semester		
II Semester Courses of B.Tech (DT)		
Market Milk	DT-211D	3+1
Introductory Dairy Microbiology	DM-211D	2+1
Heat and Mass Transfer	DE-211D	2+1
Chemistry of Milk	DC-211D	2+1
Thermodynamics	DE-212D	2+1
Electrical Engineering	DE-213D	2+1
Biochemistry and Human Nutrition	BC-211D	2+1
Physical Education	PE-201	0+1
Total		22
IV Semester		
Fat rich and Indigenous Dairy Products	DT-221D	3+1
Cheese, Fermented Products and By-products	DT-222D	3+1
Market Milk Process Equipments	DE-221D	3+1
Chemistry of Milk Products	DC-221D	3+1
Microbiology of Milk and Other Foods	DM-221D	3+1
Financial Accounting	ES-221D	2+1
Physical Education	PE-202	0+1
Total		23
V Semester		

Ice-cream and Frozen Dairy Products	DT-311D	3+1
Condensed and Dried Milks	DT-312D	3+1
Dairy Products Equipments	DE-311D	3+1
Chemical Quality Assurance	DC-311D	3+1
Microbiological Quality Assurance	DM-311D	3+1
Extension Communication & Dairy Entrepreneurship Management	DX-311D	2+1
Total		23
VI Semester		
In-Plant Training		0+25

Discipline wise Distribution of Courses

Basic Courses

Physics	3 +1
Chemistry	3 +1
Mathematics	3 +1
Introduction to English Grammar & Soft Skills	2 +1
Basics of Computer Science	2 +1
Introduction to Dairying	2 +0

Dairy Technology

Market Milk	3+1
Fat rich and Indigenous Dairy Products	3+1
Cheese, Fermented Products and By-products	3+1
Ice-cream and Frozen Dairy Products	3+1
Condensed and Dried Milks	3+1

Dairy Engineering

Engineering Drawing	0+2
Workshop Practice	1+1
Fluid Mechanics	2+1
Heat and Mass Transfer	2+1
Thermodynamics	2+1
Electrical Engineering	2+1
Market Milk Process Equipments	3+1
Dairy Products Equipments	3+1

Dairy Chemistry

Physical Chemistry of Milk	2+1
Chemistry of Milk	2+1
Biochemistry and Human Nutrition	2+1
Chemistry of Milk Products	3+1
Chemical Quality Assurance	3+1

Dairy Microbiology

Fundamentals of Microbiology	2+1
Introductory Dairy Microbiology	2+1
Microbiology of Milk and Other Foods	3+1
Microbiological Quality Assurance	3+1

Dairy Economics

Milk Production Management and Dairy Development	2+1
Environmental Studies	2+1
Economic Analysis	2+1
Financial Accounting	2+1
Extension Communication & Dairy Entrepreneurship Management	2+1

SYLLABUS FOR

DIPLOMA IN DAIRY TECHNOLOGY

SEMESTER - I

PHY-111 DD (Physics)

(3+1)

Theory

Unit I: Units of Measurement - Units of measurement; systems of units; SI units, fundamental and derived units. Length, mass and time measurements; accuracy and precision of measuring instruments; errors in measurement; significant figures. Dimensions of physical quantities

Unit II: Kinematics and motion - Motion in a straight line: speed and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity. Acceleration, Scalar and vector quantities Force. Inertia, Newton's laws of motion; momentum, ; impulse, torque, angular momentum Equilibrium of concurrent forces. Static and kinetic friction, laws of friction, rolling friction, lubrication.

Unit III: Work, Energy and Power - Work done by a force, energy, power; kinetic and potential energy; law of conservation of energy

Unit IV Properties of Bulk matter - Elastic behaviour, Stress-strain relationship, Hooke's law, Young's modulus, Pressure due to a fluid column; Pascal's law and its applications

Unit V Optics and sound - Light – reflection, refraction, velocity of light; refractive index; scattering of light, diffraction, Convergence and divergence of light, Nature of sound and its propagation, speed of sound, ultrasound; reflection of sound; echo and sonar.

Unit VI Electrostatics and electric current - Electric charges and their conservation.

Coulomb's law Electric field, Electric potential, potential difference Conductors and insulators Electric current and resistance, Ohms law

Unit VII Magnetism and electro magnets - Concept of magnetic field, Field lines Field due to a current carrying wire. Field due to current, carrying coil or solenoid. Electromagnets and Permanent magnets. Force on current carrying conductor Fleming's left hand rule. Farady's

Law, Inductance, Induced potential differences, induced current.

Practicals

Measurement of diameter of a small spherical/cylindrical body using Vernier callipers. Measurement of internal diameter and depth of a given beaker/calorimeter using Vernier callipers and its volume. Measurement of diameter of a given wire using screw gauge. Measurement of thickness of a given sheet using screw gauge. Determination of weight and density of given bodies. Determination of refractive index. Determination of the surface tension of water by capillary rise method. Determination of the coefficient of viscosity of a given viscous liquid by measuring the terminal velocity of a given spherical body. Measurement of resistance, voltage (ac/dc), current (ac) and check continuity of a given circuit using multimeter.

CHM-111DD (Chemistry)

(3+1)

Theory

Unit I: Some Basic Concepts of Chemistry - General Introduction: Importance and scope of chemistry. Concept of elements, atoms and molecules. Atomic and molecular masses. Mole concept and molar mass; percentage composition and empirical and molecular formula; chemical reactions

Unit II : Solutions - Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties – relative lowering of vapour pressure, Raoult's law, elevation of B.P., depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass, Vant Hoff factor.

Unit III: Organic Chemistry – Some Basic Principles and Techniques - General introduction, methods of purification, qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds.

Classification of Hydrocarbons. Aliphatic Hydrocarbons:

Alkanes – Nomenclature, isomerism, conformations (ethane only), physical properties, chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis. Alkenes – Nomenclature, structure of double bond (ethene), geometrical isomerism, physical properties, methods of preparation; chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition.

Aldehydes and Ketones - Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses.

Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

Unit IV: Biomolecules - Carbohydrates – Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D-L configuration, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen): importance.

Proteins - Elementary idea of a - amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes.

Hormones –Elementary idea (excluding structure). Vitamins – Classification and functions.

Nucleic Acids: DNA and RNA

Unit V: Chemistry in Everyday Life

Chemicals in medicines – analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.

Chemicals in food – preservatives, artificial sweetening agents, elementary idea of antioxidants. Cleansing agents – soaps and detergents, cleansing action.

Practicals

Cutting glass tube and glass rod. Bending a glass tube. Drawing out a glass jet. Boring a cork. Using a chemical balance. Preparation of standard solution of oxalic acid. Determination of strength of a given solution of sodium hydroxide by titrating it against standard solution of oxalic acid. Preparation of standard solution of sodium carbonate. Determination of melting point of an organic compound. Determination of boiling point of an organic compound. Determination of pH of some solutions obtained from fruit juices, solutions of known and varied concentrations of acids, bases and salts using pH paper or universal indicator. Comparing the pH of solutions of strong and weak acid of same concentration. Study the pH change in the titration of a strong acid with a strong base using universal indicator. (b) Study of pH change by common-ion effect in case of weak acids and weak bases. Acidity determination of different samples of the tea leaves. Analysis of fruit and vegetable juices for their acidity. Separation of pigments from extracts of leaves and flowers by paper chromatography and determination of R_f values. Characteristic Tests of Carbohydrates,

Fats and Proteins in Pure Samples and their Detection in given food stuffs.

MAT-111 (Mathematics)

(3+1)

Theory

Trigonometric Functions: Introduction of trigonometric functions, angles, expressing sin and cos, trigonometric equations, introduction to inverse trigonometric functions

Complex Numbers and Quadratic Equations: complex numbers; quadratic equations, algebra of complex numbers, quadratic equations, square-root of a complex number.

Binomial Theorem: Introduction, binomial theorem for positive integral indices, general and middle term, simple applications.

Limits and derivatives: Introduction, intuitive idea of derivatives, limits, derivatives, derivative of sum, difference, product and quotient of functions, derivatives of polynomial and trigonometric functions.

Matrices: Introduction of matrices, types and operations of matrices, transpose of matrices, transformation of a matrix, invertible matrices.

Continuity and Differentiability: Continuity, differentiability, concepts of exponential and logarithmic function, brief introduction of order derivatives.

Integrals: Integration as inverse process of differentiation, methods of integration, integration of a variety of functions by substitution, basic properties of definite integrals.

Differential equations : Definition, order and degree, general and particular solutions of a differential equation.

Vectors: Vectors and scalars; types of vectors, position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, scalar (dot) product of vectors, cross product of vectors.

Statistics: definition of statistics, mean, mode, median, measures of dispersion, range, mean deviation, variance and standard deviation, analysis of frequency distribution.

Probability: probability, conditional probability, multiplications theorem on probability, independent events, total probability, random variable and its probability distribution, repeated independent (Bernoulli) trials and Binomial distribution.

Practicals

Tutorial on trigonometric equations; tutorial on algebra of complex numbers and quadratic equations; tutorial on derivatives of polynomial and trigonometric functions, operations of matrices; analysis of frequency distribution, Tutorial on integrals and differential equations; solving simple statistical and probability problems using mean, mode, median and probability.

ENG-111DD (Introduction to English Grammar & Soft Skills) (2+1)

Theory

Parts of Speech. Composition – analysis, transformation and Synthesis. Correct Usages. Structures. Written Composition – Case Writing & Letter Writing. Comprehension. Precis Writing. Essay Writing. Public Speaking – extempore, prepared, debate, group discussion. Group dynamics and Team work

Practicals

CS -111 (Basics of Computer Science) (2+1)

Theory

Unit I: Introduction to Computers. Basic applications of computer. Computer organization and its components - Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output devices, Computer Memory. Hardware and software concepts and Terminologies - Introduction about Operating Systems. Introduction about Programming languages. Database concepts - definition – different types – hierarchical, network and relational databases.

Unit II: Introduction to commonly used MS Office application softwares – MS Word, Power Point, Excel. Introduction to management information systems concepts, development of MIS of dairy industry. Basic of Computer networks; LAN, WAN; Application of modern Information Communication Technologies (ICT) tools/software in Dairy Industry.

Unit III: Concept of Internet; Applications of Internet; Connecting to Internet; World Wide Web (WWW); Web Browsing softwares, Search Engines; Understanding URL; Domain name; IP Address. Introduction about HTTP and HTML. Introduction to Blogs and web page development. Basics of Electronic mail; Instant Messaging and Chatting. Video/Tele Conferencing Basics, requirements, applications and Its Potential Use.

Practicals

Understanding the Parts and Components of Computers. Practicing computer assembly and its components. Use of word processing software for creating reports and presentation. Use of Power point presentation software for creating reports and presentation. Use of Excel software for creating reports and presentation. Exploring the Internet: Web Browsing/ Searching etc. Preparation and presentation of Multimedia files. Familiarization with the application of computer in dairy industries: Milk plant, Dairy units. Familiarization with software related to dairy industry.

DX-111 (Introduction to Dairying) (2+0)

Theory

Unit I: Dairying: Genesis of Dairying, Dairy Education & Research in India, Importance of Dairying, Dairying in National and Global Context, Dairying in rural and urban scenario, Traditional v/s Commercial Dairying, Issues & challenges of dairy farming /Dairy Industry in India.

Unit II: Dairy Development Programmes: Concept, Genesis and Initiatives of Dairy Development Programmes in India. Five year plans and dairy development in India. Past and Present Dairy Development Programmes. Dairy Development Institutions and Organisations, Dairy Cooperatives- Basic Principles, Structure and Functions.

Unit III: Conceptual Orientation to Dairy Science Disciplines / Branches. Milk Production and Milk Processing, Milk Procurement and Milk Marketing, Dairy Industry, Structure and Functioning.

SEMESTER – II

DC- 121D Physical Chemistry of Milk (2+1)

Theory

Constituents and gross composition of milk of different species and breeds of milch animals, Colloidal State : Distinction between true and colloidal solution, lyophilic & lyophobic solution, properties of colloidal system. Properties of colloidal systems, Gels-their formation and properties. Milk as a colloidal system and its stability. Elementary idea about emulsion. Density : Density and specific gravity, pycnometer method, hydrometer lactometer. Density and specific gravity of milk, effect of various processing variables on the density and specific gravity of milk. Liquid State : Surface tension, surface energy interfacial tension. Surface tension of mixtures. Surface tension of milk and the factors affecting it. Viscosity- Definition of viscosity, Newtonian and Non-Newtonian liquids, Stokes Law, influence of temperature and concentration of solute on viscosity. Viscosity of milk, evaporated milk and condensed milk. Refractive index. Colligative Properties of Dilute Solution : Vapour pressure, Raoult's Law, Depression of freezing point, Elevation of boiling point. Freezing point and boiling point of milk. Osmosis and Osmotic pressure. Inter-relation of colligative properties.

Aqueous solution of Electrolytes : Electrolytes ; non-electrolytes, ionic mobility, electrical, Ostwald Dilution Law, Kohlrausch Law, Electrical conductance of milk. Ionic Equilibria : Dissociation of water, ionic product of water, concept of pH and pOH and their scale. Acids and bases : Bronsted Lewis concepts of acids and bases, dissociation constants of acids and bases. Salt-their hydrolysis. Buffer solutions. Derivation of Henderson – Hasselbach equation and its application, buffer capacity and buffer index, milk as a buffer system. Equilibrium of electrolytes. pH indicators. Oxidation- Reduction : Redox potential, Nernst equation, electrochemical cells. Hydrogen, glass and calomel electrodes. Redox system of milk. Nuclear Chemistry : The nature of isotopes, radio isotopes. Half life period of radio isotopes. Some of the important radio isotopes. Occurrence of radio nuclide in milk & milk products. Molecular Spectroscopy : The spectrum of electromagnetic radiation, the laws of Lambert and Beer, visible, and ultra-violet Spectroscopy. Mention of mass, NMR spectroscopy.

Practicals

Determination of density and specific gravity of milk using pycnometer, hydrometer and lactometer. Determination of viscosity of milk using Ostwald viscometer. Determination of surface tension of milk using Stalagmometer. Interfacial tension between water-oil phase. Determination of freezing point of milk. Preparation of a buffer solution. Determination pH of buffer solution and milk electrometrically. Determination of acidity of milk electrometrically. Determination of electrical conductance of milk. Determination of redox potential of milk. Coagulation of milk using electrolytes. Determination of refractive index of skim milk and whey. Titration of amino acid in the presence and absence of formaldehyde. Determination of PKa1 PKa2 and PL. Verification of Lambert Beer Law.

ES-121D Milk Production Management & Dairy Development (2+1)

Theory

Introduction to Animal Husbandry. Five year plans and dairy development in India. Indian and exotic breeds of dairy animals, their distinguishing characteristics and performance. Traditional Systems of cattle keeping, estimates of milk production, utilization and sale; cattle & buffalo population and its distribution; trends in population growth, annual milk production and per capita availability; productivity profile of indigenous dairy stock, industrial by-products of livestock industry. Systems of breeding methods of selection of dairy animals. Systems of housing of dairy animals. General dairy farm practices- identification, dehorning, castration, exercising, grooming, weighing, . maintenance of hygiene and sanitation at dairy farm premises. Digestive system of ruminants. Measures of feed energy. Nutrients requirements for growth and milk production. Feeding standards. Common feed resources and their nutritive values. Introduction to fodder crops. Types of soil and commonly cultivated fodder crops/grasses. Anatomy and functions of male and female reproductive system. Semen collection, evaluation and processing. Estrous cycle. Ovulation, fertilization, gestation, parturition. Care of neonates and cal management. Artificial insemination and embryo transfer and their role in animal improvement. Introduction to advanced reproductive technologies. Structure and function of mammary system. Milk secretion and milk let-down. Management of lactating and dry cows and buffaloes. Methods of milking, milking procedure and practices for quality milk production. Common diseases in dairy animals, their prevention and control. Dairy farm records and their maintenance. Introduction to bio-techniques in dairy animal production.

Practicals

Handling and restraining of dairy animals. External body parts and judging of cows and buffaloes. Feeding and management practices of calves. Identification of common feeds and fodders. Preparation of rations for adult animals. Milking of dairy animals and cleaning and sanitation of milking equipments. Identification of reproductive and digestive organs. Demonstration of semen collection, processing and artificial insemination.

DE- 123D (Engineering Drawing) (0+2)

Theory

Drawing of lines, lettering and dimensioning types of lines, types, types of lettering, types of dimensioning. Drawing of scales. Plain scale, diagonal scale, comparative scale and Vernier scale. Drawing of projections; Orthographic projections, methods of projections. Drawing of screw threads; Types of threads and terminologies used in lit. Screw fastening: Types of nuts, types of bolts, stud, locking arrangements for nuts and Foundation bolt. Drawing of rivets and riveted joints forms of rivet heads, types of riveted; joints, failure of riveted joints. Drawing of welded joints: Forms of welds, location and dimensions of welds. Drawing of keys, cotter joint, pin joints types of keys, types of cotter joints, pin joints. Drawing of shaft couplings: Rigid couplings, loose couplings, flexible couplings universal coupling. Drawing of shaft bearings. Journal bearings, pivot bearings, collar bearings.

DE-121D (Workshop Practice) (1+1)

Theory

Introduction to workshop practice, safety, care and precautions in workshop. Wood working tools and their use, Carpentry and pattern making. Mould material and their applications. Heat treatment processes: hardening, tempering, annealing, normalizing etc. Metal cutting. Soldering & Brazing, Electric arc welding, Gas welding. Smithy and forging operations, tools and equipment. The bench : Flat surface filing, Chipping, Scraping Marking out, Drilling and Screwing. Use of jigs and fixtures in production. Introduction to following machine tools : (a) Lathe (b) Milling machine (c) Shaper and planer (d) Drilling and boring machines (e) Grinder (f) CNC machines

Practicals

Simple exercises in Filing and Fitting, Chipping and Hack sawing, Chiseling, Tapping and Smithy practice, Simple exercises in Arc, Gas, & Argon welding. Simple exercises in Soldering, Brazing, Basic joints in carpentry

DE-122D (Fluid Mechanics) (2+1)

Theory

Units and dimensions, Properties of fluids. Static pressure of liquids: Hydraulic pressure, absolute and gauge pressure, pressure head of a liquid. Pressure on vertical rectangular surfaces. Compressible and non compressible fluids. Surface tension, capillarity. Pressure measuring devices, simple, differential, micro, inclined manometer, mechanical gauges, Piezometer. Floating bodies: Archimedes principle, stability of floating bodies. Equilibrium of floating bodies. Metacentric height. Fluid flow: Classification, steady uniform and non uniform flow, Laminar and turbulent, continuity equation, Bernoulli's theorem and its applications. Flow through pipes: Loss of head, determination of pipe diameter. Determination of discharge, friction factor, critical velocity. Flow through orifices, mouthpieces, notches and weirs, Vena contracta, hydraulic coefficients, discharge losses, Time for emptying a tank. Loss of head due to contraction, enlargement at entrance and exit of pipe. External and internal mouthpieces, types of notches, rectangular and triangular notches, rectangular weirs. Venturimeters, pitot tube, Rota meter. Water level point gauge, hook gauge. Dimensional analysis: Buckingham's theorem application to fluid flow phenomena. Froude Number, Reynolds number. Weber number and hydraulic similitude. Pumps: Classification, reciprocating, centrifugal pump. Pressure variation, work efficiency. Types of chambers, selection and sizing.

Practicals

Study of different tools and fittings. Plotting flow rate versus pressure drop with U-tube manometer. Verification of Bernoulli's theorem. Determination of discharge coefficient for venturi, Orifice, V-Notch. Verification of emptying time formula for a tank. Determination of critical Reynold's number by Reynold's apparatus. Study of reciprocating, centrifugal and gear pump. Calibration of Rota meter. Study of different types of valves. Problems on following topics: Pressure, capillarity and surface tension. Floating bodies, Liquid flow, venturimeter, orifice, weir, flow through pipes, pumps.

ES-121D**(Economic Analysis)****(2+1)****Theory****Micro- Economics**

Basic concepts-wants, goods, wealth, utility, consumption, demand and supply.

Consumer behaviour-law of diminishing marginal utility and equi-marginal utility, cardinal and ordinal utility approach for consumer's behaviours.

Theory of demand-law of demand, demand schedule, demand function, determinates of demand, individual consumer demand and market demand, demand forecasting, elasticity of demand, price elasticity, income elasticity and cross elasticity, Consumer's surplus.

Theory of production- concepts of firm and industry, basic factors of production and their role, production function for a single product, nature of production function, laws of returns.

Concepts of costs-fixed and variable costs, short run and long run costs, average and marginal costs, economics and diseconomies of scale, break even analysis

Concept of market- types of market, pricing and output under different market situations, market price and normal price, price determination under perfect Competition, monopoly, oligopoly and monopolistic competition.

Macro – Economics: National income – GDP, GNP, NNP, disposable personal Income, per capita income, inflation.

Economic features and characteristics of dairy sector in India. Dairy development strategy with special emphasis in post- independence era and Operation Flood Programme

Practicals

Demand Schedule & Supply schedule. Law of diminishing utility. Production Function. Law of diminishing returns. Computation of elasticity's. Cost of milk production & processing. Computation of Depreciation. Break even analysis. Project Appraisal

DM-121D**(Fundamentals of Microbiology)****(2+1)****Theory**

Microbiology: history and scope; contributions of Leeuwenhoek, Pasteur and Koch. Principle of microbiology: Light Microscopy (Bright field, dark field, phase contrast, fluorescence); preparation and staining of specimens; electron microscopy. Microbial taxonomy: principles; numerical taxonomy; major characteristics used in taxonomy; classification according to Bergey's manual of systematic bacteriology. Structure and functions of prokaryotic cells; difference between prokaryotes and eukaryotes. Microbial growth and nutrition: the growth curve; factors affecting growth of microorganisms, estimation of bacterial growth; bacteriostatic and bactericidal agents; the common nutrient requirements and nutritional types of microorganisms. Bacterial genetics; DNA as the genetic material; structure of DNA; bacterial mutations (spontaneous and induced); genetic recombination- (transformation, transduction, conjugation). Micro flora of air, soil and water: methods for controlling microorganisms in air; water as carrier of pathogens.

Practicals

General instruction for microbiological laboratory. Microscope- simple and compound; Microbiological equipments; autoclave, hot air oven, incubator, centrifuge, colorimeter, laminar airflow, membrane filter. Simple staining- methylene blue; crystal violet; negative staining. Differential staining (Gram, spore, acid fast). Mortality of microorganisms; hanging drop technique. Measurement of microorganisms by micrometry. Preparation of commonly used growth media liquid and solid: simple and differential media. Isolation technique for microorganisms- Streak & pour plate Enumeration of microorganisms in air and soil. Enumeration of microorganisms in water: total viable count, coliform (MPN).

EN-121D

(Environmental Studies)

(2+1)

Theory

Environmental Science: An introduction, Ecosystem: kinds, structure, characteristics, functioning, Biochemical cycles, Natural resources and their managements, Environmental pollution, Air pollution, Water pollution, Solid waste pollution, Noise pollution, Soil pollution, Radio active pollution, Food processing industry waste and its management, Management of urban waste water, Recycling of organic waste, Recycling of factory effluent, Control of environmental pollution through low, Composting of biological waste and Sewage, uses of water disposal effluent treatment, microbial examination.

Practicals

Environment and its analysis, Water quality parameters, collection of sample for pollution study, Determination of pH/acidity/alkalinity from sample, Estimation of dissolved oxygen, Estimation of BOD, Estimation of COD, Estimation of nitrates, Estimation of phosphates, Estimation of pollutant elements, Estimation of heavy/toxic elements, Estimation of lead/mercury, Visit to industrial sewage disposal unit.

SEMESTER – III

DT-211D

(Market Milk)

(3+1)

Theory

Market milk industry in India and abroad: Distinctive features of tropical dairying as compared to those of the tropical climate of developed countries. Collection and transportation of milk; a) Organization of milk collection routes b) Practices for collection of milk, preservation at farm, refrigeration, natural microbial inhibitors, lactoperoxidase system.

c) Microbial quality of milk produced on farm. Effect of pooling and storing on microbial quality of refrigerated milk. Role of psychrotrophs, Role of tropical climate on spoilage of milk

d) Chemical tests for grading raw milk. e) Microbiological tests for grading raw milk. Reception and treatment (pre-processing steps) of milk in the dairy plant: a) Reception, chilling, clarification and storage: General practices. b) Homogenisation: Definition, pretreatments, theories, synchronization of homogenizer with operation of pasteurizer (HTST) c) Effect of homogenization on physical properties of milk. d) Bactofugation: Theory and microbiology.

Thermal processing of milk: a) Principles of thermal processing: kinetics of microbial destruction, thermal death curve, Arrhenius equation, D value, Z value, F₀ value, Q₁₀ value. b) Factors affecting thermal destruction of microorganisms. c) Definition and description of processes: Pasteurization, thermisation, sterilization, UHT Processing. d) Microbiology of pasteurised milk, thermised, sterilized & UHT milk. e) Product control in market milk plant. f) Defects in market milk. g) Manufacture of special milks: toned, doubled toned, reconstituted, recombined, flavoured, homogenized vitaminised and sweet acidophilus milk. h) Manufacture of sterilized milk. i) Distribution systems for market milk.

Quality and safety aspects in dairy/food chain, good manufacturing practices (GMP) in dairy processing. UHT processing of milk : a) Relevance of UHT processing in the tropical climate b) UHT plants: Description. Direct, Indirect, with upstream and downstream homogenization, third generation UHT plants. c) Aseptic packaging, types and systems of packaging, sterilizing packages, filling systems. d) Technical control in the UHT plant. Training of personnel. Plant hygiene. e) Shelf life of UHT milk and tests for UHT milk. Nutritive value of milk. Effect of heat processing on nutritive value. Efficiency of plant operation: product accounting, setting up norms for operational and processing losses for quantity, fat and SNF, monitoring efficiency. Maintaining plant hygiene & HACCP. Cream: Types of cream separation, principles of centrifugal separation, efficiency of cream separation; Types of creams and legal standards

Practicals

Familiarization with equipments for reception of milk in plant; Pre-treatments: Chilling, clarification, filtration. Standardization and numericals relating to it. Cream separation: parts of separator and the process. Operation of LTLT, HTST pasteurizer, laboratory steriliser. Sampling and chemical examination of pasteurized, sterilized and UHT processed milk. Sampling and routine microbiological examination of pasteurized and sterilized milk. Preparation of special milks; toned, double toned, standardised, flavoured, sterilized milks. Cleaning of storage tanks, cream separators, HTST plants; manual cleaning and CIP. Detection of adulterants and preservatives in milk. Assessment of homogenisation efficiency in milk. Strength of common detergents and sanitizers used in market milk plant. Production of cream, standardization, homogenization, pasteurization of cream. Production of table, coffee cream

DM-211D

(Introductory Dairy Microbiology)

(2+1)

Theory

Hygienic milk production system; microbial quality of milk produced under organized v/s unorganized milk sector in India and comparison with developed countries; microbial and non microbial contaminants, their sources and entry points in milk during various stages of production; Good Hygiene Practices (GHP) during milk production operations Microorganisms associated with raw milk; morphological and biochemical characteristics of important groups and their classification; significance of different groups of bacteria i.e. psychrotrophs, mesophiles, thermotolerants, and thermophiles in milk. Microbiological changes in bulk refrigerated raw milk; Impact of various stages like milking, chilling, storage and transportation on microbial quality of milk with special reference to psychrotrophic organisms; Direct and indirect rapid technique for assessment of microbial quality of milk. Role of microorganisms in spoilage of milk; souring, curdling, bitter cream, proteolysis, lipolysis; abnormal flavors and discoloration. Mastitis milk: Processing and public health significance, organisms causing mastitis, somatic cells secreted in milk; detection of somatic cell count (SCC) and organisms causing mastitis in milk. Milk as a vehicle of pathogens; Food infection, intoxication and toxic infection caused by milk borne pathogens like E. coli, Salmonella typhi, Staph aureus, Bacillus cereus etc. Antimicrobial substances in milk: immunoglobulin, lactoferrin, lysozymes, LP systems etc.

Practicals

Morphological examination of common dairy organism (size and shape, arrangement and sporulation). Enumeration of psychrotrophic, thermophilic, thermotolerant and spore forming bacteria in milk. Detection of sources of contamination: air, water, utensils, equipment and personnel line testing. Spoilage of milk caused by microorganisms souring, sweet curdling, gassiness, lipolysis, ropiness, proteolysis and discoloration. Detection of mastitis milks, pH, SLST, somatic cell count, chloride content, Hotis test, CAMP test. Detection and estimation of coliforms; presumptive test, rapid coliform count, IMVIC test. Detection of important pathogens using selective media; E.coli, Staphylococcus aureus Salmonella and Bacillus cereus. Estimation of microbial load in milk by SPC and Dye reduction tests-(MBRT, RRT). Detection of antibiotic residues using qualitative test

DE-211 D

(Heat & Mass Transfer)

(2+1)

Theory

Basic heat transfer process, thermal conductivity, convective film co-efficient, Stefan Boltzman's constant and equivalent radiation co-efficient, Overall heat transfer co-efficient, physical properties related to heat transfer. Working principles and application of various instruments for measuring temperature. One-dimensional steady state conduction: Theory of heat conduction, Fourier's law, Derivation of Fourier's equation in Cartesian co-ordinates, Linear heat flow through slab, cylinder and sphere.

Heat flow through slab, cylinder and sphere with non-uniform thermal conductivity. Concept of electrical analogy and its application for thermal circuits, Heat transfer through composite walls and insulated pipelines. One dimensional steady state heat

conduction with heat generation : Heat flow through slab, hollow sphere and cylinder with uniform heat generation, Development of equations of temperature distribution with different boundary conditions. Steady-state heat conduction with heat dissipation to environment :Introduction to extended surfaces (FINS) of uniform area of cross-section. Equation of temperature distribution with different boundary conditions. Effectiveness and efficiency of the FINS. Introduction to unsteady state heat conduction. Convection: Forced and free convection, use of dimensional analysis for correlating variables affecting convection heat transfer, Concept of Nusselt number. Prandtl number, Reynolds number, Grashoff number, Some important empirical relations used for determination of heat transfer coefficient. Heat Exchangers: General discussion, fouling factors, jacketed kettles, LMTD, parallel and counter flow heat exchangers, Shell and tube and plate heat exchangers, Heat exchanger design. Application of different types of heat exchangers in dairy and food industry. Fick's Law of diffusion, steady state diffusion of gases and liquids through solids. Equimolal diffusion. Mass transfer co-efficient and problems on mass transfer.

Practicals

Determination of thermal conductivity: milk, solid dairy & food products. Determination of overall heat transfer co-efficient of : Shell and tube, plate heat exchangers and Jacketed kettle used in Dairy & Food Industry. Studies on heat transfer through extended surfaces. Studies on temperature distribution and heat transfer in HTST pasteuriser. Design problems on heat exchangers. Study of various types of heat exchangers. Design problems on Mass Transfer.

DC-211D

(Chemistry of Milk)

(2+1)

Theory

Definition and structure of milk, factors affecting composition of milk, Nomenclature and classification of milk proteins, Casein: Isolation, fractionation and chemical composition, physico-chemical properties of casein, Whey proteins: Preparation of total whey proteins: α -Lactalbumin and β -Lactoglobulin. Properties of α - Lactalbumin and β - lactoglobulin, Immunoglobulin and other minor milk proteins and non proteins nitrogen constituents of milk, Hydrolysis and denaturation of milk proteins under different physical and chemical environments, Estimation of milk proteins using different physical and chemical methods, Importance of genetic polymorphism of milk proteins ,Milk enzymes with special reference to lipases, Xanthine Oxidase, phosphates, proteases and lactoperoxidase, Milk carbohydrates their status and importance. Physical and chemical properties of lactose, Sugar amine condensation, Amadori rearrangement, production of hydroxyl methyl furfural (HMF), processing related degradation of lactose, Definition, general composition and classification of milk lipids. Nomenclature and general structure of glycerides, factors affecting the fatty acid composition. Milk phospholipids and their role in milk products, Unsaponifiable matter and fat soluble vitamins, Milk Salts: Mineral in milk (a) major mineral (b) Trace elements, physical equilibria among the milk salts and Milk contact surfaces and metallic contamination.

Practicals

Sampling techniques of chemical examination of milk. Determination of pH and titratable acidity of milk. Determination of fat in milk by different methods. Determination of total solids and solids not fat in milk. Determination of total milk proteins by Kjeldahal method. Determination of casein, whey proteins and NPN in milk. Estimation of alkaline

phosphatase and lipase in milk. Determination of lactose in milk. Determination of ash in milk. Determination of phosphorus and calcium in milk. Determination of chloride in milk. Determination of temporary and permanent hardness of water. Estimation of available chlorine from bleaching powder.

DE-212D (Thermodynamics) (2+1)
Theory

Basic concepts: systems, processes, cycles, energy, The Zeroth Law of Thermodynamics. Ideal gases: Equation of state, Compression and expansion of gases. The first Law of Thermodynamics: Internal energy, enthalpy. The second Law of Thermodynamics: Thermodynamic temperature scale, Carnot cycle, entropy, reversibility, availability. Air Cycles: Otto, Diesel, dual efficiencies, Plotting the cycles on various thermodynamic planes viz., p-V, T-S, p-h diagram; etc. IC. Engines: Two stroke and four stroke cycles, construction, injection and ignition of fuel, Performance of IC engines. Fuels: Chemical properties, air for combustion, Calorific value and its determination, Burners, firing of fuels. Renewable energy sources. Properties of steam: Wet, dry saturated, superheated steam, Use of steam tables and Molier charts. Steam generators : Fire tube boilers, Water tube boilers. Boiler mountings and Boiler accessories. Draught : Natural, forced, fan, jet, Measurement of Height of chimney. Condensers. Layout of pipe-line and expansion joints. Boiler trial: Codes, Indian Boiler Regulation acts. Air Compressors: Reciprocating, Single and two stage air compressors.

Practicals

Application of thermodynamics in engineering problems. Study of 2-stroke engine and 4-strokes engines. Performance tests on I.C. engines. Determination of dryness fraction of steam. To study the boiler installed in Model Plant, Water softening plant, Lancashire boiler, Locomotive boiler, Babcock & Wilcox boiler, Electrode boiler, Boiler mounting and steam-line layout and steam traps. Visit to sugar mill/rice mill or plant with steam utilization. Study of Solar water heater and biogas plants and appliances.

DE-213D (Electrical Engineering) (2+1)

Theory

Alternating current fundamentals: Electromagnetic induction magnitude of induced E.M.F. Alternating current, R.M.S. value and average value of an alternating current. Phase relations and vector representation. A.C. series and parallel circuits, Concept of resonance, polyphase alternating current circuits, three-phase concept, Star and delta connections, star delta transformation, Energy measurement. Transformers: Fundamental of transformer, Theory, vector diagram without load and with load, Losses, voltage regulation and efficiency of transformer, auto-transformer. Alternators: Elementary Principles, Construction and different types of alternators, E.M.F. in alternators, circuit breakers. Induction motors: Fundamental principles, production of rotating fields, construction, Rotor winding-squirrel cage and phase wound rotors, Analysis of current and torque, starting of induction motors, Motor housing, selection of motor and its controls. D.C. Machines: Construction and operation of D.C. generator, Types of generators, various characteristics of generator, D.C. motors, torque- speed characteristics of D.C. motors, Starting and speed control of D.C. motors. Electric Power Economics: Maximum demand charge, Load factor and power factor correction. Measuring Instruments:

Classification of instruments, Elements of a generalized measurement system, static and dynamic characteristics.

Practicals

Study of voltage resonance in L.C.R. circuits at constant frequency; (a) Star connection-study of voltage and current relation (b) Delta connection-study of voltage and current relation. Measurement of power in 3-phase circuit; (a) For balanced loads

(b) For unbalanced loads, by wattmeter and energy meters. Polarity test, no-load test, efficiency and regulation test of single phase. Voltage and current relation in a 3-phase transformer of various kinds of primary and secondary connection systems. Starting of induction motor by the following starters : (i) D.O.L. (ii) Manual star- delta (iii) Automatic star-delta (iv) Manual auto-transformer. Starting of slip-ring induction motor by normal and automatic rotor starters. Test on 3-phase induction motor, determination of efficiency, line current, speed, slip, power factor at various outputs. Determination relation between the induced armature voltage and speed of separately excited D.C. generator. Magnetization characteristic of D.C. generator. Study the starter connection and starting reversing and adjusting speed of a D.C. motor. Study of various measuring instruments.

BC-211D (Biochemistry & Human Nutrition) (2+1)

Theory

Biochemistry: Enzymes Ribozymes, isozymes, allosteric enzymes, zymogens, regulatory, Classification and mechanism of enzyme action, Factors affecting rate of enzyme catalyzed reaction, enzyme inhibition, Enzymes coenzymes and co-factors immobilisation of enzymes, Nucleic acids and Bioenergetics : Structure and function, definition and composition. Structure of RNA & DNA-Anabolism and Catabolism of carbohydrates, lipids and proteins. Vitamins and Hormones : Structure & functions, general description. Relationship between vitamins and hormones in terms of their biological role. Elementary knowledge of milk synthesis in mammary gland.

Human Nutrition: Theory and definition, Scope of Nutrition: Functions of the various nutrients in body. Digestion, absorption and assimilation of nutrients. Comparative requirements and nutritional requirement of different age groups. (WHO and ICMR standard) Methods of evaluation of nutritive value of foods Nutritional value of cow, buffalo and human milk. Milk intolerance: lactose deficiency and protein hyper sensitivity. Safety aspects of food additives, toxic elements, radionuclides, pesticides and antibiotic residues in milk and milk products. Institutional feeding of workers. Planning and implementation of national food and nutrition policies and programme. Regulatory aspects of nutrition, IDF code on nutrition, nutrition facts under NLEA, Nutrient descriptors, serving size and nutritional claims.

Practicals

Biochemistry Estimation of alkaline phosphatase and the effect of temperature and pH on its activity. Estimation of catalases and the effect of temperature and pH on its activity. Determination of the Michealis constant of an enzyme. Estimation of RNA by colorimetric method Estimation of DNA by colorimetric method. Measurement of proteolysis. Lipolysis, Amylase activity.

Estimation of vitamin 'A; in ghee. Estimation of ascorbic acid in milk. Estimation of vitamin D in milk. Estimation of proteins by Lowry's method. Biuret method. Estimation of Lipids and Lipids analysis by TLC. Estimations of cholesterol in milk. Estimation of denaturation of proteins in heated milk by dye binding method. Estimation of HMF content in food.

SEMESTER – IV

DT-221D (Fat rich and Indigenous Dairy Products) (3+1)

Theory

Butter: history, legal standards, neutralization of cream, types of neutralizers and their effect on butter quality, ripening, churning, fat losses in buttermilk; types of churns; overrun, moisture control, defects in butter, packaging; manufacture of table butter

Ghee: production by different methods, quality of ghee, effect of clarification on quality of ghee, granulation and flavour production in ghee. Packaging of ghee, defects, shelf life of ghee; judging and grading of ghee.

Indigenous milk products: Status of indigenous dairy products. Heat desiccated milk products: khoa, basundi etc.; Acid coagulated products: chhana, chakka, shrikhand, dahi etc.; Indigenous milk based sweets: gulabjamun, rasogolla, sandesh and other popular delicacies. Fermented products: dahi, lassi. Frozen products: kulfi. Defects of indigenous dairy products, remedies and prevention.

Modern developments and improvements in the manufacture of indigenous dairy products.

Practicals

Neutralisation and ripening of cream; manufacture of butter, preparation of ghee by different methods, judging of butter and ghee, Preparation of khoa, chhana, chakka, paneer. Preparation of milk sweets: burfi, gulabjamun, rasogolla, sandesh, shrikhand and other sweets.

DT-222D (Cheese, Fermented Products and By-products) (3+1)

Theory

Fermented products: history and development, Production of yoghurt, acidophilus milk, Packaging of fermented products and by-products, Nutritive values and legal standards, History of cheese making, Legal standards, Classification and composition of common varieties of cheese, Technology of manufacture of cheddar, Gouda, Mozzarella, Cottage cheese, Processed cheese and cheese spread; Stabilizers and emulsifiers used in processed cheese; physical, chemical and bacteriological changes during ripening process; packaging and defects, Judging and grading of cheese.

By-products- Classification and characterization; use of whey, preparation of whey protein; manufacture of lactose, casein, caseinates and their use.

Practicals

Production of yoghurt and acidophilus milk, Production of Cheddar cheese, Gouda cheese, cottage cheese, Mozzarella cheese, processed cheese, cheese spread; packaging of cheese; judging and grading of cheese; preparation of lactic acid and rennet caseinates, calcium caseinate, whey protein concentrate, whey powder, lactose, whey drink.

DE-221D (Market Milk Process Equipments) (3+1)

Theory

Sanitary metal and features of sanitary designs, Stainless steel Pipes and Fitting, Receiving room equipments, Working and maintenance of mechanical can washers, Different types of milk chilling equipments and their application, constructional features of milk storage tanks, Principles of centrifugal separation, cream separators, self desludging clarifiers, bactofugation, Efficiency, capacity and maintenance of separators, Constructional features, operation and maintenance of batch and HTST, pasteurizers, accessories and controls, Equipment for milk sterilization and UHT processing, Homogenizers: constructional features, operation of maintenance of homogenizers and accessories, Milk sachet and aseptic filling machines and their maintenance, C.I.P cleaning systems

Practicals

Study the constructional features and operation of the following equipments - Mechanical can washer, Plate chiller, Milk storage tank, Cream separator, Homogenizers, Batch, pasteurizer, H.T.S.T Pasteurizer, FDV controller, Sachet filling machine.

DC-221D (Chemistry of Milk Products) (3+1)

Theory

Physicochemical changes in milk and milk constituents during heating, concentration and drying, effect on nutritional values

Cream: Creaming, Stokes Law, factors affecting creaming, standards

Butter: Structure of butter, mechanism of churning, defects in butter, flavour of butter, standards, packaging

Ghee: Composition characteristic fat constants, organoleptic properties. Genesis of flavour and texture. Hydrolytic and autoxidative spoilage of ghee and its prevention. Natural and synthetic antioxidants. Common adulterants and their detection, standards, packaging. Ghee residue.

Concentrated milk: Evaporated and sweetened condensed milk. Physico chemical aspects involved in the manufacture of evaporated milk as affected by process variables. Storage defects and their prevention, standards, packaging

Dried milk: Roller drying and spray drying instantisation. Physico-chemical aspects during processing. Storage defects. Standards, packaging

Coagulated products: Milk clotting enzymes from different sources –animals, microbial and plant. Rennet action, changes taking place during manufacture and ripening of cheese, types of cheese, packaging and standards

Fermented products: Varieties, changes in milk constituents during fermentation, flavour development nutritional and therapeutic value of fermented milk products, packaging, standards

Indigenous milk products: Khoa, Chhana, Paneer, Chakka, Srikhand, Peda, Burfi, Rasagolla, Basundi etc. composition, quality attributes and defects, packaging standards

Frozen Products: Composition of ice-cream and kulfi, role of different constituents and processing parameters (homogenization, whipping, over-run) in physical attributes of ice-cream and kulfi. Defects in ice-cream and kulfi, packaging, standards

Practicals

Cream: sampling and analysis of cream for fat and acidity

Butter: determination of moisture, fat, salt, curd and acidity

Ghee : determination of fat constants, melting point, refractive index, RM and Polenske values, saponification value, iodine value , determination of acidity and peroxide value

Concentrated milk: Sampling, determination of total solids, fat proteins, sucrose and lactose

Milk powder: sampling determination of moisture, total solids , fat, proteins, total solids, fat, protein, total ash, carbohydrates, lactate, solubility percent, insolubility index bulk density

Cheese: sampling. Determination of moisture, fat, protein, salt and acidity

Dahi : sampling, determination of total solids, fat and acidity

Indigenous products: sampling and analysis of khoa, channa, chakka, and paneer for moisture/total solids, fat and proteins

Ice-cream: sampling, determination of over-run, weight per litre acidity, fat, total solids, protein and sucrose

DM-221D (Microbiology of Milk and Other Foods) (3+1)

Theory

A. Microbiology of Milk - Sources of microbial contamination of milk and their importance, Milk –borne diseases, Important groups of spoilage of microorganisms and their manifestation in milk, Microbial growth in milk during storage and transport, Taints and abnormal conditions in milk, Principles of sanitation practices at all stages of production and processing, Bacteriology of heat –treated milks, Evaluation of bacteriological features of milks.

B. Microbiology of Foods - Classification of foods, Natural functional systems of food and their interactions on shelf life, Food processing compulsions and options, Types of food spoilage and their aetiology, Methods of limiting microbial proliferation in foods , Features of food fermentations as a desirable change, Evaluation of microbiological features of foods

Practicals

A. Microbiology of Milk - Sampling of milk for microbiological analysis, Application of rapid tests for evaluation of milk quality, Enumeration of bacterial numbers by direct and indirect methods, Methods used for determining psychrotropic organisms in milk, Assessment of pasteurized milk based on the following: standard plate count, E coli test, Phosphatase test, Thermoduric and thermophilic numbers, Evaluation of utensils and equipment for sanitation

B. Microbiology of Foods - Comparative study of raw and processed foods, Study of food enzymes in relation to their profiles at shelf life, Effect of storage temperature on shelf life of foods, Microbiology of vegetables, eggs, meat, flour, bread, cereals and spices, Role of salt, sugar, inorganic acids and alkalis in food preservation

ES-221D (Financial Accounting) (2+1)

Theory

Introduction: definition, objectives, common terms and different systems of accounting. Double entry system of book-keeping. Preparation of financial statements. Banking transaction-recording and bank reconciliation statements. Recording of transactions in cash

book, purchase book, purchase returns book and sales return book. Capital and revenue expenditure- classification. Depreciation. Final accounts with adjustments. Errors & corrections. Analysis of financial statements. Uses of financial information in decision-making.

Practicals

Ledger & trial balance, Cash book, Adjustments, Capital and revenue expenditure, Depreciation, Errors and corrections

SEMESTER – V

DT-311D (Ice-cream and Frozen Dairy Products) (3+1)

Theory

Status of ice-cream industry, Classification of frozen dairy products, Composition of ice-cream, BIS and FSSAI standards for ice-cream. Calculation of mixes, ice-cream ingredients, stabilizers and emulsifiers, flavouring and colouring materials, Mix processing, ice cream freezers, packaging and handling of ice-cream, Judging and grading of ice-cream, Fruit ice-cream, nut ice-cream, kulfi preparation, Frozen Yoghurt, characteristics and production, Defects in frozen products, prevention and remedies

Practicals

Selection of ingredients for ice-cream, calculation for mix preparation, Preparation of ice-cream and kulfi, Preparation of fruit ice-cream, Production of frozen yoghurt, Judging and grading of frozen dairy products, Packaging materials and packaging of frozen dairy products

DT-312D (Condensed and Dried Milks) (3+1)

Theory

Status of condensed and dried milk industry in India and abroad, Composition and legal standards of condensed milk and dried milk products, Technology of manufacture of sweetened condensed milk and evaporated milk, Defects, causes and remedies, Packaging and keeping quality of condensed and evaporated milk, Principle of drum drying, spray drying, foam drying, Manufacture of skim, whole, malted milk powders, Defects in dried milks and their causes, prevention, Packaging and storage, Instantised milk powder, infant food formulation and method of manufacture

Practicals

Vacuum pan operation, Operation of roller and spray driers, Production of sweetened condensed and evaporated milks, Production of roller dried milk powders, Production of spray dried skin milk powders, Judging and grading of condensed and dried milk products

DE-311D (Dairy Products Equipments) (3+1)

Theory

Equipments for indigenous dairy products, Equipments for fermented and coagulated dairy products, Ice cream freezers, batch types, Ice cream freezer continuous type, accessories, Butter churn, Equipments for condensed milk, vacuum pan, Classification of continuous evaporators, Multiple effect evaporator and accessories equipment for drying milk, roller drier, parallel and counter flow spray driers and their accessories, Plant layout and design, site selection, Factors concerning design and layout, Features of dairy floors and ventilation, Dairy waste treatment and methods of disposal

Practicals

Study the constructional features and operation of the following equipments - Equipment for manufacture of indigenous dairy products, Cheese equipment, Butter churn, Vacuum

pan, Multiple effect evaporator, Roller drier, Spray drier
To draw layouts for: Chilling centers, Market milk plant, Composite milk plant

DC-311D (Chemical Quality Assurance) (3+1)

Theory

Responsibility and organization of quality control department, general principles, Principles of Quality Control, Quality Assurance, Total Quality Management, HACCP, ISO 9001 and ISO 22000, Food laws and standards – FSSAI, BIS, AG Mark, IDF, Calibration- Calibration of dairy glassware lactometer, butyrometer, milk pipette and thermometer, Colour and glass- Natural and synthetic colours, specification of colour for dairy foods, Flavour: flavour , components in dairy foods, artificial flavours, Additives: stabilizers, emulsifiers, sweeteners, vitamins, minerals, amino acids/ protein hydrolysate, antioxidants, preservatives, neutralizers, colouring matter and flavouring agents, Packaging: packaging material for dairy foods types and properties, Contaminants: pesticides residues, heavy metals, toxins, antibiotics, detergents, sanitizers and contaminants for packaging materials, Sensory evaluation: general introduction, testing conditions, taste odour aroma, texture, appearance and other parameters, difference tests and ranking tests. Individual steps in selection of test subjects, Water: Analysis , treatment , Detergents and sanitation :types, properties and analysis , Elementary knowledge of instrumental analysis

Practicals

Calibration of milk testing equipments, butyrometer, lactometer, milk pipettes, thermometers etc , Sensory evaluation of dairy foods for colour, appearance, taste, odor, texture and acceptability- different tests and ranking tests, Estimation of temporary and permanent hardness of water, Estimation of alkalinities in detergent solutions, Estimation of available chlorine and iodine in sanitizers, Separation of dairy food colours by thin layer, chromatography (demonstration)

DM-311D (Microbiological Quality Assurance) (3+1)

Theory

Basic concepts of food biology: Their relation to quality assurance, Food class orientation to plant & animal origin. Problems associated with natural foods for human consumption, Role of microbial systems in conservation of raw foods for better utility. Food safety: traditional problem emerging problems. Regulatory systems/ agencies: Government/NGO/ /Professional/other agencies. Mandatory regulations like FSSAI etc, Optional advisory systems like BIS, AG Mark, IDF etc. Comparative standards for milk produce and milk based foods of countries pioneering in specified foods, Role of supporting services systems in quality food processing: Water, air, personnel, their health, hygiene and habits, Equipment design, material used, construction, finish, Maintenance and Hygiene, packing material, nature design and hygiene, Warehousing and condition of their maintenance, Shipping or transport systems & their handling. Food plant hygiene: Basic cleaning systems, detergent support and sanitizers. Their evaluation, food service labelling, Need for providing consumer guidance on the time limit for safe consumption, Consumer assessable methods for safety of canned foods, Sampling procedures for microbiological evaluation foods, Total quality

management (TQM) systems for food industry: Quality audit concepts (ISO-9000 etc.) a holistic growth from elementary quality control to quality assurance culminating in total quality system, Hazard analysis of critical control points (HACCP): HACCP an essential tool for supporting operation of TQM in food processing industries, Microbiological quality of milk and milk production: Historical to current state of art.

Practicals

Sampling procedure for microbiological evaluation of foods, Evaluation of foods for public health safety, Salmonella, Shigella, Staphylococci, Clostridia, Listeria, Bacillus Cereus, Campylobacter, Monitoring microbial density of air-environment of processing plants, Evaluation of microbiological quality of water for the processing plant, Assessment of hygiene of personnel working in the plant, Evaluation of equipment decision, material used construction, finish and maintenance for hygiene, Assessment of packaging material for hygiene, Assessment of warehouse and their maintenance of microbiological contamination, Evaluation on basic cleaning systems, detergents support and sanitizers, HACCP evaluation of manufacturing process, Assessment of microbiological quality of milk and milk products.

DX-311D (Extension Communication and Dairy Entrepreneurship Management) (2+1)

Theory

Unit I: Concept, philosophy, principles, genesis, growth and scope of extension education. Teaching learning process and its principles. Public and Private Extension Institutions, Dairy Extension programmes.

Unit II: Communication- Meaning, Concept and Models of Communication, Key elements of communication. Communication process and Methods, Feedback in Communication and Problems in Communication. Modern Information Communication Technologies (ICT) tools in Dairy Extension. Multi-media projection and computer aided teaching aids for dairy extension.

Unit III: Definition and Concept of Enterprise and Entrepreneurship. Characteristics, Approaches and Importance of Dairy entrepreneurship. Traits of entrepreneurs and types of entrepreneurs. Entrepreneurial and managerial characteristics. Institutions and Organizations for Entrepreneurship development. Entrepreneurship development programs; SWOT analysis. Government schemes and incentives for promotion of entrepreneurship.

Unit IV: Management – Concept, Principles, Functions of Management and Importance in Dairy context. Production management, concept, functions and structure of production management. Industrial relations, Personnel management and manpower planning. Job Specifications, job evaluation, job enhancement, job enrichment. Dairy Institutions and Organizations for Dairy management, Good Management Practices for Dairy Industry.

Practicals

Orientation to various communication tools & techniques and communication skills. Study of the organizational set-up and functioning of State Animal Husbandry Department and dairy/rural development agencies. Field visit to dairy enterprises - Study of characteristics of successful dairy enterprises and entrepreneurs. Profile study of Indian Dairy processing and export industries. Case study of Successful Dairy Entrepreneurs. Swot analysis of various Entrepreneurship development programmes. Understanding the functioning of dairy/development institutions – Dairy Cooperatives and critical evaluation of different dairy development programmes. Understanding the functioning of dairy industries, field visits to various mini & mega dairy.

