- DAIRY SCIENCE SYLLABUS

DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRYING

M.Sc. (Ag.) ANIMAL HUSBANDRY AND DAIRYING (DAIRY SCIENCE)

SEMESTERWISE COURSE STRUCTURE

SEMESTER	CREDIT HOURS	TOTAL
SEMESTER-I		
DSC 501: Market Milk.	**3(2+1)**	
DSC 502: Dairy Technology I	**3(2+1)**	
DSC 503 General Microbiology	**3(2+1)**	**12**
*DSC 511: Breeding and Reproduction Management	**4(3+1)**	
AST 501: Agricultural statistics	**3(2+1)**	
SEMESTER-II		
DSC 504: Dairy Technology II	**3(2+1)**	
DSC 505:Dairy Chemistry	**3(2+1)**	
DSC 510: Cattle and Buffalo Production Management	**3(2+1)**	**11**
*DSC512: Management of Sheep,Goat,Pig and Poultry	**4(3+1)**	
AST 503: Computer application	**2(1+1)**	
SEMESTER-III		
DSC 506: Rheology and Packaging of Milk and Milk Products	**3(2+1)**	
DSC 507:Dairy Plant Management	**3(2+1)**	**9**
DSC-508: Microbiology of Milk and Milk Products.	**3(2+1)**	
*DSC 513: Livestock and Poultry Housing Management	**4(3+1)**	
SEMESTER-IV		
DSC 509:.Dairy Quality Control	**3(2+1)**	
*DSC 514: Milk Secretion, Composition and Physical Properties	**4(3+1)**	**24**
*DSC 515: Utilization of milk by-products	**4(3+1)**	
DSC 516:Seminar- :	**1(0+1)**	
DSC 517:Thesis- :	**20**	
		56

*Special papers in lieu of thesis.

DSC 501: Market Milk: 3 (2+1)

Status of dairy industry in India. Operation flood program. Technology mission on dairying. National Milk Grid Marketing, their concepts, achievements, limitations and impact on dairy industry in India. Milk production trends and dairy development through successive national plans. Recent policy changes to dairy sector (MMPO/GATT) and their impact on dairy industry in the country.

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, double toned, reconstitute and recombined sterilized, flavoured and filled milk

Practical: Assembling and dissembling of cream separator and separation of milk. Study of parts of LTLT and HTST pasteurizers, refrigeration plants and preparation of report. Preparation of special milks like toned milk, double toned milk, chocolate milk, sterilized milk, flavoured and filled milk. Visits to milk plants and milk products factories and submission of the report. Numerical problems on the standardization of milk

DSC 502: Dairy Technology- I: 3 (2+1)

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 shelflife, 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.

Practical: Preparation of khoa, chhana and paneer and their judging for market quality. Cream separation, cleaning and sterilization of cream separators. Preparation of ghee and its judging. Calculations on ice cream mix. Preparation of ice cream and kulfi and their judging. Preparation of production reports of various milk products.

DSC 503: General Microbiology 3(2+1)

Introduction and scope of microbiology. Microbiology in relation to other science, application in relation to other living organisms, a brief study of historical development of microbiology. A general study with regard to the structure of yeast and moulds, algae, protozoa, actinomyceties and bacteriophase.

The bacterial cell, its size. shape, gross cell structure and composition, capsule membrane, protoplasm, nuclear material, cell aggregation in bacteria, colony formation, growth and physiological curve.

Bacterial variation and a general concept of bacterial genetics. Principles underlying staining methods. A general study of the taxonomy and classification of bacteria. Microscope its type and working.

Nutrition and nutritional requirement of bacteria, Metabolism of sugar, protein and fats. Growth, growth curve and factors (physical, chemical and biological factors) affecting the growth of bacteria. Bacteriological techniques and methods. Bacterial count by direct microscopic count and standard plate count methods.

PRACTICAL:

General familiarity with the equipment of a bacteriological laboratory, cleaning and sterilisation of laboratory glassware and other articles. Microscope, its construction, function of the different parts, use and care. Preparation of hanging drop culture and examining micro-organisms for motility. Preparation of dilution blanks and common media needed in dairy microbiological work and sterilisation of the same. Preparation of staining solution and other reagents needed in microbiological work. Staining methods; simple staining: gram staining, spore staining, staining of capsules, negative staining and acid fast *Measuring the size of micro-organisms. Sampling of milk for bacteriological purposes. Estimation of different types of bacteria in milk by various methods. Preparation and maintenance of pure cultures.

DSC 504: Dairy Technology- II: 3 (2+1)

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, Guada, Mozzerella, Swis, Cottage and Roquefort cheese. Role of starter culture in cheese quality. Status of calf and microbial rannets 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, Misti Dahi, Lassi, khefir, acidophilus and bifido milk.

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,EM and, 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.

Practical: Manufacture of Cheddar and cottage cheese and their judging for their market quality. Manufacture of Dahi,Yoghurt, Shrikhand, Lassi and Misti Dahi and their judging for their market quality. General study of evaporators. Numerical problems related to condensed milk.

DSC 505: Dairy Chemistry 3 (2+1)

Chemistry of Lactose- General description, Significance of lactose in milk and milk products. Chemical properties, fermentation of lactose, manifature 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.

Practicals: (i)Estimation of proteins in milk.

(ii)Estimation of lactose in milk by Fehlings solution and Iodometric

(iii) Estimation of ash

(iv) Estimation of Calcium, Phosphorus and magnesium.

(v) Estimation of total solids

(vi) Determination of casein, albumin,

DSC 506: Rheology and Packaging of milk products: 3 (2+1)

Rheology of Dairy Foods- Introduction to rheology to foods, physical consideration in the study of foods, its importance and practical application in selected dairy products, type of texture in food rheological determination in different 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 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.

Practical: Study of instruments commonly used in dairy rheology assessment. of rheological quality of various dairy products. Determination of rheological properties. Collection of various types of packaging used in the packaging of various milk products.

DSC 507: Dairy Plant Management: 3(2+1)

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 equipments, bottles and cans.

Construction, operation and maintenance and technical control methods of equipments: 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 the of brine

solution. Role harness of water in the dairy and methods of overcoming the problem

Practical: Preparation of dairy schemes. Calculation on economy of machines used in dairy plant. Assembling and dissembling of dairy plant equipments. Visit to dairy plants and factories and submission of visit reports. Drawing and Plant layouts. All tests related to evaluation of Sanitizers ,Brine and hardwater.

DSC 508: MICROBIOLOGY OF MILK AND MILK PRODUCTS 3(2+1)

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 nmanufacture 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.

PRACTICAL:

Isolation of lactic acid bacteria from milk and milk products. Enumeration of bacteria in milk products by plate count and direct microscopi count metods. Maintenance of pure cultures, test for purity of cultures. Testing the activity of starters. Bacteriological examinations of cream and butter Enumeration of yeasts and moulds in butter, familiarity with colony characteristics and microscopic appearance of some of the common moulds frequently met with in dairy industry, Bacteriological examination of other milk products ice cream, cheese, condensed milk and milk powder testing different ingredients for their bacteriological quality.

DSC 509: Dairy Quality Control 3 (2+1)

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 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 etc.

Practical: Analysis of milk for chemical and bacteriological quality at various stages of production, processing and handling. Assessments of the contamination of milk handling equipments. Detection of adulterants of milk and milk products. Detection of preservatives in milk and milk products. Numerical problems on the adulteration of milk.

DSC 510: CATTLE AND BUFFALO PRODUCTION AND MANAGEMENT: 3(2+1)

Introduction – Development of Dairy Industry in India and world - Present status and future prospects of livestock development in India.

Important breeds of cattle and buffalo, traits of economic importance and their inter-elationships - Selection of high quality animals - Role of management in improving the reproduction efficiency in farm animals. - Housing and rearing systems.

Breeding Management: System of breeding Economic traits. Methods of Breeding - Prenatal and postnatal care and management of cattle and buffalo -General management and feeding practices of calves, heifers, pregnant. lactating and dry animals, and bulls and working animals. Management strategies for reducing mortality in calves, age at first calving and calving interval in cattle and buffaloes.

Routine dairy farms operations and labour management. Milking management, Machine milking and hand milking, Technique of clean and hygienic milk production, transportation of animals, health management. Management of draught animals and summer management.

Dairy farm accounts and records. Concepts of input and output cost of dairy farming (small and large holdings).

Practical:

Visits to cattle farms and critical analysis of various types of managerial practices. Familiarization with body points of animals, Approaching, handling and restraining of cattle, buffalo. Methods of identification (marking, tattooing, branding, tagging and electronic chip). Familiarization with routine farm operations. Determination of age. Determination of body weight using different measurements. Study of breeding management in the farm- Analysis of practical feeding management.

DSC 516: SEMINAR **1Credit**

DSC 517 THESIS **20 Credits**

OR

FOLLOWING PAPERS IN LIEU OF THEIS

DSC 511: BREEDING AND REPRODUCTION MANAGEMENTS: 4 (3+1)

Functional morphology of male and female reproductive organs of farm animals. Management strategies for attaining early maturity. Heat detect methods association problems and their management. Artificial management. Artificial breeding and its economic importance, post management pregnancy development and diagnosis. Management of down calves post Partum care, factors influencing reproductive efficiency in buffaloes and cross breed cattle and measures for improvement. Management of breeding bulls, methods of semen collection factors affection quality semen production, evaluation processing and preservation of semen. Merits and demerits of different extenders . Maintenance of records for artificial breeding.

Basic principles of inheritance, concept of heritability and repeatability importance, methods of selection and system of breeding in animals. Blood and its composition, properties and function.

Practical: Examination of reproductive organs at various stages of reproductive cycle. Heat detection in cattle , buffaloes. Preparation of heat expectancy chart. Calculation of heat detection index of herd. Artificial insemination by rectovaginal and spectrum method . Pregnancy diagnosis by per rectum method. Calculation of breeding efficiency, heritability and repeatability of the herd preparation of bull semen collection. Evaluation of semen preparation of extendors dilution and preservation of semen , maintenance and handling of liquid semen cell count, cell volume , haemoglobin, blood sugar and blood serum.

DSC 512: MANAGEMENT OF SHEEP,GOAT, PIG AND POULTRY: 4(3+1)

Livestock and poultry development programme currently in operation in the country important breeds of sheep, goat, pig and poultry. their characteristics classification and distribution. Management of sheep, goat, pig and poultry during growth, reproduction and production. Marking for identification. Docking, dehorning, dubbing, clipping and sterilization. Selection and disposal of culled animals. Different records of management of related animals. Economics of sheep, goat, pic and poultry farming.

PRACTICAL: Preparation of management calendar for sheep, goat , pig and poultry. Judging of poultry, identification , debeaking , caponization. Maintenance of records at the farm calculation of cost of meat, egg , wool , hair and milk.

DSC 513: LIVESTOCK AND POULTRY HOUSING MANAGEMENT: 4 (3+1)

Principles of construction of farm building selection of site .Types and design for various livestock and poultry. Space requirements of different categories of livestock and poultry under different housing

system. Requirements of various housing components Viz. ventilation , humidity and temperature control types of floors , walls , gates , roofs , stalls , managers tying devices and food storage. Housing for experimental animals methods of drainage and sewage disposal sewage treatment and classification of various types of septic and sedimentation tanks digestion tanks , sewage filtration sludge and lagoons, recycling of waste and sludge farming and biogas, common disinfectants, detergents and sanitizer used on farm premises method of application and factors affecting their efficiency. Construction of auxiliary building like bull exerciser. Wallowing tank and feed processing unit.

Practical: Drawing of environment profiles in different agro-climatic region. Layout plans including cost kit or different size units and categories of animals. Design and construction of different types of shades. Cleaning disinfection of sanitation of dairy farm equipment, layout plans for waster/sewage disposal and sewage plants management.

DSC 514: Milk Secretion, Composition and Physical Properties: 4(3+1)

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.

Practical: A comparative study of specific gravity of milk by lactometer, Westphal balance and RD Bottle (or pycnometer), Determination of electrical conductivity, viscosity and surface tension of milk. Determination of pH and buffer index of milk. Determination of acidity of milk.

DSC 515: Utilization of milk by-products: **4(3+1)**

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 butter milk.

Practical:

Manufacture of various types of casein.

Preparation of whey drinks.