

I.D.D.(DAIRY TECHNOLOGY)

SEMESTER I

Course Code	Course Title	L-T-P	Credits
IDD-301	Dairy Technology I (Indian Dairy Industry & Market Milk)	3-0-2	4
IDD-302	Dairy Chemistry I (Chemistry of Milk & Milk constituents)	3-0-2	4
IDD-303	Dairy Microbiology I (Basic Microbiology)	3-0-2	4
LNG-300	English & Basic Technical Writing	3-0-0	3
IDD-304	Dairy Production –I (Fodder Production & Cattle Nutrition)	3-0-2	4
IDD-305	Applied Maths & Statistics	3-1-0	4

SEMESTER II

Course Code	Course Title	L-T-P	Credits
IDD-308	Dairy Production II (Cattle Breeding & Gen. Mgt.)	2-0-2	3
IDD-309	Dairy Engineering- I (Drawing & Workshop Practices)	3-0-2	4
IDD-310	Dairy Chemistry- II (Chemistry of Milk Products)	3-0-2	4
IDD-311	Dairy Microbiology -II (Microbiology Milk)	3-0-2	4
IDD-312	Dairy Technology- II (Fat Rich Dairy Products)	3-0-2	4
IDD-313	Dairy Technology- III (Indigenous Milk products & Milk based sweets)	2.-0-1	3

SEMESTER III

Course Code	Course Title	L-T-P	Credits
IDD – 319	Dairy Production –III (Cattle Health & Reproduction)	2-0-2	3
IDD – 320	Dairy Engineering – II (Refrigeration & Steam Engineering)	3-0-2	4
IDD - 321	Dairy Microbiology – III (Microbiology of Milk Products)	3-0-2	4
IDD – 322.	Dairy Technology – IV (Cheese Fermented Milk Foods & By Products)	3-0-2	4
IDD – 323	Dairy Technology – V (Condensed & Dried Milks)	3-0-2	4
IDD – 324	Economic Principles and Financial Accounting in Dairy Business	3-1-0	4

SEMESTER IV

Course Code	Course Title	L-T-P	Credits
_IDD 331	Dairy Engineering – III	3-0-2	4
IDD- 332	Dairy Engineering – IV	3-0-2	4
IDD – 333	Dairy Technology- VI (Ice Cream & Frozen Dairy Products)	3-0-2	4
IDD – 334	Quality Assurance of Dairy Products	2-0-1	3
IDD – 335	Dairy Plant Management	3-0-0	3
COMP- 401	Computer Application	1-0-2	2

SYLLABUS OF I.D.D.(DT)

FIRST SEMESTER

IDD-301

DAIRY TECHNOLOGY- I

4 Credits

INDIAN DAIRY INDUSTRY & MARKET MILK

1. Market Milk: Market Milk Industry in India and Abroad
2. Clean Milk production, collection of Milk and practices followed at rural milk collection centres, chilling of milk, milk preservation by hydrogen peroxide and LP systems
3. Transportation of milk. Reception of milk. Platform tests
4. Filtration, clarification and separation of milk, Standardization of milk
5. Pasteurization of milk
6. Homogenization of milk
7. Sterilization of milk by conventional method UHT processing of milk sterilization
8. Special milks, recombined milk, toned milk, double toned milk, filled milk, vitaminised milk, flavoured milk
9. Packaging and distribution of milk
10. Metals in dairy equipments manufacture
11. Cleaning and sanitation of dairy equipment
12. Defects in milk, their causes and prevention

Practical

1. Reception of milk and platform tests
2. Fat. SNF and acidity tests of milk
3. Filtration and clarification of milk
4. Preparation of standardized, recombined, toned double toned milks
5. Preparation of flavoured and sterilized milk
6. Can washing and sanitation of dairy equipments.
7. Separation of milk
8. Homogenization of milk and efficiency of homogenization.
9. Pasteurization of milk
10. Filling/ Packing of milk by FFS Machines, common problems

IDD-302

DAIRY CHEMISTRY - I

4 Credits

CHEMISTRY OF MILK & MILK CONSTITUENTS

- i. Composition of Milk:
Definition of Milk: Gross Composition of milk (Cow, buffalo, goat, sheep, and human).
Factors affecting composition: Colostrum and Abnormal milk. Market Milk: Standard, toned, double toned, skim, sterilized flavoured, recombined and reconstituted milks and UHT Milk.

- ii. Physical properties of milk:
 Colour and flavour, factors responsible, Density and specific gravity: Methods of measurements: Calculation of total solids and solids-not-fat using formula. Factors affecting density and specific gravity of milk. Racknagel effect.
- Freezing point and boiling point: effect of dissolved substance on freezing point and boiling point; Use of cryscope in detecting adulteration of milk with water.
- Surface tension: Explanation, factors affecting
- Viscosity: Factors affecting, importance.
- Electrical conductivity: factors responsible, application in detection of mastitis.
- Refractive, Index: Explanation, importance.
- pH and titratable acidity pH of milk, its importance; milk acidity- natural and developed; constituents responsible: extent of contribution.
- Buffer value: Explanation, Buffering agents in milk.
- Oxidation:- Reduction potential: Explanation, factors affecting, significance.
- iii. Neutralisers and preventives in milk;
- iv. Milk constituents and their chemical properties:
- i) Milk lipids; Definition and composition of fat glycerides, fatty acids, saponifiable and unsaponifiable matter, sterols, fat soluble vitamin, phospholipids; Properties of milk fat- density, refractive index, iodine value, RM value, polenske value, saponification value, melting point. Relation of milk fat constants to fatty acid composition; importance in quality control.
 - ii) Milk proteins:
 Structure, nomenclature, classification, Isolation, fractionation. Determination major milk proteins. Non protein nitrogen constituents. Properties of milk proteins-hydration, solubility, denaturation, isoelectric point, hydrolysis and colour reactions.
 - (iii) Major milk enzymes:
 Level in milk and their role in milk processing.
 Functions, influence of processing parameters.
 - (iv) Water soluble vitamins in milk:
 Levels in milk, effects of light and heat
 - (v) Carbohydrates:
 Definition, classification, presence in milk.
 Lactose – structures, physical forms. Solubility, reducing property, hydrolysis, status of lactose in milk, estimation of lactose in milk.
 - (vi) Minerals in milk:
 Major and trace elements: salt balance (Physical equilibrium-colloidal, soluble and ionic) and its importance: Factors affecting physical

equilibrium among the salts-temperature, pH and concentration.

Practical

1. Preparation and standardization of sodium hydroxide, hydrochloric acid, sulphuric acid, silver nitrate, potassium permanganate and sodium thisulphate.
2. Sampling of milk for chemical analysis Platform tests of milk.
3. Determination of titratable acidity of milk
4. Preparation of Gerber acid and determination of fat in milk by Gerber and Milk tester methods.
5. Determination of fat by Mojonnier method
6. Determination of lactose in milk by Lane Eynon and polarimetric method.
7. Determination of milk proteins by Kjeldahl and Pyne's methods.
8. Determination of ash, phosphorus, calcium and chloride of milk.
9. Phosphates test
10. Detection of preservatives, neutralizers and adulterants in milk.
11. Detection of adulteration of milk with water by freezing point method.

IDD-303

DAIRY MICROBIOLOGY - I

4 Credits

BASIC MICROBIOLOGY

A. General Microbiology

1. Introduction to Microbiology; Definition, History of Microbiology, Microbiology, Microscope & its uses.
2. Nutrition & Metabolism of Bacteria
3. Bacterial growth
4. Effect of environment of growth of bacteria
5. Destruction of bacteria by physical & chemical modes.
6. Salient features of Moulds
7. Salient features of Actinomycetes, Rickettsiae and virus.

B. Salient features of Applied Microbiology

1. Soil Microbiology
2. Air Microbiology
3. Water Microbiology
4. Silage Microbiology
5. Industrial Microbiology

Practical

1. Familiarity with common equipment used in microbiological work; use of ovens, steam sterilizers, pressure sterilizers, refrigerators, care of microscope.
2. Common Bacteriological Techniques;

- Cleaning & sterilization of glassware, preparation of media, pH adjustment, preparation of dilution blanks, preparation of stains and indicators and their use in microbiology.
- Simple staining and differential staining; motility of microorganisms.
- 3 Evaluation of Bacterial population on agar plate and direct cell enumeration.
 - 4 Study of important characteristics of microbes; Staphylococci, Streptococci, Micrococci, Enterococci, Aerobic and Anaerobic bacteria, Lactic acid bacteria, coliforms, streptococci, micrococci, clostridia, yeasts and moulds.
 - 5 Microbiological examination of Soil, Air, Water and Silage.

LNG-300

ENGLISH & BASIC TECHNICAL WRITING

3 CREDIT

1. Language:

- a. Word Enrichment- Antonyms, Synonyms, One word substitution
- b. Sentence – Types, Structure & Parts
- c. Inflection – Noun
- d. Tenses
- e. Parts of speech
- f. Voice

2. Reading

Comprehension:

- a. Listening
- b. Reading

3. Writing:

Composition

- a. Precis Writing
- b. Essay Writing
- c. Letter Writing (Components, Formats & different types)
- d. CV
- e. Resume

IDD-304

**DAIRY PRODUCTION – I
(Fodder Production & Cattle Nutrition)**

4 CREDITS

- A Fodder Production:
1. Systems of forage farming and dairy production in India.
 2. Classification of soils, factors affecting fertility of soil acidity, salinity and methods of reclamation.
 3. Tillage, tools and implements used for tillage.
 4. Manures and fertilizers, methods of application
 5. Methods of sowing and implements used for sowing.
 6. Weeds and their eradication methods.
 7. Study of plant disease and pests, plant protection methods, use of weedicides and pesticides in fodder crops.
 8. Sources of irrigation, methods of irrigation, water requirement of fodder crops, drainage of water.
 9. Parts of plants and nutrients required for plant growth.
 10. Classification of fodder crops, selection of fodder crop.

11. Cultivation of grasses- Hybrid Napier, Guinea grass, para grass etc.
12. Cultivation of cereal fodders- maize, oats barley, teosinte etc.
13. Cultivation of Millet fodders- jowar, ragi, bajra etc.
14. Cultivation of legumes- berseem, Lucerne, cowpea, dolichos etc.
15. Study of fodder trees and shrubs- subabul, susbenia, gliricidia etc.
16. Important crop rotations in different regions of the country, importance of crop rotations mixed cropping.
17. Conservation of fodder- silage and hay making
18. Cost of production of forage crops- working standards of labour and machinery.
19. Seed production for fodder crops available sources

Practicals

1. Use of common tools and implements for tillage.
2. Seed bed preparation- ploughing, harrowing, leveling making bunds and channels.
3. Identification of forage crops, parts of plants, quality of crops.
4. Preparing rootslips and transplanting grasses.
5. Identification of seeds, sowing maize and Lucerne, application of manures and fertilizers.
6. Study of irrigation and drainage practice.
7. Application of weedicides and pesticides.
8. Harvesting of fodder crops, assessment of fodder yield and their quality aspects.

B Animal Nutrition:

1. Digestive system: Digestive enzymes, their classifications and properties.
2. Importance of salivary secretion in ruminants (Amount, composition and action of saliva).
3. Digestion in the ruminant stomach, movements of the rumen.
4. Rumination and its nervous control (regurgitation, mastication, reinsalivation) Absorption through the rumen wall.
5. Functions of abdominal secretion Digestion in the small intestine.
6. Regulation and control of intestinal secretions. Role of pancreas. Absorption at various levels of the gut.
7. Feeding of Dairy animals; Feeding stuffs – their classifications for growth and milk production of dairy animals.
8. Importance of major and trace elements and their requirements for growth and milk production of dairy animals.
9. Vitamins necessary for dairy cattle, variation of chemical composition of feeding stuff in relation to soil fertility, soil plant, animal and human inter-relationship.
10. Digestion, absorption and utilization of feed nutrients in ruminants.
11. Digestibility coefficients, Total digestible nutrients, Nutritive ratio, starch equivalent.
12. Various measures of feed energy-gross, metabolisable and net energy.
13. Feeding standards in different countries.
14. Basal metabolism, Maintenance requirement. Requirement for growth and milk production.
15. Feeding standards, Computation and preparation of balanced rations under various conditions.
16. Machines used for feed processing:: formulation of concentrate feed stuffs for various categories of cattle.
17. BIS standards –least cost ration formulation for dairy animals. Concentrate preparation as mash and pellets.
18. Complete feed formulation and feeding system.

Practical

1. Identification of common feeds and fodders Examination of common concentrate feeds for quality control.
2. Chemical composition of feeds for moisture, crude and true protein, ether extract, fibre, total and soluble ash, calcium and phosphorous.
3. Study of feed mixing and pellet making plant and its operations. Visit to a feed factory in organized sector.
4. Metabolism trial. Least cost ration formulations for various categories of cattle.

IDD-305

Applied Maths & Statistics

4 Credit

Applied Maths

1. Differential calculus

Differential co-efficient, simple applications, meaning of the sign of differential co-efficient, application to small errors and the theory of equations. Higher order derivatives, Leibnitz theorem, Geometrical applications, Tangent and normal's, angle between curves, sub-tangent and sub-normal, Asymptotes, Curvature radius of curvature, centre of curvature, Concavity and convexity, points of inflexion, maxima and minima of functions of single variable, elements of curve tracing, Partial differentiation. Roll's theorem, mean value theorem, Taylors theorem, Taylors and Maclaurins series, evaluation of indeterminate forms, L' Hospital's rule.

2. Integral calculus.

Definite integral as a limit of a sum, rectification of simple plans curves, areas of plane curves, areas of plane curves, surfaces and volumes of revolution, theorem of pappas. Centre of gravity, centre of pressure, moment of inertia, Approximate integration, transpezidal, Simposons rule.

3. Vector calculus

Scalar and vector fields, Directional derivative, gradient of a scalar field, divergence and curl of vector field. Line integral, evaluation of line integrals, Multiple integrals and their evaluation. Surface and volume integrals, Divergence theorem and strokes theorem.

Basic Statistics

Compilation of Data: Introduction, Scores: Discrete and Continuous, Frequency distributions, graphical Representation of the data (Polygon, histogram & pie- diagram)

Measures of Central Value Arithmetic Mean, Median, Mode

Measures of Dispersion of scores – range, Q, mean deviation, standard deviation, co-efficient of variation.

Normal curve- characteristics, Non- normal curves- skewness and kurtosis.

Causes of non- normality

Significance of the difference between two means by t- test, χ^2 – test (chi- square test)

Significance of the differences among more than two means by F-test

Sampling methods: types, requisites for randomization, use of random numbers.

SECOND SEMESTER

IDD-308 **Dairy Production II** **3 Credit**
(Cattle Breeding & Gen. Mgt.)

General Introduction: Importance of inheritance and environment in development of cattle, concept and significance of Dairy Farm management.

Cattle Breeding: Systems of breeding and their relative advantages and disadvantages. Inbreeding coefficient, Heat and its detection in cows.

Artificial Insemination : Merits, demerits, limitations, A.I. for higher rate of conception. Current breeding policies and salient features.

Dairy Farm Management: Indian and exotic breeds of cattle, systems of raising calves, care of milking herd, marking of animals, Dehorning and disbudding, Castrating male calves, clean milk production.

Practicals

1. Identification of different equipments used in animal reproduction and dairy farm management.
2. Problems on inbreeding co-efficient.
3. Familiarity with various breeding records maintained at dairy farm.
4. Care of newly born calf.
5. Marking and dehorning disbudding of animals
6. Detection of heat in cow.

IDD-309 **DAIRY ENGINEERING- I** **4 Credit**
(DRAWING & WORKSHOP PRACTICES)

1. Engineering Drawing: Principles, first and third angle projections, Principal planes, orthographic projection
2. Isometric Views
3. Drawing elevation, side and plan of simple objects/machine parts.
4. Elements of Workshop Technology's workshop practice, safety care

5. Welding, brazing and soldering, gas and electric welding
6. Working of lathe, milling machine, shaper & planer
7. Grinding machines and drilling machines
8. Hydraulics: Pressure, pressure head units: Measurements of pressure
9. Meaning of laminar and turbulent flow:
Statement of continuity equation
10. Bernoulli's theorem and its application
11. Flow measurement with orifice, venturimeter and rotameter.
12. Water supply for the Dairy: Sources, water Quality
13. Selection of pumping equipment: Classification of pumps: principles of working, operation and maintenance of centrifugal and reciprocating pumps, sanitary pumps
14. Elements of heat transfer: Modes of heat transfer: Fourier's law.
15. Heat transfer through slab and composite wall: Overall heat transfer coefficients
16. Types of heat exchangers and their application in the Dairy: Efficiency of plate heat exchangers Heat insulators.
17. Temperature measurement devices

PRACTICALS

1. Operation of lathe machine
2. Operation of drilling and grinding machine
3. Soldering and welding practice
4. Performance of a centrifugal pump
5. Study of sanitary milk pumps
6. Measurement of thermal conductivity
7. Pressure, temperature and flow measurement in liquid lines.
8. Preparation of G.I. and S.S. pipe joints and fittings.
9. Study of different types of heat exchangers.

IDD-310

Dairy Chemistry- II

4 Credit

(Chemistry of Milk Products)

1. Physicochemical changes in milk and milk constituents during heating, concentration and drying: effect on nutritional value.
2. Cream: Creaming, Stokes law; factors affecting creaming, rheological characteristics of cream, composition and properties of dry cream, standards.
3. Butter: Structure of butter, mechanism of churning, factors affecting fat losses. Ageing: Churning time and consistency of butter. Influence of fatty acid composition and physical state of fat on the consistency of butter, defects in butter, flavour of butter, standards, packaging.
4. Butter oil and Ghee: Composition, characteristics for constants, organoleptic properties. Genesis of flavour and texture. Hydrolytic and auto oxidative spoilage of ghee and its prevention. Natural and synthetic antioxidants, Ghee residue. Common adulterants and their detection, standards, packaging.
5. Concentrated milk: Evaporated and sweetened condensed milk. Physico chemical aspects involved in the manufacture of evaporated and condensed milk. Heat stability of concentrated milk as affected by process variables. Milk constituents and additives. Storage defects and their prevention, standards, packaging.

6. Dried milk: roller drying and spray drying. Instantisation. Physico-chemical aspects during processing. Factors influencing the formation and quality of the products. Storage defects, standards packaging.
7. Infant milk foods: Milk for infant feeding Special features.
8. Malted milk foods: Composition, physico chemical aspects in the preparation of malted milk foods, standards packaging
9. Coagulated products: milk clotting enzymes from different sources- Animal, microbial and plant. Factors affecting coagulation of milk and characteristics of curd. Rennet action: Changes taking place during manufacture and ripening of cheese. Types of cheese. Packaging, standards.
10. Fermented products: Varieties, change in milk constituents during fermentation. Flavour development Nutritional and therapeutic value of fermented milk products. Packaging, standards.
11. Indigenous milk products: khoa, chhana, paneer, chakka, srikhand, peda, burfi, rasagolla, basundi etc. composition, quality attributes and defects, packaging, standards.
12. Frozen products: Composition of icecream and kulfi, emulsifiers and stabilizers, role of different constituents and processing parameters (Homogenization, whipping, overrun) in Physical attributes of ice cream and kulfi. Defects in ice cream and kulfi, Packaging, standards.
13. Caseinates and co-precipitates: Different types of casein preparations, their uses and standards, preparations of co-precipitates. Functional properties of caseinates and co-precipitates.
14. Whey proteins: Whey proteins concentrate and whey protein isolates. Applications of whey proteins as functional proteins in various food systems.
15. Lactose: manufacture and use in food and pharmaceutical preparations.
16. Nutritional quality of Dairy foods: Nutritive requirements of specific groups. Nutritive value of dairy foods and their constituents. Effects of processing and storage on the nutritive value of dairy foods.

Practicals

- (a) Cream: Sampling and analysis of cream for fat acidity.
- (b) Butter: Determination of moisture, fat, salt, curd, and acidity.
- (c) Ghee: Determination of fat constants: melting point, refractive index. RM and potenke values, saponification value. Iodine value, determination of acidity and peroxide value.
- (d) Concentrated milk: Sampling determination of total solids, fat, proteins, sucrose and lactose.
- (e) Milk powder: sampling, determination of moisture, total solids, fat, proteins, total ash, carbohydrates, lactose, solubility percent. Insolubility index bulk density.
- (f) Infant foods and malted milk foods, moisture, total ash and insoluble ash, solubility, starch.
- (g) Cheese: Sampling, determination of moisture, fat, protein, salt and acidity.
- (h) Dahi: sampling, Determination of total solids, fat and acidity.
- (i) Yoghurt: determination of sugar.
- (j) Indigenous products: Sampling and analysis of Khoa, channa, chakka, and paneer, for moisture/ total solids, fat and proteins.

- (k) Ice- cream; sampling, Determination of overrun, acidity, fat total solids, protein and sucrose.
- (l) Caseinate and co-precipitates, Analysis for moisture, fat, ash, colour.

IDD-311

**DAIRY MICROBIOLOGY- II
(MICROBIOLOGY OF MILK)**

4 Credits

A Microbiology of Milk

1. Sources of microbial contamination of milk and their importance
2. Milk – borne disease
3. Important groups of spoilage of micro organisms and their manifestation in milk.
4. Microbial growth in milk during storage and transport
5. Taints and abnormal conditions in milk

6. Principles of sanitation practices at all stages of production and processing
7. Bacteriology of heat-treated milks
8. Evaluation of bacteriological features of milks

B Microbiology of Foods

1. Classification of foods
2. Natural functional systems of food and their interactions on shelf life
3. Food processing compulsions and options
4. Types of food spoilage and their aetiology
5. Methods of limiting microbial proliferation in foods
6. Features of food fermentations as a desirable change
7. Evaluation of microbiological features of foods

Practical

A Microbiology of milk

1. Sampling of milk for microbiological analysis
2. Application of rapid tests for evaluation of milk quality
3. Enumeration of bacterial numbers by direct and indirect methods
4. Methods used for determining psychrotropic organisms in milk
5. Assessment of pasteurized milk based on the following; standard plate count. E coil test. Phosphate test, thermoduric and thermophilic numbers
6. Evaluation of utensils and equipments for sanitation

B Microbiology of foods

1. Comparative study of raw and processed foods
2. Study of food enzymes in relation to their profiles at shelf life
3. Effect of storage temperature on shelf life foods
4. Microbiology of vegetables, eggs, meat, flour, bread, cereals and spices
5. Role of salt, sugar, inorganic acids and alkalies in food preservation

IDD-312

**DAIRY TECHNOLOGY- II
(FAT RICH DAIRY PRODUCTS)**

4 Credit

Status of fat rich dairy products in India and abroad.

Introduction to milk lipids - definition and general composition of milk fat.

Cream: efficiency of cream separation and factors affecting it; control of fat concentration in cream. Receiving, grading, sampling and weighing of raw cream; neutralization, pasteurization and cooling of cream. Preparation and properties of different types of cream; table cream, sterilized cream, whipped cream, plastic cream, frozen cream and cultured cream. Preparation of cream for butter making.

Butter: introduction to the butter-making process; theory of churning; batch and continuous methods. Technology of butter manufacture; over-run in butter; control off at losses in -utter milk; packaging and storage; transportation; defects in butter; rheology of butter; uses of butter. Butter-making equipment: construction, operation, care and maintenance of cream separators, coolers and vacreator, factory butterchurn and continuous butter making machines.

Special butters and related products: *manufacture, packaging, storage and properties of whey butter, flavoured butter, whipped butter, renovated butter/fractionated and poly-unsaturated milk, fat products, vegetable oil-blended products and low-fat spreads.*

Manufacture, packaging, storage, and characteristics of Margarine of different types.

Ghee and butteroil: Methods of ghee making . batch and industrial processes, innovations in *ghee* production, procedure, packaging and preservation of ghee; utilization of substandard milk and old/stored butter in the manufacture of ghee.

Continuous process for the production of ghee.

Methods of manufacture, packaging, storage, distribution and uses of butter- oil.

Nutritional aspects of cream, butter, butter-milk, ghee and ghee residue.

Health aspects of milk fat.

Technical control in butter industry: Factors affecting plant operations' efficiencies,. Losses of milk solids, methods of improving operational efficiency and product accounting.

Practicals

1. Standardization, neutralization, pasteurization and cooling of cream
2. Preparation of sterilized cream.
3. Preparation of cooking butter by the hand-operated chum.
4. Preparation of *desi* butter.
5. Manufacture of table butter using the power-driven chum.
6. Preparation of a low-fat spread.
7. Preparation of *ghee* from cream and butter.
8. Plant visit.

IDD-313

**DAIRY TECHNOLOGY- III
(INDIGENOUS MILK PRODUCTS & MILK BASED SWEETS)**

3 Credit

INDIGENOUS MILK PRODUCTS

1. Ghee:

- (a) Definition of ghee, importance of ghee in India
- (b) Methods of manufacturing ghee
- (c) Grading of Ghee and factors influencing quality of ghee
- (d) Difference of ghee & butter oil
- (e) Utilization of ghee and resedue.

2. Khoa

3. Chhana

4. Paneer

5. Dahi

6. Indigenous Cheese

- (a) Preparation & Packaging, yield and composition.

- (b) Factor affecting quality
- (c) Packaging & Preservation
- (d) Marketing and grading
- (e) Legal standards

MILK BASED SWEETS

1. Place of milk based sweets in India and abroad.
2. Method of manufacture, packaging, storage and transportation of Rasogulla, Gulab jamun, Kalakhand, Rabri, Keer, Khurcha, malai, Rasmalai, Barfi, Pedas, Srikhand, Sandesh, Chakka, Milk cake, Pantoa, Payodhi and lassi.

Practicals

1. Preparation of *khoa*
2. Preparation of Ghee from butter and cream.
3. Preparation of *Paneer*.
4. Preparation of *chhana*
5. Preparation of *Dahi*
6. Preparation of Surti Cheese
7. Preparation of milk based sweets

THIRD SEMESTER

IDD-319

**DAIRY PRODUCTION -III
(CATTLE HEALTH & REPRDUCTION)**

3 Credits

1. General Management: Importance of ruminants, classification of breeds of the basis of utility.
2. Important dairy breeds of indigenous and exotic cattle and buffaloes.
3. Calf rearing different methods
4. Management of dairy heifers and bull calves
5. Care of pregnant animals during and after parturition.
6. Management and care of milking stock, dry stock and breeding bulls.
7. Cleaning and sanitation of cattle yard premises.
8. Clean milk production, principles of milking, milk recording. Records essential to good herd management.
9. Milk secretion.
10. Preparation of animals for cattle shows, transport of animals by roads and rail.
11. The principles and practices of breeding dairy stock.
12. Mendelism, Different systems of breeding
13. In breeding, line breeding, cross breeding, grading up, pregnancy testing, culling and selection of animals in the open market.
14. Anatomy of reproductive organs Artificial Insemination.
15. Embryo transfer technology- a general concept and its role in national perspective.
16. Signs of health and ill health.
17. Diagnosis and detection of diseases care and feeding of sick animals

- 18 Disinfections, isolation and prophylaxis measures during outbreak of contagious diseases of cattle like foot and mouth, Rinder Pest, Brucellosis, T.B. Johne's and mastitis.
19. Diseases of young stock, Navel-ill, Pneumonia, scours, Ring worm and Mange.

Practicals

1. Layout of a cattleyard, living space for each category of animal from health point of view.
2. Recognition of body parts of dairy animals
3. Physical character of the breeds maintained.
4. Calf feeding, Tattooing, Dehorning, Grooming.
5. Estimation of age and body weight
6. Preparation of animals for milking, milk cooling, observations of signs of oestrus and pregnancy.
7. Cleaning and sanitation of milking sheds and milk record room.
8. Judging of milch cows
9. Preparation of animals for show
10. Study of important cattle records
11. Identification of common cattle feeds computation of rations
12. Recording observations on temperature, pulse and respiration.
13. Identification and use of common first aid drugs and pharmaceutical instruments used in the cattle yard.
14. Dressing of wounds and bandaging
15. Diagnosis and treatment of mastitis.
16. Practice in Artificial Insemination
- 17 Demonstration on Embryo Transfer Technology at the appropriate centre

IDD – 320

**DAIRY ENGINEERING – II
(REFRIGERATION & STEAM ENGINEERING)**

4 Credits

1. Steam and steam generators; Wet, dry and super heated steam; dryness fraction, internal energy and enthalpy; Use of steam tables.
2. Classification of boilers; constructional features and operations of vertical fire tube, horizontal return flue and automatic boilers.
3. Boiler mountings, accessories and their uses
4. Capacity and horsepower of boilers; scaling of boiler and water treatment plant.
5. Electrical Engineering: Simple and three phase power supply; star and delta connections.
6. Types and working principles of transformers
7. Principles of working, operation, selection and maintenance of single and three phase induction motors and starters.
8. Instruments for measurements of voltage current. Power and energy
9. Refrigeration Engineering: Unit of refrigeration; important components and controls of Mechanical vapour compression refrigeration system and their functions.
10. Common refrigerants
11. Application of sealed units
12. Ice bank systems
- 13 Features of cold stores, insulating materials, vapour barriers etc.

Practical

1. Study of constructional features of vertical fire tube boiler
2. Study of constructional features of horizontal return flue type boiler
3. Boiler fittings
4. Boiler safety devices
5. Measurement of electrical power in A.C. circuits
6. Fluorescent tube connections
7. Starting of three phase induction motor with DOL starter
8. Star delta starters
9. Study of different types of motors
10. Study of performance of different types of compressors
11. Study of refrigeration evaporators and condensers
12. Study of different types of expansion devices
13. To determine C.O.P. of a refrigeration system

IDD - 321

DAIRY MICROBIOLOGY – III (MICROBIOLOGY OF MILK PRODUCTS)

4 Credits

1. Starter cultures; Functions, classifications, maintenance, evaluation of cultures, heterophages and recent concepts of starter technology.
2. Microbiology of fermented milk; History, features of fermentation, nutritive and therapeutic values. Methods of manufacture, problems of spoilage and evaluation.
3. Microbiology of cheese: classification, features of cheese in relation to microbial metabolism, selection of starter systems. Brief techno-microbial features of Cheddar, Gouda, Swiss, Blue, Camembert, Brie, soft unripened and Cream cheeses.
4. Microbiology of cream and Butter: types of cream. Microbiology of raw cream and their manifestations; evaluation of raw cream. Pasteurization of cream, storage and its evaluation.

Definition and composition of butter, comparative microbiology of Desi and Creamery butter, Microbial metabolism in butter, Ripened and cultured butter, and their manifestation.

Influence of technologies on microbial load and functioning. Production, handling, storage and microbial defects in butter, Ripened and cultured butter, their advantages and limitations.

5. Microbiology of ice – cream and other frozen dairy products; Definition and composition of ice-cream. Microbial load in ice cream. Growth of microorganisms in ice cream mix. Types of organisms found in ice cream.

Effect of addition of ingredients on quality of ice cream. Sources of contamination during production, handling and packaging. Brief description of Kulfi and other frozen milk products.

6. Microbiology of dry milks; Types of dried milks, Brief description of drying methods.

Effect of process technology on microbial content. Influence of packing and storage on microbiological features, public health safety and evaluation.

Microbiology of reconstituted dry milks, dry milk as food adjunct and its impact on foods.

7. Microbiology of frozen desserts; Types of frozen desserts- Microbiological integrity of ingredients used. Public health hazards. Processing features and their impact on microflora. Effect of storage, transport, retailing and parlour dispensing on microbiology, plant and handling sanitation and evaluation.

8. Microbiology of indigenous milk products; Paneer/ Chahana; Physio-chemical features and their influence on microbial metabolism. Sanitation practices to check flora. Effect of storage spoilage and evaluation.

Khoa/ burfi/ mawa; Products suitability for proliferation of Microbes. Production and handling hygiene. Public health hazards. Shelf life, spoilage and evaluation.

Chakka/ Shrikhand; Microbial features in relation to basal material, production hygiene and storage. Spoilage and evaluation.

Practical

1. Preparation and evaluation of starter cultures Microbiological examination of
2. Cream, butter
3. Ice cream
4. Cheese
5. Evaporated milk, sweetened condensed milk. Plain condensed milk & dried milks
6. Dahi, Yoghurt, Acidophilus
7. Khoa and Channa

IDD – 322

DAIRY TECHNOLOGY – IV

4 Credits

(CHEESE FERMENTED MILK FOODS & BY PRODUCTS)

1. Fermented Products:- History and development
2. Production of Dahi, Yoghurt, Acidophilus milk, Lassi
3. Packaging of fermented products
4. Nutritive value and legal standards
5. History of cheese making
6. Legal standards
7. Classification and composition of common varieties of Cheese
8. Technology of manufactures of Cheddar, Gauda, Mozzarella, Cottage cheeses
9. Processed cheese, Cheese spread, Cheese foods and cheese
10. Stabilizers and emulsifiers used in processed cheese
11. Physical, Chemical and Bacteriological changes during ripening process, packaging and defects.
12. Judging and grading of cheese
13. By products- classification and characterization
14. Use of whey, preparation of whey protein
15. Manufacture of lactose and its use

16 Manufacture of casein and its use

Practical

1. Production of Dahi, Yoghurt, Acidophilus milk, lassi
2. Production of cheddar Cheese
3. Production of Gouda Cheese
4. Production of Mozarella cheese
5. Production of processed cheese and cheese spread
6. Production of cottage cheese
7. Packaging and analysis of cheese
8. Judging and grading of cheese
9. Manufacture of Byproduct (Preparation of lactose lactical rennet casein, calcium caseinate, whey protein concentrate, whey powder and whey drink)
10. Preparation of lactic acid and rennet casein
11. Preparation of calcium caseinates
12. Preparation of whey protein concentrates
13. Preparation of whey powder
14. Preparation of lactose
15. Preparation of whey milk.

IDD – 323

**DAIRY TECHNOLOGY – V
(CONDENSED & DRIED MILKS)**

4 Credit

1. Status of condensed and dried milk industry in India and abroad
2. Composition and legal standards of condensed and dried milk products
3. Technology of manufacture of Sweetened condensed milk and evaporated milk
4. Defects, causes and remedies
5. Packaging and keeping quality of condensed and evaporated milks
6. Principle of drum drying, spray drying, foam drying
7. Manufacture of skim, whole, malted milk powders
8. Defects in dried milks and their causes
9. Packaging and storage
10. Instantized milk powder, infant food formulation and method of manufacture

Practical

1. Vacuum pan operation
2. Operation of roller and spray drier
3. Production of sweetened condensed and evaporated milks
4. Production of roller and dried milk powders
5. Production of spray dried skim milk powder
6. Production of malted milk
7. Judging and grading of condensed and dried milk products

IDD – 324

**ECONOMIC PRINCIPLES AND FINANCIAL
ACCOUNTING IN DAIRY BUSINESS**

4 Credit

1. Basic concept; Nature of Economics, Meaning, definition, scope of Economics, Utility, Goods value, Wealth.
2. Concept of consumption: Meaning and importance, determination and characteristics, classification of wants, Law of Diminishing utility, Law of Equi-marginal utility.
3. Concept of Production: Meaning, Factors of production, Land, Labour, Capital, organization, Enterprise.
4. Concept of Exchange: Meaning, Definition, Advantages of Exchange, Forms of Exchange.
5. Concept of Market, Meaning, Definition, Degree of competition in market, Demand and supply.
6. Concept of Distribution: Meaning, Definition, problem of distribution, Method of Distribution, Rent, Wages, etc.
7. Financial Management and its planning: Meaning, Objectives.
8. Concept of Financial accounting: Subject matter, Basic principles, classification and its importance.
9. Concept of Accounting procedure, Journal, Definition, Meaning, Role for Debit and Credit.
10. Concept of Double Entry System: Advantages of Double entry system.
11. Ledger: Concept, Necessities, Types of ruling, Deference between Journal and Ledger
12. Cashbook: Meaning, Types of cash book, Advantages, Difference & Similarities with Ledger.
13. Trial Balance: Meaning, Definition, Its objectives, advantages, and Limitation, Characteristics
14. Concept of Depreciation: Definition, Meaning Objectives, Different method of calculating Depreciation.

Practical

1. Preparation of Journal
2. Preparation of Ledges
3. Preparation of Cash Book
4. Preparation of Trial Balance
5. Preparation of Format of milk reception
6. Preparation of stock sheet
7. Calculation of Depreciation

FOURTH SEMESTER

IDD 331

DAIRY ENGINEERING – III

4 Credits

1. Sanitary metal and features of sanitary designs
2. S.S. Pipes and Fittings
3. Receiving room equipments
4. Working and maintenance of mechanical can washers
5. Different types of milk chilling equipments and their application.
6. A study of constructional features of milk storage tanks.
7. Principles of centrifugal separation: cream separators: self desludging clarifiers.
8. Efficiency, capacity and maintenance of separators
9. Constructional features, operation and maintenance of batch and HTST: pasteurizers and controls.
10. Equipment for milk sterilization and UHT processing
11. Homogenizers: Constructional features, operation and maintenance of homogenizers and accessories.
12. A study of milk sachet and aseptic filling machines and their maintenance.
13. C.I.P. cleaning systems.

PRACTICALS

To conduct the study of constructional features and operation of:

1. Mechanical can washer
2. Plate chiller
3. Milk storage tank
4. Cream separator
5. Study of Homogenizers
6. Batch Pasteurizer
7. H.T.S.T. pasteurizer
8. FDV controller
9. Sachet filling machine

IDD- 332

DAIRY ENGINEERING – IV

4 Credits

1. A study of equipments for indigenous dairy products
2. Equipments for fermented and coagulated dairy products.
3. Ice cream freezers: batch type
4. Ice cream freezer continuous type, accessories
5. Equipments for condensed milk, vacuum pan
6. Classification of continuous evaporators
7. Multiple effect evaporator and accessories Equipments for drying milk: roller drier: parallel and counter flow spray driers and their accessories
8. Plant layout and design: site selection
9. Factors concerning design and layout; example
10. Features of dairy floors and ventilation
11. Dairy waste treatment and methods of disposal

PRACTICALS

To conduct the study of constructional features and operation of:

1. Equipments for manufacture of indigenous dairy products.
2. Cheese equipment.
3. Butter churn
4. Vacuum pan
5. Multiple effect evaporator
6. Roller drier
7. Spray drier

To draw layouts for:

8. Chilling centers
9. Market milk plant
10. A plant with market milk and milk products
(Composite milk plant)

IDD– 333

DAIRY TECHNOLOGY- VI (ICE CREAM & FROZEN DAIRY PRODUCTS)

4 Credit

1. Status of Ice Cream Industry
2. Classification of Frozen dairy products
3. Composition of Ice Cream, BIS and PFA standards for Ice Cream. Calculation of mixes. Ice Cream ingredients, stabilizers and emulsifiers, flavouring and colouring materials
4. Mix processing, Ice cream freezers, packaging and handling of Ice Cream
5. Judging and grading of Ice Cream
6. Fruit Ice Cream, Nut Ice cream, Kulfi preparation
7. Frozen Yoghurt, characteristics and production
8. Defects in frozed products, prevention and remedies

Practical

1. Selection of ingredients for Ice cream, calculation of mix preparation
2. Preparation of Ice Cream and kulfi
3. Preparation of Fruit Ice Cream
4. Preparation of Casata Ice Cream
5. Studies on the characteristics of stabilizer and emulsifiers
6. Effect of homogenization on the quality of Ice Cream
7. Production of Frozen yoghurt
8. Judging and grading of frozen dairy products
9. Packaging materials and packaging of Frozen Dairy products.

IDD – 334

QUALITY ASSURANCE OF DAIRY PRODUCTS

3 Credit

Chemical Quality Control:

1. Responsibility and organization of quality control department general principles.
2. Food and laws and standards – PFA, BIS, Agmark, IDF
3. Calibration: Calibration of dairy glassware lactometer, butyrometer, milk pipette end.
4. Colour and gloss: Natural synthetic colours, Specification of colour for dairy foods.
5. Flavour: Flavor components in dairy foods, Artificial flavours.
6. Additive: stabilizers, emulsifiers, sweeteners, vitamins, minerals, amino acids/ protein hydrolysate antioxidants, preservatives, neutralizers, coloring matter and flavouring agents.
7. Packaging: packaging material for dairy foods- types and properties.
8. Contaminate pesticide residues, heavy metals, toxins, antibiotics, detergents, sanitizers and contaminants from packaging materials.
9. Sensory evaluation: General introduction, testing conditions, taste, odour, aroma, texture appearance, and other parameters. Difference testes and ranking tests. Individual tests, Individual steps in selection of test subjects.
10. Water, analysis, treatment
11. Detergents and sanitizers: types, properties and analysis.
12. Elementary knowledge of instrumental analysis.
13. Prediction of self- life of dairy products including UHT processed Sterilized milk

Practical

1. Standardization of milk testing equipments butyrometer, lactometer, milk pipette, thermometers etc,
2. Physical properties of dairy foods, Estimation of pH, acidity, density, specific gravity, viscosity, surface tension, electrical conductivity, buffering capacity and oxidation potential.
3. Estimation of browning in dairy foods.
4. Estimation of antioxidant, preservatives, neutralizers and monostearate.
5. Estimation of organ chlorine pesticide residue in dairy foods.
6. Sensory evaluation of dairy foods for colour, appearance, taste, odour, texture and acceptability. Difference taste and ranking taste.
7. Estimation of temporary and permanent hardness of water.
8. Estimation of alkalinities in detergent solutions.
9. Estimation of available chlorine and Iodine in sanitizer.
- 10 Determination of iron in fortified dairy foods.
11. Separation of dairy food colours by thin layer chromatography.

Microbiological Quality Assurance:

1. Basic Concept of Food biology: their relation to quality assurance. Food class orientation plant and animal origin. Problems associated with natural foods for human consumption. Role of microbial systems in conversation of Taw foods for better utility.
2. Food Safety: Traditional problems. Emerging problems
3. Regulatory systems/ agencies: Government / NGO / Professional / Other agencies. Mandatory regulation like PFA, etc, Optional Advisory systems like BIS, IDF Agmark based etc. Comparative standards of milk produce and milk foods of countries pioneering in specified foods.
4. Role of supporting service systems in quality food processing: water, Air, Personnel, their health, hygiene and habits, equipments design, material used, construction, finish,

- maintenance and hygiene, packing material, nature, design and type: warehousing and condition of their maintenance, shipping, transport systems and their handling.
5. Food plant hygiene: Need for providing consumer guidance on the time limit for safe consumption. Consumer assessable methods for safety of canned feeds.
 6. Sampling procedure for microbiological evaluation of foods.
 7. Total quality management system for food industry, Quality audit concepts (ISO etc) a wholistic growth from elementary. Quality control to quality Assurance culminating in total quality system.
 8. Hazard analysis of critical control points (HACCP): HAACCP- an essential tool for supporting operation of TQM in food processing industries.
 9. Microbiological quality of milk and milk products Historical to current state of art.
 10. Organization of microbiological evaluation laboratories, setting up laboratories to support TQM system.
 11. Food industry effluent management: Biochemical characteristics of food industry effluents, methods for reduction of organic matter in waste waters, recycling of water for better management of ecology.

Practicals

- a. Sampling procedures for microbiological evaluation of foods.
- b. Evaluation of foods for public health safety, salmonella, shigella, staphylococci, clostridia, Listeria, bacillus cereus, Campylobacter.
- c. Monitoring microbial density of air-environment of processing plant.
- d. Evaluation of microbiological quality of water for the processing plant.
- e. Assessment of hygiene of personnel working in the plant.
- f. Evaluation of equipment decision, material used, consyruction, finish and maintenance, for hygiene.
- g. Assessment of packing material for hygiene.
- h. Assessment of warehouse and their maintenance of microbiological contamination.
- i. Evaluation of basic cleaning systems, detergent support and sanitisers.
- j. HAACP evaluation of manufacturing process.
- k. Assessment of microbiological quality of milk and milk products.
- l. Study of microbiological laboratories with reference to their layout and their functioning.

IDD – 335

DAIRY PLANT MANAGEMENT

3 Credit

Production management

Definition, functions and structure of production management.

Production planning and control, work study and measurement, motion and method study.

Plant operations: efficiency factors, losses, BEP, financial and managerial efficiency.

Provisions of industrial legislation in India particularly for the dairy industry.

Personnel management: manpower planning. recruitment. training. transfer and promotion policies.

Job specifications, job evaluation, job enhancement, job enrichment, MBO.

Practicals

1. Flow Process Charts of different milk products
2. Identification of steps of material losses in the plant.
3. Identification of hazardous processes and equipments, safety and precautions

4. Identification and uses of common lubricants
5. Waste utilization processes

COMP- 401

COMPUTER APPLICATION

2 Credit

1. Introduction to Computers
2. H/W and S/W Concepts and Terminology
3. Operating System
 - (a) DOS
 - (b) Windows
4. Introduction to commonly used application software
 - (a) MS Word
 - (b) MS Excel
5. Computer Languages & Introduction to 'C' Programming Language
 - (a) Input & Out put statements
 - (b) Declaration of variables
 - (c) Operators
 - (d) Control Statements (Branching and Looping)
6. Introduction to computer Networks
7. Introduction to Internet
8. Application of I.T.

Practical List:

- (a) Working with operating systems like MS. DOS, Windows
- (b) Study of Software packages, Like MS Word, MS Excel and MS. PowerPoint
- (c) Packages related to medical applications
- (d) How to search data, workable knowledge of Internet
- (e) Simple programs in C languages
 - (i) To find the largest among three numbers
 - (ii) To check whether the given number is palindrome or not.
 - (iii) To find whether the given number is the prime
 - (iv) To find sum and average of n integer using linear array
 - (v) To generate the Fibonacci series

To find factorial of a given number using functions.