



Andhra Pradesh State Council of Higher Education

B.Sc., Honours in Dairy Science - MAJOR

w.e.f AY 2023-24 onwards

COURSE STRUCTURE

Year	Semester	Course	Title	No. Hrs./Week	No. of Credits
I	I	1	Introduction to Classical Biology	5	4
	I	2	Introduction to Applied Biology	5	4
	II	3	Breeds and breeding of dairy cattle and buffaloes - (T)	3	3
			Breeds and breeding of dairy cattle and buffaloes - (P)	2	1
	II	4	Dairy Cattle Nutrition- (T)	3	3
			Dairy Cattle Nutrition- (P)	2	1
II	III	5	Dairy Chemistry (Chemistry of fluid milk) - (T)	3	3
			Dairy Chemistry (Chemistry of fluid milk) - (P)	2	1
	III	6	Dairy Microbiology- (T)	3	3
			Dairy Microbiology- (P)	2	1
	III	7	Dairy farm management- (T)	3	3
			Dairy farm management- (P)	2	1
	III	8	Management of Sheep and Goats- (T)	3	3
			Management of Sheep and Goats- (P)	2	1
	IV	9	Processing of milk- (T)	3	3
			Processing of milk- (P)	2	1
	IV	10	Technology of Dairy products- (T)	3	3
			Technology of Dairy products- (P)	2	1
	IV	11	Technology of fat- rich dairy products- (T)	3	3
			Technology of fat- rich dairy products- (P)	2	1
III	V	12	Technology of Condensed and Dried Milks- (T)	3	3
			Technology of Condensed and Dried Milks- (P)	2	1
		13	Traditional Indian Dairy Products - (T)	3	3
			Traditional Indian Dairy Products- (P)	2	1
		14	Dairy development and Dairy cooperatives. - (T)	3	3
			Dairy development and Dairy cooperatives. - (P)	2	1
15	Ice-Cream and Frozen Desserts- (T)	3	3		
	Ice-Cream and Frozen Desserts- (P)	2	1		
	VI		Internship/apprenticeship		
IV	VII	16	Chemistry of Dairy Products- (T)	3	3
			Chemistry of Dairy Products- (P)	2	1
		17	Microbiology of Dairy Products- (T)	3	3
			Microbiology of Dairy Products- (P)	2	1
		18	Starter Cultures and Fermented Milk Products- (T)	3	3
			Starter Cultures and Fermented Milk Products- (P)	2	1
19	Quality assurance in dairy industry- (T)	3	3		
	Quality assurance in dairy industry- (P)	2	1		

	VIII	20A	Sensory Evaluation of Dairy Products- (T)	3	3
			Sensory Evaluation of Dairy Products- (P)	2	1
		20 B	Entrepreneurship Development and Industrial Consultancy- (T)	3	3
			Entrepreneurship Development and Industrial Consultancy- (P)	2	1
		21 A	Dairy Process Engineering- (T)	3	3
			Dairy Process Engineering- (P)	2	1
		21 B	Refrigeration and Air – Conditioning- (T)	3	3
			Refrigeration and Air – Conditioning- (P)	2	1

Semester – 1

Course: 1

INTRODUCTION TO CLASSICAL BIOLOGY

Hours/Week: 5

Credits: 4

Learning objectives

The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

Learning Outcomes

1. Learn the principles of classification and preservation of biodiversity
2. Understand the plant anatomical, physiological and reproductive processes.
3. Knowledge on animal classification, physiology, embryonic development and their economic importance.
4. Outline the cell components, cell processes like cell division, heredity and molecular processes.
5. Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

Unit 1: Introduction to systematics, taxonomy and ecology.

- 1.1. Systematics – Definition and concept, Taxonomy – Definition and hierarchy.
- 1.2. Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature.
- 1.3. Ecology – Concept of ecosystem, Biodiversity and conservation.
- 1.4. Pollution and climate change.

Unit 2: Essentials of Botany.

- 2.1. The classification of plant kingdom.
- 2.2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).
- 2.3. Structure of flower – Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.
- 2.4 Mushroom cultivation, floriculture and landscaping.

Unit 3: Essentials of Zoology

- 3.1. The classification of Kingdom Animalia and Chordata.
- 3.2 Animal Physiology – Basics of Organ Systems & their functions, Hormones and Disorders
- 3.3 Developmental Biology – Basic process of development (Gametogenesis, Fertilization, Cleavage and Organogenesis)
- 3.4 Economic Zoology – Sericulture, Apiculture, Aquaculture

Unit 4: Cell biology, Genetics and Evolution

- 4.1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.
- 4.2. Chromosomes and heredity – Structure of chromosomes, concept of gene.
- 4.3. Central Dogma of Molecular Biology.
- 4.4. Origin of life

Unit 5: Essentials of chemistry

- 5.1. Definition and scope of chemistry, applications of chemistry in daily life.
- 5.2. Branches of chemistry
- 5.3. Chemical bonds – ionic, covalent, noncovalent – Vander Waals, hydrophobic, hydrogen bonds.
- 5.4. Green chemistry

References

1. Sharma O.P., 1993. Plant taxonomy. 2nd Edition. McGraw Hill publishers.
2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4th edition. S. Chand publishers, New Delhi, India.
3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. S. Chand publishers, New Delhi, India.
4. Rastogi, S.C., 2019. Essentials of animal physiology. 4th Edition. New Age International Publishers.
5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India.
6. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
8. Karen Timberlake, William Timberlake, 2019. Basic chemistry. 5th Edition. Pearson publishers.
9. Subrata Sen Gupta, 2014. Organic chemistry. 1st Edition. Oxford publishers.

ACTIVITIES:

1. Make a display chart of life cycle of nonflowering plants.
2. Make a display chart of life cycle of flowering plants.
3. Study of stomata
4. Activity to prove that chlorophyll is essential for photosynthesis
5. Study of pollen grains.
6. Observation of pollen germination.
7. Ikebana.

8. Differentiate between edible and poisonous mushrooms.
9. Visit a nearby mushroom cultivation unit and know the economics of mushroom cultivation.
10. Draw the Ultrastructure of Prokaryotic and Eukaryotic Cell
11. Visit to Zoology Lab and observe different types of preservation of specimens
12. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter, Electronic Weighing Balance, Laminar Air Flow
13. Visit to Zoo / Sericulture / Apiculture / Aquaculture unit
14. List out different hormonal, genetic and physiological disorders from the society

Semester – 1

Course: 2

INTRODUCTION TO APPLIED BIOLOGY

Hours/Week: 5

Credits: 4

Learning objectives

The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

Learning Outcomes

1. Learn the history, ultrastructure, diversity and importance of microorganisms.
2. Understand the structure and functions of macromolecules.
3. Knowledge on biotechnology principles and its applications in food and medicine.
4. Outline the techniques, tools and their uses in diagnosis and therapy.
5. Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

Unit 1: Essentials of Microbiology and Immunology

- 1.1. History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.
- 1.2. Groups of Microorganisms – Structure and characteristics of Bacteria, Fungi, Archaea and Virus.
- 1.3. Applications of microorganisms in – Food, Agriculture, Environment, and Industry.
- 1.4. Immune system – Immunity, types of immunity, cells and organs of immune system.

Unit 2: Essentials of Biochemistry

- 2.1. Biomolecules I – Carbohydrates, Lipids.
- 2.2. Biomolecules II – Amino acids & Proteins.
- 2.3. Biomolecules III – Nucleic acids -DNA and RNA.
- 2.4. Basics of Metabolism – Anabolism and catabolism.

Unit 3: Essentials of Biotechnology

- 3.1. History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.
- 3.2. Environmental Biotechnology – Bioremediation and Biofuels, Biofertilizers and Biopesticides.
- 3.3. Genetic engineering – Gene manipulation using restriction enzymes and cloning vectors; Physical, chemical, and biological methods of gene transfer.

3.4. Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salt tolerance). Transgenic animals – Animal and disease models.

Unit 4: Analytical Tools and techniques in biology – Applications

4.1. Applications in forensics – PCR and DNA fingerprinting

4.2. Immunological techniques – Immunoblotting and ELISA.

4.3. Monoclonal antibodies – Applications in diagnosis and therapy.

4.4. Eugenics and Gene therapy

Unit 5: Biostatistics and Bioinformatics

5.1. Data collection and sampling. Measures of central tendency – Mean, Median, Mode.

5.2. Measures of dispersion – range, standard deviation and variance. Probability and tests of significance.

5.3. Introduction, Genomics, Proteomics, types of Biological data, biological databases-NCBI, EBI, Gen Bank; Protein 3D structures, Sequence alignment

5.4. Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench

REFERENCES

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11th Edition. Pearson publications, London, England.
2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5th Edition. McGraw Education, New York, USA.
3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.
6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3rd Edition. Cambridge Publishers.
7. U. Sathyanarayana, 2005. Biotechnology. 1st Edition. Books and Allied Publishers pvt. Ltd., Kolkata.
8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.
9. Arthur M. Lesk. Introduction to Bioinformatics. 5th Edition. Oxford publishers.
10. AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers.

ACTIVITIES

1. Identification of given organism as harmful or beneficial.
2. Observation of microorganisms from house dust under microscope.
3. Finding microorganism from pond water.
4. Visit to a microbiology industry or biotech company.
5. Visit to a wastewater treatment plant.
6. Retrieving a DNA or protein sequence of a gene'
7. Performing a BLAST analysis for DNA and protein.
8. Problems on biostatistics.
9. Field trip and awareness programs on environmental pollution by different types of wastes and hazardous materials.
10. Demonstration on basic biotechnology lab equipment.
11. Preparation of 3D models of genetic engineering techniques.
12. Preparation of 3D models of transgenic plants and animals.

[**NOTE:** In the colleges where there is availability of faculty for microbiology and biotechnology, those chapters need to be handled by microbiology and biotechnology faculty. In other colleges, the above topics shall be dealt by Botany and Zoology faculty]

II Semester
Course 3: Breeds and breeding of dairy cattle and buffaloes

Credits -3

Unit-1: Livestock census; Breeds of Dairy cattle, Buffaloes and Goats. Indigenous, Exotic and Crossbred Cattle breeds – classification of Indian breeds of cattle based on utility Classification of Indian breeds of buffaloes – conservation of indigenous local breeds of cattle.(15 Lectures)

Unit-2: Anatomy of Udder; Development of udder; Lacto genesis and Galactopoises; Letdown of milk – composition of milk and colostrum – Difference between milk of cows, buffaloes and goats. (10 Lectures)

Unit-3: Artificial insemination- advantages and disadvantages. Differences between natural service and artificial insemination. Oestrous cycle; Symptoms of heat in cows and buffaloes. Conception, Pregnancy diagnosis in cattle. Multi-ovulation and embryo transfer technique. Cloning - (15 Lectures)

Unit-4: Economic traits of Dairy cattle - factors influencing yield and composition of milk. Methods of selection of dairy animals – progeny testing program. (15 Lectures)

Unit-5: Systems of Dairy cattle breeding. Inbreeding, Out breeding, Cross breeding, Grading up. Breeding systems suitable to enhance milk production in India (Cross breeding of cattle and Grading up of buffaloes). (5 Lectures)

II Semester
Course 3: Breeds and breeding of dairy cattle and buffaloes

Credits -1

1. Points dairy cow.
2. Identification of different breeds of dairy cattle and buffaloes.
3. Male and female reproductive systems.
4. Symptoms of heat in cow and buffalo.
5. Artificial insemination.
6. Pregnancy diagnosis in cattle.
7. To study the comparative merits of cows and buffaloes; zebu and crossbred cows
8. Differences between swamp and river water buffaloes.
9. Importance of dairy wedges in dairy animal selection.

Reference Books

1. Text book of Animal Husbandry - G C Benarjee
2. Hand book of Animal Husbandry - ICAR Edition
3. Principles and practices of Dairy Farm –Jagdish Prasad

II Semester
Course 4: Dairy Cattle Nutrition
Credits -3

Unit-1: Classification of Feeds and Fodders. Importance of proteins, fats and carbohydrates in livestock feeding – Importance of vitamins and minerals in cattle feeding (15 Lectures)

Unit-2: Conservation of Fodder–Hay and Silage –Fodder security measures during summer and drought seasons. (10 Lectures)

Unit- 3: Feeding standards; Balanced rations for Dairy cattle; Feeding practices of Dairy cattle) Soiling (ii) Ensiling, (iii) Pasturing, (iv) Hay feeding, (v) General feeding practices with regard to management – Azolla feeding - Hydroponic fodder production. (20 Lectures)

Unit-4 : Types of Fodder varieties-legumes and non-legumes, seasonal and perennial fodder crops. Cultivation practices of fodder crops-Para grass, Hybrid Napier, Berseem, Cow pea, Jowar – fodder trees – Silvi pasture system – Horti pasture system. (10 Lectures)

Unit-5: Utilization of agricultural and industrial by-products for livestock feeding. Enrichment of poor quality roughages – Urea treatment of paddy straw – Total mix ration(TMR).(5 Lectures)

II Semester
Course 4: Dairy Cattle Nutrition
Credits -1

1. Identification of feeds and fodders.
2. Computation of rations.
3. Hay making.
4. Silage making.
5. Estimation of dry matter of feed or fodder.
6. Cultivation of fodder crops.

Preparation of ration schedules for different categories of animals- calves, young, heifers, pregnant, and lactating animals.

Reference books

1. Text Book of Animal Husbandry - G C Benarjee
2. Principles and practices of Dairy Farm –Jagdish Prasad
3. Animal Nutrition and feeding practices – Dr Surendra K .Ranjhan
4. Dairy Chemistry and Animal Nutrition – M M Roy.

III Semester
Course 5: Dairy Chemistry (Chemistry of fluid milk)

Credits -3

Unit-1: Composition of Milk: Definition of milk as per FSSAI, composition of cow milk, differences in the composition of milk from cow, buffalo, goat, sheep, human. Colostrum: Significance, Composition, difference between normal milk and colostrum

Unit-2: Constituents of milk: Minor and major constituents; proteins, casein, whey proteins, NPN compounds, milk fat, triglycerides, phospholipids, sterols, fat globule membrane, enzymes in milk and their significance.

Unit-3: Factors affecting composition and yield of milk –Species, Breed, individuality, Stage of lactation, Age of the animal, Season, Interval between milking, Stage of milking, Feed, Estruses, Exercise, Milker and Drugs.

Unit-4: Physico-chemical properties of milk- Colour, Flavour, Density and Specific gravity, Freezing point, Boiling point, Surface tension, Viscosity, Specific heat, Refractive index, Electrical conductivity, Germicidal property, PH and acidity, Ionic balance . Physicochemical constants of milk fat, RM value, Polenske Value, saponification value, Iodine number.

Unit-5. Nutritive value of milk. Platform tests; Tests for detection of adulteration of milk; Preservatives and Neutralizers. FSSAI Specifications for milk.

III Semester
Course 5: Dairy Chemistry (Chemistry of fluid milk)

Credits -1

1. Estimation of specific gravity of milk
2. Estimation of Fat in milk
3. Estimation of SNF in milk
4. Estimation of Protein in milk using Pyne's constant
5. Estimation of acidity in milk
6. Estimation of pH in milk
7. Platform tests.
8. Tests for detection of adulteration of milk
9. Tests for Preservatives and Neutralizers.
10. Comment on the quality of given milk sample

Reference Books

1. Dairy chemistry and Animal Nutrition - M M Roy
2. Text of practical Dairy Chemistry - N K Roy
3. Fundamentals of Dairy Chemistry - Webb Johnson and Alfred
4. Dairy chemistry and Physics - Pieter Walstra, Robert Jenness.
5. Fundamentals of Dairy Chemistry - Noble P W

III Semester

Course 6: Dairy Microbiology (microbiology of market milk)

Credits -3

Unit-1: Definition, Microscopy – Simple, Compound - bright-field microscopy. Structure and functions of prokaryotic cells; Taxonomy of Microorganisms - Classification, nomenclature, identification; Differences between cell wall of Gram positive and Gram negative bacteria.

Unit-2: Sources of contamination of milk and their control: exterior of the animal, interior of the udder, utensils, water, milker, flies and insects, soil and manure, milking barn, cattle shed and surroundings. Methods of clean milk production.

Unit-3: Sources and Significance of specific groups of microorganisms in milk i.e. psychrotrophic, mesophilic, thermoduric and thermophilic bacteria - their morphological and biochemical characteristics. Types of Microorganisms in milk such as acid producing, gas producing, protein splitting, fat splitting microbes; Pathogens associated with raw milk and inert organisms.

Unit-4: Chemical changes observed during storage of milk and abnormal fermentations observed in milk: souring, gassy fermentation, proteolysis, lipolysis, ropiness, and flavour fermentations. Factors affecting growth of bacteria, Common nutrient requirements and nutritional types of microorganisms.

Unit-5: Milk borne diseases: bacterial, viral and other diseases.

Microbiological examination of milk: direct microscopic count, standard plate count, methylene blue reduction test, resazurin reduction test and coliform test. Microbiological grading and legal standards of raw and processed milk.

III Semester

Course 6: Dairy Microbiology (microbiology of market milk)

Credits -1

1. Microbiological equipment; autoclave, hot air oven, incubator centrifuge, colorimeter, laminar airflow, membrane filter.
2. Staining of Microbes: Simple staining- methylene blue and Differential staining (Gram)
3. Preparation of commonly used growth media liquid and solid
4. Grading of raw milk by direct microscopic count.
5. Grading of raw milk by standard plate count
6. Grading of raw milk by coliform counts
7. Grading of raw milk by methylene blue reduction time.
8. Grading of raw milk by resazurin reduction test
9. Enumeration of psychrophilic and thermophilic microorganism in milk

Reference books :

1. Dairy Microbiology – R K Robinson
2. Milk products preparation and quality control - C P Ananthkrishnan
3. Food Microbiology - W C Frazier

III Semester
Course 7: Dairy Farm Management
Credits -3

Unit-1: Systems of Housing of Dairy cattle- Loose Housing and Conventional Dairy Barns. Drawing of layouts for dairy cattle dwellings; Criteria for selecting site for establishing Dairy farm buildings; Water requirement of dairy animals – drainage system in dairy farms – disposal of dairy farm wastes–composting– establishment of small scale gobar gas units. (20 Lectures)

Unit-2: Symptoms of ill health of Dairy animals. Diseases of Dairy animals- Bacterial, Viral, Parasitic and Nutritional diseases and their control –Economically important diseases – mastitis and foot and mouth disease. (10 Lectures)

Unit-3: Management of different classes of Dairy animals- Milk producing animals, Pregnant animals, dry animals, heifers and calves –management of sick animals – quarantine, sanitation and hygiene –Management during transport, drought and summer season.

Unit-4: Management practices for Dairy farm; Identification, Dehorning, Castration, Deworming, Vaccination, Disinfection, and Milking management. (15 Lectures)

Unit-5: Maintenance of high level of fertility in the herd. Importance, reasons for low fertility, methods of maintaining high level of fertility in the herd. Methods of determining reproductive efficiency : (i) by no return percentage of cows, (ii) by calving interval period, (iii) by pregnancy days of cows per year.- Reducing prolonged calving intervals. (15 Lectures).

III Semester
Credits -1

1. Dairy Farm layout
2. Methods of Identification of cows,
3. Dehorning of calves
4. Castration of bulls
5. Deworming of dairy cattle
6. Preparation of vaccination schedule of dairy cattle
7. Identification of sick animals
8. Tests for hardness of water.
9. Determining the strength of detergent solution.

Reference Books :

1. Text book of Animal Husbandry - G C Benarjee
2. Hand book of Animal Husbandry ICAR Edition

III Semester
Course 8: Management of Sheep and Goats
Credits -3

Unit-1: importance of goat farming.

Breeds of Indigenous goats.

Important Exotic goat breeds for India.

Differences between goat and sheep.

Unit-2: Advantages of sheep farming.

Breeds of sheep—Indian and exotic breeds. Reproduction in sheep.

Nutrition of sheep.

Unit-3: Anatomy of male reproductive system in goat and sheep,

Anatomy of female reproductive system in goat and sheep, Reproduction in female animals (symptoms of heat, mating systems etc) . Pregnancy diagnosis in sheep and goat.

Unit-4: Feeding habits of goat and sheep.

Nutrient requirements of goat and sheep.

Feeding regimes and practical feeding of sheep and goat.

Unit-5: Management of goat farms and sheep farms.

Routine operations in goat and sheep farms. Essentials of sheep and goat management.

Housing, deworming, health care and hygiene in goat and sheep farms.

III Semester
Course 8: Management of Sheep and Goats

Credits -1

1. Identification of important goat breeds.
2. Identification of important sheep breeds.
3. Symptoms of heat in goat and sheep.
4. Methods of pregnancy diagnosis in goat and sheep
5. Preparation of feeding regimes or rations for different categories – young, lactating and pregnant goat and sheep.
6. Preparation of project report for 25 and 50 goat farms (economic aspects)
7. Preparation of project report for 25 and 50 sheep farms (economic aspects)
8. Management techniques of sheep and goat farms.

References

1. Text book of Animal Husbandry - G C Benarjee
2. Principles and practices of Dairy Farm –Jagdish Prasad

IV Semester
Course 9: Processing of Milk (Market milk)

Theory 03 hours /Week Credits -3

UNIT-I. a) Reception of Milk- Unloading, Grading, Sampling, Testing, Weighing and Recording.

b) Storage of Milk c) Straining, Filtration and Clarification of Milk.

UNIT- II. Pasteurization of Milk- Definition, Objectives, Principles of Heat exchange, Methods of Pasteurization.- (LTLT, HTST, Uperization). UHT and Sterilization of Milk.

UNIT- III. a) Homogenization of Milk- Factors influencing Homogenization of Milk (Temperature and Pressure), Effect of Homogenization on Milk. (b) Standardization of Milk: Standardization using Pearson square method.

Unit-IV : a) Market Milk- Toned milk, Double toned milk, Reconstituted milk, Standardized milk, and Full cream milk - Standards and methods of manufacture. (b) Packaging of Milk- Desirable characters and types of packaging materials, Forms of Packaging.

UNIT V. (a) Cleaning and sanitation of dairy equipment: Types of cleaning and sanitizing agents, mode of action, different types of cleaning methods, (i) Hand washing, (ii) Mechanical washing (iii) Cleaning in place(CIP). (b) Disposal of Dairy effluents: Sources of Dairy wastes, Necessity of treating Dairy wastes, methods of treatment, Low cost methods, Conventional methods, Activated sludge process and trickling filters.

IV Semester
Course 9: Processing of Milk (Market milk)
Credits -1

- 1.RMRD Testing of Milk (Platform tests)
- 2.Standardization of Milk
- 3.Homogenization of Milk
- 4.Pasteurization of Milk
- 5.Sterilization of Milk
- 6.Preparation of Toned Milk
- 7.Preparation of Double Toned Milk
- 8.Preparation of Reconstituted Milk
- 9.Cream Separation.

REFERENCE BOOKS

- 1.Outlines of Dairy Technology – Sukumar De
- 2.Milk Products Preparation and Quality Control- C.P.Anantha Krishnan
- 3.The Technology of Milk Processing- C.P. Anantha Krishnan
- 4.Modern Dairy Products- Lincoln M Lampert

IV Semester
Course 10: Technology of Dairy products
Credits -3

UNIT-I: Significance and health benefits of fermented milks. Types of Fermented milks- Cultured butter milk, Lassi, Kumiss, Dahi, Yoghurt.

UNIT II. Cheese - Definition, PFA Standards, Composition, Classification, Method of manufacture of Cheddar Cheese.

UNIT III. Method of manufacture of Processed Cheese, Method of manufacture of Cottage Cheese, Packaging of Cheese and Storage of Cheese.

UNIT IV: Ice Cream- BSI Standards, Definition, Composition, Classification, Methods of manufacture of Ice cream. Over run in Ice Cream, Packaging and Storage of Ice Cream.

UNIT V: Maintenance of dairy equipment. - Daily and periodical maintenance. Maintenance of industrial and personal hygiene in dairy plants

IV Semester
Course 10: Technology of Dairy products
Credits -1

1. Preparation of Cheddar Cheese
2. Preparation of Cottage Cheese
3. Preparation of Ice Cream mix.
4. Manufacture of Ice Cream and calculation of Over run in Ice Cream.
5. Estimation of acidity in milk and Whey
6. Estimation of fat percentage in cheese, Ice cream and whey.

REFERENCE BOOKS

1. Outlines of Dairy Technology – Sukumar De
2. Milk Products Preparation and Quality Control- C.P. Anantha Krishnan
3. The Technology of Milk Processing- C.P. Anantha Krishnan
4. Modern Dairy Products- Lincoln M Lampert

IV Semester
Course 11: Technology of Fat- Rich Dairy Products
Credits -3

Unit-1: Cream: Definition & Legal standards, efficiency of cream and factors responsible for fat loss in butter milk. Control of fat concentration in cream. Packaging and storage of cream. Methods of manufacture of cream.

Unit-2: (a) Neutralization, standardization, pasteurization and cooling of cream. (b) different types of cream; table cream, sterilized cream, whipped cream, plastic cream and frozen cream. (c) UHT processing of cream. d) factors affecting quality of cream; ripening of cream e), defects in cream and their prevention.

Unit:3: Butter: a) Introduction to the butter making process; theory of churning, Legal standards. b) Technology of Butter manufacture, Batch and continuous methods.

(c) Over-run in butter; control of fat loses in butter-milk; packaging and storage; transportation; defects in butter; uses of butter; Preparation of Desi butter.

Unit-4: (a) Ghee : Preparation of ghee from cream and butter. Methods of ghee making -batch and industrial processes, innovations in ghee production, procedure, packaging and preservation of ghee. (b) AG Mark Standards and PFA Standards for Ghee.

Unit-5: Utilization of dairy by-products – skim milk, butter milk, whey etc. Butteroil: Manufacture of butteroil, packaging and storage.

IV Semester
Course 11: Technology of Fat- Rich Dairy Products

Credits -1

- 1.Preparation of White butter and Table butter
- 2.Calculation of Over run in butter
- 3.Cream separation
4. Estimation of fat percentage in cream
5. Estimation of fat% in butter milk
6. Estimation of fat% in butter
7. Neutralization of cream

REFERENCE BOOKS

- 1.Outlines of Dairy Technology- Sukumar De
- 2.Milk and Milk Products – Eckles, Combs and Macy
- 3.Milk, Milk Products and Quality Control- C.P. Anantha Krishnan
- 4.The Technology of Milk Processing- C.P. Anantha Krishnan

V Semester
Course 12: Technology of Condensed and Dried Milks
Credits -3

UNIT 1. Evaporated Milks- Definition, PFA Standards, Composition and method of manufacture.

UNIT 2. Condensed Milks- Definition, PFA Standards, Composition and method of manufacture.

Unit 3: Milk Powder- Skim milk powder(SMP), Whole milk powder(WMP. Spray dried and Roller dried methods, Definitions, PFA Standards, Method of manufacture and Storage.

UNIT 4. Fermented Milk Products- Dahi, Yoghurt, Acidophilus milk, Bulgarian butter milk, Kefir and Kumiss. Definition, Composition and method of manufacture of Dahi and Yoghurt.

UNIT 5:. Indegenous Dairy Products .- Khoa, Channa and Paneer. - Definitions, Composition, PFA Standards, Methods of manufacture.

V Semester
Course 12: Technology of Condensed and Dried Milks
Credits -1

- 1.Preparation of Dahi
- 2.Preparation of Yoghurt
- 3.Propagation of bacterial cultures
- 4.Preparation of Desi butter
- 5.Preparation of Kulfi
- 6.Preparation of Khoa and associated products such as Burfi, Gulab jamun, Pedas, Kalakhand etc.
- 7.Preparation of Channa and associated products such as Rasagulla, Sandesh etc.
- 8.Preparation of Ghee by various methods.

REFERENCE BOOKS

1. Outlines of Dairy Technology- Sukumar De
2. Milk, Milk Products and Quality Control- C.P. Anantha Krishnan
3. The Technology of Milk Processing- C.P. Anantha Krishnan

V Semester

Course 13: Traditional Indian Dairy Products

Credits -3

Unit-1: Status and significance of traditional Indian milk products in India.

Khoa: Classification of types, standards methods of manufacture and preservation, factors affecting yield of khoa. Khoa based sweets: Burfi, Peda, Milkcake, Kalakhand, Gulabjaman and their compositional profile and manufacture practices.

Unit- 2: (a)Rabri and Basundi: process description, factors affecting yield, physico-chemical changes during manufacture.

(b)Bio-preservative principles in enhancing the self-life of indigenous milk products including active packaging.

Unit- 3: Chhana: standards, method of manufacture, packaging and preservation. Chhana-based sweets: Rasogolla, Sandesh, Rasomalai.

Paneer: standards, method of manufacture, packaging and preservation. Mechanization of Paneer manufacturing/packaging process.

Unit- 4: Chakka/Maska and Shrikhand: standards, method of manufacture, small scale and industrial process of production, packaging and preservation aspects.

Unit-5: Misti Dahi: Product description method of manufacture and packaging process. Kheer and Payasam: Product description methods of manufacture, innovations in manufacturing and packaging processes.

V Semester

Course 13: Traditional Indian Dairy Products

Credits -1

1. Preparation of Khoa from cow, buffalo and concentrated milk.
2. Preparation of Burfi, Peda, Kalakand, Milkcake and Gulabjamun.
3. Preparation of Paneer from cow, buffalo and mixed milk.
4. Preparation of Chhana from cow and buffalo milk and mixed milk.
5. Preparation of Sandesh and Rasogolla.
6. Preparation of kheer.
7. Preparation of Rabri, Misti Dahi, Chhaka and Shrikhand.
8. Visit to industry.

REFERENCE BOOKS

1. Outlines of Dairy Technology- Sukumar De
2. Milk, Milk Products and Quality Control- C.P. Anantha Krishnan
3. The Technology of Milk Processing- C.P. Anantha Krishnan

V Semester
Course 14: Dairy Development and Co-operatives
Credits -3

Learning objectives:

1. The student will be able to understand various dairy development programs implemented in India before and after independence.
2. The students will learn the impact of cooperative dairying on the dairy development in India.
3. Students will also learn the status of India in the world in terms of milk production.

Theory

Unit-1 : Advantages of Dairying. Principals involved in successful dairying. Systems of dairy farming-Mixed farming and Specialized dairy farming – organic farming system.

Unit-2: Methods of procurement of milk; Transportation of milk; Pricing of milk, methods of Marketing of milk.

Unit-3: Cooperative Dairying-Structure of Dairy cooperatives- Anand pattern - Primary milk producer's cooperative society; District milk producer's cooperative union; State level dairy development cooperative Federation, objectives and functions - Milk and milk products order MMPO(1992)- Role of private dairies in India.

Unit-4: Dairy development programs implemented in India. Statistical analysis of progress in development of Dairy industry in India, Operation Flood Program., Key village scheme. Quantity of milk produced in India over the past five decades vis-a vis other countries.

Unit-5: Economics of maintaining Dairy farm- Income and expenditure in dairy farms. Estimating the production cost of milk.

V Semester
Course 14: Dairy Development and Co-operatives
Credits -1

Practicals:

1. Estimation of production cost of milk for 5 animals and 10 animal dairy units.
2. Estimating income and expenditure involved in dairy farming
3. Preparation of project report for different sizes of dairy farms
4. Essentials for setting up of dairy farm
5. On Farm training for one month is suggested and a comprehensive training report should be submitted as mandatory requirement while appearing for semester practical exam which would carry 20 marks out of 50 marks as weightage.

References

1. Text book of Animal Husbandry - G C Benarjee
2. Principles and practices of Dairy Farm –Jagdish Prasad

Learning outcomes:

After successful completion of the course, both theoretically and practically,

- Students learn about various dairy development programs implemented in India.
- Students will get knowledge about various methods of pricing of milk
- The students will also have knowledge about various methods used for procurement, transport and marketing of milk.

V Semester
Course 15: Ice-Cream and Frozen Desserts
Credits -3

Unit-1. History, development and status of ice cream industry Definition, classification and composition and standards of ice cream and other frozen desserts, Stabilizers and emulsifiers-their classification, properties and role in quality of ice cream,

Unit-2. Technological aspects of ice cream manufacture, Thermodynamics of freezing and calculation of refrigeration loads, Types of freezers,

Unit-3. Instrumentation Hygiene, cleaning and sanitation of ice cream plant, Effect of process treatments on the physico-chemical properties of ice-cream mixes and ice cream,

Unit-4. Processing and freezing of ice-cream mix and control of over run, Packaging, hardening, storage and shipping of icecream, Defects in ice cream, their causes and prevention,

Unit-5. Recent advances in ice-cream industry (flavourings, colourings, fat replacers, bulking agents) and plant management Nutritive value of ice-cream.

V Semester
Course 15: Ice-Cream and Frozen Desserts
Credits -1

1. Calculation of standardization of ice-cream mixes.
2. Manufacture of plain and fruit flavoured ice- cream.
3. Manufacture of chocolate, fruit and nut ice cream.
4. Preparation of sherbets/ices.
5. Preparation of soft served and filled ice-cream.
6. Manufacture of kulfi. Study of continuous and batch type freezers.
7. Manufacture of ice-cream by continuous process. Determination of overrun in ice cream.
8. Factory visit.

REFERENCE BOOKS

1. Dairy Microbiology- Parihar and Parihar
2. Outlines of Dairy Technology- Sukumar De
3. Milk, Milk Products and Quality Control- C.P. Anantha Krishnan

VII Semester
Course 16: Chemistry of Dairy Products
Credits -3

Unit-1: Chemical composition and legal standards of milk products.- Cream, Butter, Ice cream and Ghee. Chemistry of creaming and factors affecting the same.

Unit-2: Ripening and neutralization of cream. Theories of churning and factors affecting the fat losses in cream and over run in butter.

Unit-3: Ghee: Physico-chemical changes during manufacture. Hydrolytic and oxidative deterioration and their causes, prevention. Role of antioxidants in the quality of ghee.

Unit-4: Physico-chemical changes in milk constituents during manufacture and storage of traditional dairy products: Khoa, Paneer, Dahi, Channa, Lassi, Chakka, Shrikhand. Chemistry of cheese: milk clotting enzymes, enzymatic coagulation of milk, biochemical changes during ripening.

Unit-5: Physico-chemical changes during preparation and storage of concentrated and dried milk products. Physico-chemical changes during processing and storage of ice cream and frozen desserts. Role and mechanism of stabilizers and emulsifiers in ice cream.

VII Semester
Course 16: Chemistry of Dairy Products

Credits -1

1. Cream: estimation of fat and acidity.
2. Butter: estimation of fat, moisture, curd and salt content.
3. Ghee: estimation of moisture, acid value, Butyro- refractive reading and Reichert Meissl value /Polanske value.
4. Determination of lactose and sucrose in sweetened condensed milk.
5. Milk powder: moisture, fat, ash, solubility, acidity and bulk density.
6. Ice cream: estimation of fat and total solids.
7. Estimation of moisture, fat and salt content in cheese.
8. Khoa/paneer: estimation of moisture and fat.
9. Estimation of protein content in milk products and protein rich dairy products using Kjeldahl method.

REFERENCE BOOKS

1. Outlines of Dairy Technology- Sukumar De
2. Milk, Milk Products and Quality Control- C.P. Anantha Krishnan
3. The Technology of Milk Processing- C.P. Anantha Krishnan

VII Semester
Course 17: Microbiology of Dairy Products
Credits -3

Unit-1: Microbiology of Cream and Butter - Micro-environment and impact of critical process factors on entry of spoilage and pathogenic organisms in cream and butter; Microbiological aspects including defects in pasteurized (ripened/unripened cream), sterilized and UHT cream; Factors influencing the microbial growth during batch/continuous butter making process; Microbial Defects in butter - Bacterial/mold discoloration, enzymatic deterioration and their control measures; Regulatory microbiological standards.

Unit-2: Microbiology of Condensed, Evaporated and Dried products: Type of microorganisms associated with condensed, evaporated and dried products, their growth/ survival during manufacture and storage; Microbial defects - Bacterial thickening / Mold button formation in SCM; Gassiness/bloating, Bacterial coagulation (Sour and sweet), Bitterness, Fishy flavor in evaporated milk;

Unit-3: Pre-heating/DSI temperature and their impact on microflora of dried products; Effect of reconstitution on microbial quality of milk powder including baby foods and survivability of pathogens; Regulatory microbiological standards

Unit-4: Microbiology of Ice Cream and Frozen desserts: Microenvironment in ice cream, microbiological quality of ingredients, critical process factors and their impact on entry of pathogens in ice cream and frozen desserts, their survival during storage, food poisoning outbreaks and legal standards.

Unit-5: Microbiology of Indigenous Milk Products: Predominance of spoilage and pathogenic organisms in khoa and khoa based sweets – burfi, peda, gulabjamun, etc., paneer, Chhanna and Chhanna based sweets – rasogulla; kheer, shrikhand, dahi, kulfi etc.; Factors affecting the microbiological quality in reference to production, processing, storage and distribution. Microbial defects, control measures and legal standards; Active packaging concepts and role in bio-preservation.

VII Semester
Course 17: Microbiology of Dairy Products
Credits -1

1. Practical Microbiological examination of raw, pasteurized, sterilized and UHT cream for Standard plate count (SPC) as well as lipolytic and coliform counts
2. Direct microscopic count (DMC), dye reduction tests and sterility test.
3. Microbiological examination of salted and unsalted butter for SPC, psychrotrophic, lipolytic, coliforms and yeast and mold count; Keeping Quality (KQ) test.
4. Microbiological examination of concentrated milk for SPC, coliforms, spores, yeast and mold, thermotolerant and thermophilic counts.
5. Microbiological examination of dried milks for SPC, coliforms, Staph. aureus, B. cereus, E. coli, Salmonella, Sulphite reducing clostridia and Staphylococcal enterotoxins.
6. Microbiological examination of ice-cream and other frozen desserts for SPC, coliforms and Staphylococcal counts; Detection of Salmonella spp./E. coli.

7. Microbiological examination of khoa for SPC, coliforms and staphylococcal counts besides yeast and mold counts.
8. Microbiological examination of paneer and shrikhand for SPC, Spores, coliforms, yeast and molds and Staphylococcal counts.
9. Microbiological examination of packaging materials for SPC, Spores and Yeast and mold counts.

REFERENCE BOOKS

1. Dairy Microbiology- Parihar and Parihar
2. Outlines of Dairy Technology- Sukumar De
3. Milk, Milk Products and Quality Control- C.P. Anantha Krishnan
4. Dairy Microbiology – R K Robinson
5. Food Microbiology - W C Frazier

VII Semester
Course 18: Starter Cultures and Fermented Milk Products
Credits -3

Unit-1: Types, metabolism and propagation of starter cultures: History, classification and importance of starter Cultures in dairy industry; Single, multiple, defined and mixed strain starters; Probiotics and Special cultures like exopolysaccharide production;

Unit-2: Propagation of starter cultures concentrates - direct bulk and direct vat starter cultures, factors affecting propagation; Metabolism of starter cultures (carbohydrate, protein, citrate) and production of metabolites and antibacterial substances; methods of starter distillates their merits/demerits.

Unit-3: Activity, Purity, Preservation of Starters and Starter Failure: Quality and activity tests for dairy starters and their preservation- methods (liquid, spray drying, vacuum drying, freeze-drying, frozen concentrate, concentrated dried cultures), merits and demerits; factors affecting the survival of cultures during preservation; Defects in starters and their control; Starter failures- effect of antibiotic residues, sanitizers and bacteriophages. Phages-life cycle, sources, prevention, chemical and mechanically protected systems.

Unit-4: Role of Starters in fermented milks: Role of starters in the preparation of various fermented milks; Types of fermented milks - dahi, yoghurt, acidophilus milk; different types of dahi and yoghurt; preparation; defects and their control. Kefir and koumiss : origin and characteristics; microbiology of kefir grains; Other fermented milks such as Bulgarian milk, cultured buttermilk, Leben, Villi and Yakult; Microbiology of fermented milk products; their nutritional and therapeutic significance.

Unit-5: Chesse Starters: Classification, desirable properties, Artisanal and adjunct cheese cultures, primary and secondary flora of cheese; biochemical changes during ripening, bacterial and mold ripened cheeses: soft, semi-soft, semi-hard, hard, Brick and Brie cheese, Camembert and Roquefort cheese; Rennet: rennet substitutes, microbial rennet and recombinant chymosin.

VII Semester
Course 18: Starter Cultures and Fermented Milk Products
Credits -1

1. Testing purity of starter cultures by gram's staining, catalase test; creatine test.
2. Testing starter activity by dye reduction tests, Horrall-Elliker, WhiteHead & Cox test.
3. Preparation of single and mixed starter cultures.
4. Evaluation of homo-fermentation and hetero-fermentation separately and in combination.
5. Effect of physical factors (temperature, pH, Salt and Sugar) on dairy starters.
6. Testing milk for presence of inhibitory substances using *B. stearothermophilus* and *S. thermophilus* as indicator organisms.
7. Effect of presence of antibiotic residues in milk on starter activity. Evaluation of associative growth of Starter cultures in milk.
8. Detection of Bacteriophages in cheese whey by plaque assay method.
9. Preparation and microbial examination of dahi, yoghurt, cultured butter milk, acidophilus milk and kefir.

REFERENCE BOOKS

1. Dairy Microbiology- Parihar and Parihar
2. Outlines of Dairy Technology- Sukumar De
3. Milk, Milk Products and Quality Control- C.P. Anantha Krishnan

VIII Semester
Course 19: Quality Assurance in Dairy Industry
Credits -3

UNIT I. Importance of quality control. Changing scenario, quality assurance and Total Quality Management (TQM) in Dairy industry. Role of National and International food regulatory systems and standards with respect to quality and safety of milk and milk products: FSSAI, PFA, AGMARK, BIS etc. Integrated food law and its main functions and features. Concepts of Quality management system (QMS) - ISO 9000:2000, Principles of QMS

UNIT II. Application of food safety management system (ISO: 22000). Hazard analysis and critical control points (HACCP) systems and its application in dairy industry.

UNIT III. Sampling procedures, labelling of samples for analysis, choice of analytical tests for milk and milk products for chemical analysis and instrumental methods of analysis. Chemical quality of water in dairy industry.

UNIT IV. Rapid enumeration techniques: Enumeration principles and procedure for rapid detection of predominant hygiene indicator organisms and pathogens like E.Coli, Salmonella, Shigella, Staphylococcus aureus, Bacillus cereus., Plant and equipment hygiene: concepts of hygiene and sanitation, microbiological quality of water and environmental hygiene in dairy plant, chlorination of dairy water supply, quality of air, personnel hygiene.

UNIT V . Qualitative and quantitative tests for assessing microbiological quality of milk. MBRT, RRT, Estimation of total bacterial count in milk, (SPC,DMC)

VIII Semester
Course 18: Quality Assurance in Dairy Industry
Credits -1

1. FASSAI standards for milk and Milk products
2. Agmark standards for ghee
3. Enumeration of E.coli
4. Enumeration of total bacterial counts.
5. In-Plant training in all sections of a commercial dairy plant in various sections as follows:
 1. RMRD Section
 2. Processing section
 3. Butter and Ghee section
 4. Condensed milks and Powder section
 5. Indigenous milk products section
 6. Quality control section
 7. Boiler section
 8. Refrigeration section
 9. Dairy waste disposal section

REFERENCE BOOKS

1. Dairy Microbiology- Parihar and Parihar
2. Outlines of Dairy Technology- Sukumar De
3. Milk, Milk Products and Quality Control- C.P. Anantha Krishnan
4. The Technology of Milk Processing- C.P. Anantha Krishnan

VIII Semester
Course 20 A: Sensory Evaluation of Dairy Products
Credits -3

Unit-1: Introduction, definition and importance of sensory evaluation in relation to consumer acceptability and economic aspects. Terminology related to sensory evaluation. Basic principles: senses and sensory perception. Physiology of sensory organs. Classification of tastes and odours, threshold value. Factors affecting senses, visual, auditory, tactile and other responses.

Unit-2: Fundamental rules for scoring and grading of milk and milk products. Procedure and types of tests – difference tests (Paired comparison, due-trio, triangle) ranking, scoring, hedonic scale and descriptive tests. Panel selection, screening and training of judges.

Requirements of sensory evaluation, sampling procedures. Factors influencing sensory measurements. Sensory Evaluation of milk and dairy products - Milk: score card and its use. Judging and grading of milk, defects associated with milk.

Unit-3: Cream: desirable attributes and defects in cream, Score card for cream, sensory evaluation of different types of cream. Butter: Specific requirements of high grade butter, undesirable attributes of butter, butter score-card, sensory evaluation of butter. Ghee: grades of ghee, special requirements of quality ghee, defects in ghee, sensory evaluation of ghee.

Unit-4: Fermented milks: desirable and undesirable characteristics of fermented milks, sensory evaluation of dahi, yoghurt, chakka, srikhand, lassi and other fermented drinks. Frozen dairy products: desirable and undesirable characteristics of frozen dairy products. Sensory evaluation of ice cream, kulfi and milk sherbets.

Unit-5: Cheese: Sensory attributes of some common cheese varieties and their defects, score card for cheese. Sensory evaluation and grading for cheddar, cottage and other varieties of cheeses. Dried dairy products: desirable and undesirable characteristic of dried milks. Sensory evaluation and grading of dry milk products. Concentrated milks: desirable attributes and defects.

VIII Semester
Course 20 A: Sensory Evaluation of Dairy Products
Credits -1

1. Consumer acceptance studies: Objectives, methods,
2. Types or questionnaires, development of questionnaires,
3. Comparison of laboratory testing and consumers studies, limitations.
4. Interrelationship between sensory properties of dairy products and various instrumental and physico-chemical tests.
5. Practical Determination of threshold value for basic tastes.
6. Determination of threshold value for various odours.
7. Selection of sensory evaluation panel.
8. Training of judges, for recognition of certain common flavour and texture defects using different types of sensory tests.
9. Sensory evaluation of milk and cream using score cards.

10. Sensory evaluation of butter and ghee.
11. Sensory evaluation of condensed and evaporated milk.
12. Sensory evaluation of milk powders, cheese and related products.
13. Sensory evaluation of frozen products.
14. Sensory evaluation of khoa and khoa- based sweets. Sensory evaluation of chhana and chhana based sweets.
15. Novel techniques of sensory evaluation.

REFERENCE BOOKS

1. Outlines of Dairy Technology- Sukumar De
2. Milk, Milk Products and Quality Control- C.P. Anantha Krishnan
3. The Technology of Milk Processing- C.P. Anantha Krishnan

VIII Semester
Course 20 B: Entrepreneurship Development and Industrial Consultancy
Credits -3

Unit-1. Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalisation and the emerging business/entrepreneurial environment.

Unit-2. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis,

Unit-3. Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs)/SSIs.

Unit-4. Export and Import. Policies relevant to dairy sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Overview of dairy inputs industry. Characteristics of Indian dairy processing and export industry. Social Responsibility of Business.

Unit-5. Industrial Consultancy: Dairy plant management system- milk procurement from the rural milk producer, milk processing and products manufacturing. Pricing and marketing of milk and milk products.

VIII Semester
Course 20 B: Entrepreneurship Development and Industrial Consultancy
Credits -1

1. Survey on milk production potential and marketed surplus of milk for setting up of milk plants.
2. Study of Recruitment and training of manpower
3. Estimation of costs of product manufacture and energy utilization in food processing plants. 4.
4. Sources of finance for setting up of dairy farms and processing plants/ units.
5. Guidelines for obtaining ISO/HACCP certification for dairy plants.
6. Assessment of entrepreneurial skills and characteristics for successful entrepreneur.
7. Consumer opinion surveys.
8. Pricing of milk and milk products.
9. Preparation of feasibility reports for setting of dairy farms, composite milk plants, collection centers, chilling units and processing units.

References:

1. Entrepreneurship books for agriculture and other areas.

VIII Semester
Course 21A : Dairy Process Engineering
Credits -3

Unit-1. Evaporation: Basic principles of evaporators, construction and operation, Different types of evaporators used in dairy industry, Calculation of heat transfer area and water requirement of condensers, Basic concepts of multiple effect evaporators, Operations and various feeding systems, Economy of operation, Thermo processor and MVR system, Care and maintenance of evaporators.

Unit-2. Drying: Introduction to principle of drying, Equilibrium moisture constant, bound and unbound moisture, Rate of drying- constant and falling rate, Effect of Shrinkage, Classification of dryers-spray and drum dryers, spray drying, etc., air heating systems,

Unit-3. Atomization and feeding systems. Factors affecting bulk density of powder, spray dryer controls, Theory of solid gas separation, cyclone separators, Bag Filters, Care and Maintenance of drum and spray dryers.

Unit-4. Processing equipments: Mechanization and equipment used in manufacture of indigenous dairy products, Ice-cream and Cheese making equipments. Packaging equipments: Packaging machines for milk & milk products.

Unit-5. Membrane Processing: Ultra filtration, Reverse Osmosis and electro dialysis, Materials for membrane construction, Ultra filtration of milk, Effect of milk constituents on operation, membranes for electro-dialysis.

VIII Semester
Course 21 A: Dairy Process Engineering
Credits -1

1. Constructional details, operation and maintenance of Vacuum pan.
2. Constructional details, operation and maintenance of multiple effect evaporator.
3. Constructional details, operation and maintenance of spray drier.
4. Constructional details, operation and maintenance of butter making equipment.
5. Constructional details, operation and maintenance of equipment related to ghee production.
6. Constructional details, operation and maintenance of ice-cream making equipment.
7. Constructional details, operation and maintenance of cheese making equipment.
8. Constructional details, operation and maintenance of reverse osmosis and ultra filtration system.
9. Design problems on double effect evaporator and vacuum pan. Visit to a milk product plant.

Reference books:

1. Milk and milk product technology- Edgar Spreer
2. Text book of Dairy Engineering

II Semester
Course 21 B: Refrigeration and Air – Conditioning
Credits -3

Unit-1. Basic refrigeration cycles and concepts: Standard rating refrigerating machines; Elementary vapour compression refrigeration cycle with reciprocating, rotary and centrifugal compressors; Theoretical vapour compression cycle;

Unit-2 Refrigerants: Primary and secondary refrigerants; common refrigerants (Ammonia, Freon, HFC, HCFC etc); Brine, their properties and comparison. Multi-Pressure Refrigeration Systems: Applications; Multi-evaporators with single stage and multi-stage compression and expansion systems.

Unit-3 Design and Balancing of Refrigeration System: Basic elements of design of individual components and a complete refrigeration system. Input and Output design parameters, Balancing of components of refrigeration system for optimum performance. Absorption Refrigeration Systems: Simple vapour absorption refrigeration systems, Actual Vapour absorption refrigeration system, Refrigerant absorbent pairs, Absorption cycle analysis.

Unit-4. Cryogenic Freezing: Cryogenics, cryogenics, properties, applications, cryogenic freezers. Psychrometry: Definition, properties of moist air, psychrometric charts, psychrometric processes; Cooling/ Heating coils, humidifiers and dehumidifiers, Temperature and humidity measurements and controls.

Unit-5. Cold Storage: Types of cold storages, Types of cooling loads in cold storages used for food/ dairy products; Construction and operation of cold storage. Insulating materials and vapour barriers.

II Semester
Course 21 B: Refrigeration and Air – Conditioning
Credits -1

1. Study of different types of Refrigeration tools generally used in installation and maintenance of a refrigeration plant/ equipment including charging and leakage-detection tools.
2. Study of specification, components, operation, control, maintenance and precautions taken during working of a Domestic refrigerator.
3. Study of specifications, components, operation, control, maintenance and precautions taken during working of a Water cooler.
4. Study of specifications, components, operation, control, maintenance and precautions taken during working of a Bulkmilk cooler.
5. Study of specifications, components, operation, control, maintenance and precautions taken during working of a Walk-in-cooler.
6. Study of different parts and learn the operation of a refrigeration plant/ice plant using ammonia refrigerant.
7. Estimation of installed cooling capacity with the help of observed working pressures.

8. Study of specifications, components, operation, control and maintenance of Ice Bank Tank (IBT).
9. Study of specifications, components, operation, control and maintenance of a Cold Storage.
10. Study of the Evaporative Cooling Devices like Cooling Tower, Spray Pond, Air-Washer or Room air-cooler etc.
11. Study of the parts and components of different types of refrigerant compressors used in various refrigeration applications.

Reference books:

1. Milk and milk product technology- Edgar Spreer
2. Text book of Dairy Engineering

II Semester

Course : Dairy Development and Co-Operatives

Theory

03 hours /Week

Credits -3

Unit-1 : Advantages of Dairying. Principles involved in successful dairying. Systems of dairy farming-Mixed farming and Specialized dairy farming – organic farming system. (10 Lectures)

Unit-2: Methods of procurement of milk; Transportation of milk; Pricing of milk, Marketing of milk.(10 Lectures)

Unit-3: Cooperative Dairying-Structure of Dairy cooperatives- Anand pattern - Primary milk producer's cooperative society; District milk producer's cooperative union; State level dairy development cooperative Federation, objectives and functions - Milk and milk products order MMPO(1992)- Role of private dairies in India. (20 Lectures)

Unit-4: Dairy development programs implemented in India. Statistical analysis of progress in development of Dairy industry in India, Operation Flood Program., Key village scheme(10 Lectures)

Unit-5: Economics of maintaining Dairy farm- Income and expenditure in dairy farms. Estimating the production cost of milk. (10 Lectures).

II Semester

Course : Dairy Development and Co-Operatives

Practical

02 hours /Week

Credits -1

6. Estimation of production cost of milk for 5 animals and 10 animal dairy units.
7. Estimating income and expenditure involved in dairy farming
8. Preparation of project report for different sizes of dairy farms
9. On Farm training for one month is suggested and a comprehensive training report should be submitted as mandatory requirement while appearing for semester practical exam which would carry 20 marks out of 50 marks as weightage.

MODEL QUESTION PAPER

Time: 3 hours

Marks: 75 marks

Note: This question paper contains two parts A and B.

PART – A Answer any Five of the following question. (5X5=25M)

1

2

3

4

5

6

7

8

Part-B Answer all the questions with internal choice. Each question carries 10 marks.(5x10=50)

1 a.

OR

1b

2a

OR

2b

3a

OR

3b

4a

OR

4b

5a

OR

5b