DAIRY SCIENCE
SYLLABUS FOR
B.Sc (Vocational Subject)

CHOICE BASED CREDIT SYSTEM (CBCS)

To be commenced from the Academic year 2025-26

KAKATIYA UNIVERSITY
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TELANGANA STATE

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CREDIT DISTRIBUTION FOR THE COURSE

Annexure-I (Credits)

Proposed CBCS Structure from 2025-2026 for Undergraduate Course

Courses		Papers	Total Credits	Credits for each paper/ Semester					
				B.Sc					
				I	II	III	IV	V	VI
Core Courses (DSC)	Major-1	6	30	5	5	5	5	5	5
	Major-2	6	30	5	5	5	5	5	5
	Minor-1	4	20	5	5	5	5	---	----
MIL/AEC (First language)	English	4	20	5	5	5	5	---	----
Second Language (Telugu, Hindi, Urdu etc.,)		4	20	5	5	5	5	---	----
Multi Disciplinary Course	MDC-1	1	4	---	----	---	----	4	----
SEC 1,2		2	4	---	----	---	----	2	2
SEC 3,4		2	4	---	----	---	----	2	2
Value added course (VAC)	VAC 1,2	2	6	---	----	---	----	3	3
Internships	Internship/Project	1	4	---	----	---	----	---	4
Total Credits in each semester		----	142	25	25	25	25	21	21
Total Credits in UG		---	142						

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CURRICULUM FOR DAIRY SCIENCE FOR B.Sc. (UG) 2025-26

YEAR	Semester	Course Title (Theory and Practical)	HPW	Number of Credits	Total Credits	Max. Marks		
						I.A	End Exam	Total
1st Year	I Sem	Paper-1: Dairy Husbandry-I (Theory)	4	4	5	20	80	100
		Dairy Husbandry-I (Practical)	2	1		-	25	25
	II Sem	Paper-II: Dairy Husbandry-II (Theory)	4	4	5	20	80	100
		Dairy Husbandry-II (Practical)	2	1		-	25	25
2nd Year	III Sem	Paper-III: Dairy Cattle Nutrition (Theory)	4	4	5	20	80	100
		Dairy Cattle Nutrition (Practical)	2	1		-	25	25
	IV Sem	Paper-IV: Dairy Development & Cooperative Societies (Theory)	4	4	5	20	80	100
		Dairy Development & Cooperative Societies (Practical)	2	1		-	25	25
3rd Year	V Sem	Paper-V: Technology of Dairy Products (Theory)	4	4	5	20	80	100
		Technology of Dairy Products (Practical)	2	1			25	25
		MDC-1: Bioinformatics	4	4	4	20	80	100
		SEC-1: Entrepreneurship Development	2	2	2	10	40	50
		SEC-2: Food Hygiene and Quality Testing	2	2	2	10	40	50
		VAC-1: AI in Dairy	3	3	3	15	60	75
	VI Sem	Paper-VI: Dairy Chemistry & Microbiology (Theory)	4	4	5	20	80	100
		Dairy Chemistry & Microbiology (Practical)	2	1		-	25	25
		SEC-3: Dairy Equipment Handling	2	2	2	10	40	50
		SEC-4: Dairy Plant Operations & Product Packaging	2	2	2	10	40	50
		VAC-2: Environmental Protection	3	3	3	15	60	75
		Internship / Project	4	4	4	20	80	100
		TOTAL	**58**	**52**	**52**	**230**	**1070**	**1300**

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Sl.No	Paper	Credits
1	Major - 1	30
2	Major -2	30
3	Minor - 1	20
4	AEC (Ability Enhancement Course) - English	20
5	Second Language	20
6	MDC (Multi-Disciplinary Course) - 1	4
7	SEC (Skill Enhancement Course) – 1,2,3,4	8
8	VAC (Value Added Course) -1,2	6
9	Project	4
	TOTAL	**142**

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Under Graduate Courses (Under CBCS AY: 2025-2026)

B.Sc. DAIRY SCIENCE (Vocational Subject)

I Year: Semester-I

Paper – I: Dairy Husbandry - I

[4 HPW:: 4 Credits :: 100 Marks (External: 80, Internal:20)]

Unit I: Introduction to Dairy Husbandry and Dairy Breeds

1. Basic terms and definitions in animal husbandry
2. Livestock population and distribution in India (cattle, buffalo, goats)
3. Milk production statistics – national and global trends
4. Breeds of dairy animals: Indigenous, Exotic, and Crossbred cattle, buffaloes, and goats

Unit II: Udder Function and Clean Milk Production

1. Anatomy and development of the udder
2. Physiology of milk secretion: Lactogenesis and galactopoiesis
3. Let-down of milk and hormonal control
4. Milking hygiene: Cleanliness of animals, utensils, milkers, and milking environment

Unit III: Milking Techniques and Animal Selection

1. Milking methods: Stripping, full-hand, knuckling, and machine milking
2. Economic traits of dairy cattle (milk yield, fat %, calving interval, etc.)
3. Methods of selection: Individual, pedigree, family, and progeny performance
4. Scoring systems: Unified Score Card System, Body Condition Scoring (BCS)

Unit IV: Breeding Systems and Advanced Reproductive Techniques

1. Breeding systems: Inbreeding, outbreeding, crossbreeding, grading up
2. Suitable breeding strategies for Indian conditions (crossbreeding of cattle, grading up of buffaloes)
3. Advanced techniques: Multiple ovulation and embryo transfer (MOET)
4. Recent developments: Cloning and transgenic animals

Suggested Readings

1. Banerjee, G. C. (2012). *A Textbook of Animal Husbandry* (8th ed.). New Delhi: Oxford & IBH Publishing.
2. Sastry, N. S. R., & Thomas, C. K. (2005). *Livestock Production Management*. Ludhiana: Kalyani Publishers.
3. Jainudeen, M. R., & Hafez, E. S. E. (2000). *Reproduction in Farm Animals* (7th ed.). Philadelphia: Lippincott Williams & Wilkins.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

I Year: Semester-I

Paper – I: Dairy Husbandry – I
Practical Syllabus (1 Credit)

1. Confirmation Points of dairy cow.
2. Identification of different breeds of dairy cattle and buffaloes.
3. Classification and study of distinguishing characters of Indian and Exotic cattle.
4. Study of descriptive and productive features of different Indian cattle breeds.
5. Classification and study of distinguishing characters of Buffalo breeds.
6. To study the comparative merits of cows and buffaloes; Zebu and crossbred cows.

Reference Books:

1. Text Book of Animal Husbandry – G.C. Banerjee.
2. Hand Book of Animal Husbandry – ICAR Edition.
3. Principles and practices of Dairy farm – Jagdish Prasad.
4. Livestock production Management in tropics – Verma, D.N.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

I Year: Semester-II

B.Sc. DAIRY SCIENCE (Vocational Subject)

I Year: Semester-II

Paper – II: DAIRY HUSBANDRY – II

[4 HPW:: 4 Credits :: 100 Marks (External: 80, Internal:20)]

Unit I: Housing and Farm Planning for Dairy Animals

1. Types of housing: Loose housing system and conventional stanchion barns
2. Site selection criteria for setting up a dairy farm
3. Layout and drawing plans for cow sheds and calf pens
4. Water requirements and supply management for dairy animals

Unit II: Dairy Animal Health and Disease Management

1. General symptoms of sick dairy animals
2. Common diseases: Bacterial (e.g., mastitis, brucellosis); Viral (e.g., foot and mouth disease, rabies); Parasitic (e.g., ticks, worms); Nutritional deficiency disorders (e.g., milk fever, ketosis)
3. Preventive measures and control strategies for each disease type
4. Importance of timely diagnosis and veterinary assistance

Unit III: Management of Dairy Animals

1. Daily care of different classes of animals: ;Lactating (milch) cows; Pregnant animals; Dry animals; Heifers and calves; Common farm management practices.
2. Identification (tagging, tattooing); Dehorning and castration.
3. Grooming and disinfection; Deworming and vaccination schedules
4. Milking hygiene and routines

Unit IV: Reproductive Management and Fertility

1. Importance of fertility in dairy herd productivity
2. Causes of low fertility and infertility in dairy cattle
3. Methods to maintain high fertility: Balanced feeding; Timely breeding; Health monitoring and heat detection
4. Measuring reproductive efficiency using: Non-return rate; Calving interval; Pregnancy days per cow per year

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Suggested Readings

1. Banerjee, G. C. (2012). *A Textbook of Animal Husbandry* (8th ed.). New Delhi: Oxford & IBH Publishing.
2. Sastry, N. S. R., & Thomas, C. K. (2005). *Livestock Production Management*. Ludhiana: Kalyani Publishers.
3. Radostits, O. M., et al. (2006). *Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats* (10th ed.). Philadelphia: Saunders Elsevier.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

I Year: Semester-II

Paper 2: Dairy Husbandry - II
Practical Syllabus (1 Credit)

1. Dairy Farm layout.
2. 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 disinfectant and detergent solutions.

Reference Books:

1. Text Book of Animal Husbandry – G.C. Banerjee.
2. Hand Book of Animal Husbandry – ICAR Edition.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

I Year: Semester-II

Paper-III: DAIRY CATTLE NUTRITION

[4 HPW:: 4 Credits :: 100 Marks (External: 80, Internal:20)]

Unit I: Basics of Dairy Cattle Nutrition

1. Structure and function of the ruminant digestive system
2. Role and importance of nutrients: proteins, carbohydrates, and fats
3. Classification of feedstuffs: concentrates, roughages, and additives
4. Importance of minerals and vitamins in dairy cattle diet

Unit II: Fodder Types and Cultivation

1. Classification of fodder crops: legumes vs. non-legumes
2. Seasonal vs. perennial fodder crops
3. Cultivation practices of major fodder crops: Para grass, Hybrid Napier
4. Cultivation of Berseem, Cowpea, and Jowar

Unit III: Feeding Standards and Practices

1. Concept of feeding standards and nutrient requirements
2. Preparation of balanced rations for different dairy animals
3. Common feeding methods: soiling, pasturing, silage, hay
4. Practical feeding management at different physiological stages

Unit IV: Low-Cost Feeding and By-Product Utilization

1. Use of agricultural by-products (e.g., straw, bran, husk) in feeding
2. Use of industrial by-products (e.g., molasses, oil cakes)
3. Enrichment of low-quality roughages
4. Urea treatment technique for paddy straw

Suggested Readings

1. Banerjee, G. C. (2012). *Animal Nutrition*. New Delhi: Oxford & IBH Publishing.
2. Ranjhan, S. K. (2007). *Animal Nutrition in the Tropics*. New Delhi: Vikas Publishing House.
3. Sastry, N. S. R., & Thomas, C. K. (2005). *Livestock Production Management*. Ludhiana: Kalyani Publishers.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

II Year: Semester-III

Paper-III: DAIRY CATTLE NUTRITION

Practical Syllabus (1 Credit)

1. Identification of feeds and fodder.
2. Computation of rations.
3. Preparation of urea enriched paddy straw.
4. Determination of dry matter and moisture content in feed or fodder.
5. Determination of crude protein content by Kjeldahls method.

Reference Books:

1. Text Book of Animal Husbandry – G.C. Banerjee.
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.

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Under Graduate Courses (Under CBCS AY: 2025-2026)

B.Sc. DAIRY SCIENCE (Vocational Subject)

III Year: Semester-V

Pape-IV: DAIRY DEVELOPMENT AND COOPERATIVE SOCIETIES

[4 HPW:: 4 Credits :: 100 Marks (External: 80, Internal:20)]

Unit I: Fundamentals of Dairying

1. Importance and advantages of dairying in rural economy
2. Principles for successful dairy enterprise
3. Mixed farming vs. Specialized dairy farming
4. Role of dairying in employment and nutrition

Unit II: Milk Procurement and Marketing

1. Methods of milk procurement from farmers
2. Transportation and storage of milk
3. Milk pricing policies and quality-based payment systems
4. Channels and strategies for milk marketing

Unit III: Cooperative Dairy Structure

1. Role and significance of dairy cooperatives
2. Structure and function of Primary Milk Producers' Cooperative Societies
3. Functions of District Milk Producers' Cooperative Unions
4. Challenges and future prospects in cooperative dairy development

Unit IV: Dairy Development and Farm Economics

1. Overview of dairy development programs in India
2. Operation Flood – Phases, achievements, and impact
3. Economics of dairy farming: income and expenditure analysis
4. Estimation of cost of milk production and profit margins

Suggested Readings

1. Kurien, V. (2012). *I Too Had a Dream*. New Delhi: Roli Books.
2. Dutta, S. (2009). *Cooperative Dairy Development in India*. New Delhi: Mittal Publications.
3. Sharma, V. P. (2015). *Indian Dairy Sector: Structure, Performance and Prospects*. IIM Ahmedabad.
4. Taneja, V. K. (2004). *Operation Flood: Development of Dairy Sector in India*. NDDB.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

III Year: Semester-V

Paper IV: Dairy Development and Cooperative Societies
Practical Syllabus (1 Credit)

1. Visit to a Primary Dairy Cooperative Society – Observation and reporting of its structure, roles, and daily operations.
2. Milk Procurement Practices – Demonstration of milk collection, quality testing, and payment systems.
3. Milk Transportation Systems – Study of hygienic practices and logistics in rural milk transport.
4. Preparation of Milk Marketing Plan – Developing a basic plan for local milk distribution and sales.
5. Case Study on Operation Flood Program – Analysis of its impact on milk production and rural income.
6. Survey of Local Dairy Farmers – Collecting and analyzing data on farm income and cost of milk production.
7. Preparation of Farm Budget – Estimating income and expenditure for a small-scale dairy unit.
8. Organizing a Farmer Awareness Program – Planning extension activity on clean milk production or cooperative benefits.
9. Analysis of Dairy Cooperative Records – Understanding membership register, milk payment register, and quality records.
10. Report Writing on Dairy Development Programs – Submission of a short field report on NDDB, AMUL, or similar models.

Reference Books:

1. Dairy management in India – Madan Mohan.
2. Text Book of Animal Husbandry – G.C. Banerjee.
3. Principles and practices of Dairy Farm – Jagdish Prasad.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

III Year: Semester-V

Paper-V: TECHNOLOGY OF DAIRY PRODUCTS

HPW: 4; Credits-4: Max Marks: 100 (20+80)

Unit I: Milk Reception, Pasteurization, and Packaging

1. Reception of milk: unloading, grading, sampling, testing, weighing, and storage
2. Filtration, clarification, and standardization of milk
3. Pasteurization methods: LTLT, HTST, UHT; principles and objections
4. Packaging of milk: materials, types, and desirable properties

Unit II: Market Milk and Cream Products

1. Types of market milk: toned, double toned, standardized, full cream, reconstituted
2. Homogenization: process, influencing factors, and effects on milk
3. Cream: types, composition, separation methods (gravity and centrifugal)
4. Factors affecting fat losses and fat content in cream

Unit III: Butter, Cheese, and Frozen Products

1. Butter and butter oil: standards, composition, method of manufacture, overrun
2. Cheese: classification, composition, manufacturing of cheese and cottage cheese
3. Ice cream: BIS standards, composition, method of manufacture, overrun
4. Introduction to frozen dairy desserts (e.g., kulfi)

Unit IV: Milk Powder, Condensed Milk, and Indigenous Dairy Products

1. Condensed and evaporated milk: types, standards, methods of manufacture
2. Milk powder: BIS standards, drying methods (roller and spray drying)
3. Indigenous products: Khoa, Channa, Ghee, Dahi – standards and preparation methods
4. Waste management in dairy plants: sources, treatment methods (low-cost & conventional)

Suggested Readings :

1. Sukumar De. (2001). *Outlines of Dairy Technology*. New Delhi: Oxford University Press.
2. Rangappa, K. S., & Achaya, K. T. (1975). *Indian Dairy Products*. New Delhi: Asia Publishing House.
3. Aneja, R. P., Mathur, B. N., Chandan, R. C., & Banerjee, A. K. (2002). *Technology of Indian Milk Products*. New Delhi: Dairy India Yearbook.

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III Year: Semester-V

Paper-V: TECHNOLOGY OF DAIRY PRODUCTS

Practical Syllabus (1 Credit)

1. RMRD Testing of milk.
2. Standardization of milk.
3. Homogenization of milk.
4. Pasteurization of milk.
5. Sterilization of milk.
6. Preparation of toned milk and double toned milk.
7. Preparation of Reconstituted milk.
8. Cream separation.

Reference Books:

1. Dairy processing handbook – Gosta Bylund.
2. Outlines of Dairy Technology – Sukumar De.
3. Milk products preparation and quality control – C.P. Ananthakrishnan.
4. The technology of milk processing – C.P. Ananthakrishnan.
5. Modern Dairy products – Lincoln M. Lampert.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

III Year: Semester-V

MDC-1 (Multi-Disciplinary Course)

Paper-VI: BIOINFORMATICS

[4 HPW:4 Credits **100 Marks (External: 80, Internal 20**

UNIT – I: Introduction to Computational Biology and Bioinformatics

1.1 Definitions and Scope of Computational Biology and Bioinformatics
1.2 Applications in Nutrition and Dietetics
1.3 Basic Concepts in Molecular Biology: DNA, RNA, Proteins
1.4 Introduction to Central Dogma and Gene Expression

UNIT – II: Biological Databases and Data Retrieval

2.1 Types of Biological Databases – Primary, Secondary, Composite
2.2 NCBI, EMBL, DDBJ, UniProt – Structure and Use
2.3 Sequence Data Retrieval – Using GenBank and FASTA formats
2.4 BLAST: Basic Local Alignment Search Tool – Concept and Applications

UNIT – III: Sequence Alignment and Phylogenetics

3.1 Pairwise Sequence Alignment – Global and Local
3.2 Multiple Sequence Alignment – Introduction and Tools (e.g., CLUSTALW)
3.3 Scoring Matrices – PAM and BLOSUM
3.4 Basics of Phylogenetic Tree Construction and Applications

UNIT – IV: Applications in Poultry and Biotechnology

4.1 Use of Bioinformatics in Nutritional Disorders
4.2 Protein Structure Prediction – Primary to Tertiary
4.3 Molecular Docking and Vaccine Design – Introduction
4.4 Future Perspectives: AI and Machine Learning in Nutritional Bioinformatics

References

1. Lesk, Arthur M. *Introduction to Bioinformatics*. 5th ed., Oxford University Press, 2019.
2. Mount, David W. *Bioinformatics: Sequence and Genome Analysis*. 2nd ed., Cold Spring Harbor Laboratory Press, 2004.
3. Baxevanis, Andreas D., and B. F. Francis Ouellette. *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins*. 3rd ed., Wiley-Interscience, 2005.
4. Rastogi, S. C., N. Mendiratta, and P. Rastogi. *Bioinformatics: Methods and Applications – Genomics, Proteomics and Drug Discovery*. 4th ed., PHI Learning Pvt. Ltd., 2015.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

III Year: Semester-VI

Paper-VII: ENTREPRENEURSHIP DEVELOPMENT (SEC-1)

SEC-1 (2 hrs/week) **(2 Credits) Total Marks:50**

Unit I: Introduction to Entrepreneurship

1. Definition and characteristics of an entrepreneur
2. Importance of entrepreneurship in the dairy and food sector
3. Role of entrepreneurship in rural development and self-employment
4. Case studies of successful dairy and food entrepreneurs

Unit II: Entrepreneurial Skill Development

1. Entrepreneurial mindset and qualities: creativity, risk-taking, and innovation
2. Techniques to develop self-confidence and positive attitude
3. Entrepreneurial skill assessment (self-evaluation exercises)
4. Time management, goal setting, and leadership skills

Unit III: Business Opportunity Identification

1. Methods of generating business ideas in dairy and food processing
2. Sensing market needs and gap identification
3. SWOT analysis of business ideas and competitors
4. Feasibility analysis of dairy-based enterprises

Unit IV: Business Planning and Management

1. Steps in preparing a business plan and project report
2. Basics of marketing, pricing, and sales in small enterprises
3. Sources of finance and government schemes for dairy entrepreneurs
4. Resource management: procurement of raw materials, equipment, and manpower

Recommended Books:

1. Acharya SS and Agarwal NL "Agricultural Marketing in India", Oxford and ISH Publishers Co., New Delhi, 1987.
2. Chandra, Prasanna "Projects, Planning, Analysis, Selection, Implementation and Review", TMH Pub., Co., New Delhi, 1996.
3. David D and Erickson S "Principles of Agribusiness Management" MGH Book Co., New Delhi, 1987.
4. David H. Holt "Entrepreneurship – A new Venture Creation" Prentice Hall of India, New Delhi, 2002.
5. Phillip Kottler "Marketing Management", PHI Pvt. Ltd., New Delhi, 1994.

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Under Graduate Courses (Under CBCS AY: 2025-2026)

B.Sc. DAIRY SCIENCE (Vocational Subject)

III Year: Semester-VI

Paper-VIII: FOOD HYGIENE AND QUALITY TESTING
SEC-2

SEC-1 (2 hrs/week) **(2 Credits) Total Marks:50**

Unit I: Basics of Food Hygiene and Safety

1. Introduction to food hygiene and food spoilage
2. Safe handling of food and high-risk foods
3. Cooking temperatures and proper food storage techniques
4. Personal hygiene and food safety practices in dairy and food industries

Unit II: Sanitation Practices in Food Institutions

1. Cleaning and disinfection procedures
2. Pest control methods in food areas
3. Waste management and safe disposal methods
4. Sanitation protocols in dairy plants and food service institutions

Unit III: Sensory Evaluation of Food Quality

1. Role of senses in food quality: taste, smell, appearance, and flavor
2. Sensory evaluation techniques and scoring methods
3. Panel selection and test conditions
4. Applications of sensory methods in dairy product testing

Unit IV: Objective Methods of Quality Testing

1. Physical testing: moisture, texture, viscosity, color, acidity, and water activity
2. Basic chemical tests: protein, fat, ash, and moisture
3. Introduction to microbiological sampling and common tests
4. Quality control procedures in dairy and food laboratories

Recommended Books:

1. Fellows P et al. Making Safe Food: A Guide to Safe Food Handling and Packaging for Small-scale Producers Practical. Action Publishing, 1998.
2. Frazier WC and Westhoff DC. Food Microbiology, TMH, New Delhi, 2004.
3. IFST. Food Hygiene Training: A Guide to its Responsible Management, UK: Institute of Food Science and Technology 1992.
4. Lawley R, Curtis L and Davis J. The Food Safety Hazard Guidebook , RSC Publishing, 2004.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

III Year: Semester-VI

Paper-IX: AI (ARTIFICIAL INTELLIGENCE) IN DAIRY (VAC-1)

HPW: 3; Credits-3 Max Marks 50 (10+40)

Unit I: Basics of Artificial Intelligence

1. Introduction to AI: Definition, history, and scope
2. AI vs Machine Learning vs Deep Learning
3. Common tools and platforms used in AI (e.g., Python, TensorFlow)
4. Ethical and practical challenges in AI adoption in agriculture

Unit II: AI Applications in Dairy Farming

1. AI in animal health monitoring and disease prediction
2. Smart feeding systems and behavioral analysis using sensors
3. Estrus detection and reproductive management using AI
4. Precision dairy farming using drones, robots, and IoT

Unit III: AI in Milk Processing and Quality Control

1. AI in milk grading and adulteration detection
2. Automated systems for pasteurization and packaging
3. Predictive maintenance of processing equipment
4. AI for microbial and residue detection in dairy products

Unit IV: AI in Dairy Supply Chain and Marketing

1. AI for cold chain monitoring and logistics optimization
2. Demand forecasting and price prediction using AI
3. Chatbots and virtual assistants for customer service
4. Blockchain and AI integration for traceability in dairy supply

Suggested Readings / References:

1. Choudhury, S. R., & Saha, R. (2022). *Artificial Intelligence in Agriculture and Dairy Industry*. New Delhi: Satish Serial Publishing House.
2. Sundararajan, V. (2021). *Smart Dairy Farming: Technological Advances and Innovations*. Chennai: Allied Publishers.
3. Kumar, R., & Sharma, P. (2020). *AI and Machine Learning Applications in Dairy and Livestock*. Hyderabad: Bio-Green Books.

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III Year: Semester-VI

Paper-X: DAIRY CHEMISTRY AND MICROBIOLOGY

[4 HPW:: 4 Credits :: 100 Marks (External: 80, Internal:20)]

Unit I: Composition and Constituents of Milk

1. Definition and general composition of milk from cow, buffalo, goat, sheep, and human
2. Differences between cow and buffalo milk
3. Colostrum: composition, significance, and comparison with normal milk
4. Major and minor constituents of milk

Unit II: Factors Affecting Milk Quality and Chemical Properties

1. Factors influencing composition: species, breed, stage of lactation, feed, season
2. Physico-chemical properties: density, freezing point, boiling point, pH, and acidity
3. Color, flavor, surface tension, viscosity, and germicidal properties of milk
4. Nutritive value of milk and common platform/adulteration tests

Unit III: Microorganisms and Milk Fermentation

1. Types of microorganisms in milk: acid producers, gas formers, proteolytic and lipolytic organisms
2. Temperature-based classification: psychrophilic, mesophilic, thermophilic, thermoduric
3. Abnormal fermentations: souring, gassy milk, proteolysis, lipolysis, ropiness
4. Sources of milk contamination and methods of clean milk production

Unit IV: Milk Testing, Hygiene and Safety Standards

1. Microbiological examination: DMC, SPC, MBRT, Resazurin test, Coliform test
2. Milk-borne diseases: bacterial, viral, and others
3. Cleaning and sanitization of dairy equipment: detergents, sanitizers, CIP methods
4. FSSAI specifications for milk and milk safety regulations

Recommended Readings

1. Aneja, R. P., Mathur, B. N., Chandan, R. C., & Banerjee, A. K. (2002). *Technology of milk processing*. New Delhi: Tata McGraw-Hill Education.
2. Fox, P. F., & McSweeney, P. L. H. (2015). *Advanced dairy chemistry* (Vol. 1–3). New York: Springer.
3. Robinson, R. K. (2005). *Dairy microbiology handbook: The microbiology of milk and milk products* (3rd ed.). Hoboken, NJ: Wiley-Interscience.

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III Year: Semester-VI

DAIRY CHEMISTRY AND MICROBIOLOGY
Practical Syllabus (1 Credit)

1. Estimation of Fat and SNF in Milk
2. Determination of Specific Gravity and Acidity of Milk
3. Measurement of pH, Surface Tension, and Viscosity of Milk
4. Assessment of Milk Quality Using Platform Tests
5. Methylene Blue Reduction Test (MBRT) for Microbial Quality
6. Resazurin Reduction Test (RRT) for Microbial Load Estimation
7. Direct Microscopic Count (DMC) of Microorganisms in Milk
8. Standard Plate Count (SPC) for Total Viable Bacteria
9. Coliform Count in Milk Samples
10. Identification of Psychrophilic, Mesophilic, Thermophilic, and Thermoduric Bacteria in Milk

Reference Books:

1. Dairy Chemistry and Animal Nutrition – M.M. Roy.
2. Text book of Practical Dairy Chemistry – N.K. Roy.
3. Fundamentals of Dairy Chemistry – Webb Johnson and Alfred.
4. Dairy Chemistry and Physics – Pieter Walstra and Robert Jenner.
5. Fundamentals of Dairy Chemistry – Noble P. Wong.
6. A text book of Dairy Chemistry – Ling, E.R.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

III Year: Semester-VI

PAPER-XI: DAIRY EQUIPMENT HANDLING (SEC-3)

HPW:2; Credit-2: Max Marks: 50 (10+40)

Unit I: Introduction to Dairy Equipment

1. Classification of dairy equipment: manual, semi-automatic, and automatic
2. Basic tools and machinery used in dairy farms
3. Layout and components of a small-scale dairy processing unit
4. Importance of equipment hygiene and maintenance

Unit II: Milking and Storage Equipment

1. Milking machines: parts, working principles, and handling
2. Milk cans, bulk milk coolers (BMC), and milk storage tanks
3. Milk pumps and pipelines: cleaning and precautions
4. Maintenance of milking and storage equipment

Unit III: Processing and Packaging Equipment

1. Cream separators and pasteurizers: working and precautions
2. Homogenizers and chillers: use and safety practices
3. Packaging machines (pouch filling, bottle filling): basic handling
4. Common equipment malfunctions and troubleshooting

Unit IV: Cleaning, Sanitization, and Safety

1. Methods of cleaning: hand washing, mechanical, and CIP (Clean-In-Place)
2. Detergents and sanitizers used in dairy plant cleaning
3. Personal hygiene and workplace sanitation in dairy operations
4. Equipment safety guidelines and preventive maintenance

Recommended Readings

1. Tufail, S. M. (2017). *Dairy plant engineering and management*. New Delhi: Kitab Mahal.
2. Ramaswamy, H. S., & Marcotte, M. (2006). *Food processing: Principles and applications*. Boca Raton, FL: CRC Press.
3. Smith, G. (2008). *Introduction to dairy equipment and operation*. Chennai: Allied Publishers.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

III Year: Semester-VI

Paper-XII: DAIRY PLANT OPERATIONS & PRODUCT PACKAGING (SEC-3)

HPW:2; Credit-2: Max Marks: 50 (10+40)

Unit I: Overview of Dairy Plant Operations

1. Structure and layout of a typical dairy processing plant
2. Milk reception, filtration, chilling, and storage processes
3. Flow diagrams of major dairy products (e.g., pasteurized milk, cream, curd)
4. Good Manufacturing Practices (GMP) and SOPs in plant operations

Unit II: Key Dairy Processing Equipment

1. Milk pasteurizer, cream separator, homogenizer – working principles
2. Heating, cooling, and fermentation units
3. Butter churns, ghee kettles, paneer and curd making equipment
4. Cleaning-In-Place (CIP) systems – concept and practice

Unit III: Dairy Product Packaging

1. Importance of packaging in the dairy industry
2. Packaging materials: glass, plastic, metal, paper, and laminates
3. Packaging systems for milk, curd, ghee, butter, paneer, and flavored milk
4. Shelf-life considerations and labeling requirements

Unit IV: Quality, Safety, and Regulatory Aspects

1. Hygiene and sanitation in plant operations
2. FSSAI packaging and labeling guidelines
3. Common faults in plant operation and product packaging
4. Safety precautions for machinery handling and maintenance

Recommended Readings

1. Sukumar De. (2001). *Outlines of dairy technology*. New Delhi: Oxford University Press.
2. Smith, G. (2014). *Dairy plant operations and packaging systems*. Mumbai: Himalaya Publishing House.
3. Goff, H. D., & Hill, A. R. (2003). *Dairy science and technology*. Madison, WI: University of Wisconsin–Madison.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

III Year: Semester-VI

VAC-2:
Paper-XIII: ENVIRONMENTAL PROTECTION

Unit I: Introduction to Environmental Science

1. Concept and scope of environmental protection
2. Natural resources: Renewable and non-renewable
3. Ecosystem and biodiversity conservation
4. Climate change and its impact on agriculture and livestock

Unit II: Pollution and Environmental Degradation

1. Types of pollution: Air, water, soil, noise
2. Agricultural and dairy sources of pollution
3. Effects of methane and ammonia emissions from livestock
4. Contamination from dairy plant effluents and manure runoff

Unit III: Dairy-Specific Environmental Concerns

1. Solid and liquid waste management in dairy farms
2. Sustainable manure management: Biogas, composting, slurry use
3. Water usage and recycling techniques in dairy operations
4. Use of eco-friendly packaging and energy-efficient equipment in dairy processing

Unit IV: Green Practices and Regulations

1. Clean milk production and its environmental benefits
2. Organic dairy farming and eco-certifications
3. Government policies: CPCB, FSSAI, and environmental laws
4. Role of dairy professionals in environmental awareness and sustainable development

Suggested Readings

1. Mishra, D. D. (2010). *Fundamental concepts in environmental studies*. New Delhi: S. Chand & Company Ltd.
2. Garg, S. K. (2019). *Environmental Engineering* (Vol. 1 & 2). New Delhi: Khanna Publishers.
3. Yadav, G., & Singh, S. P. (2016). *Environmental management in dairy industry*. Ludhiana: Dairy Publications India.

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B.Sc. DAIRY SCIENCE (Vocational Subject)

III Year: Semester-VI

INTERNSHIP

(4 hrs/week) (4 Credits; Max Marks: 100 (20+80)

Deliverables by Students:

1. Animal handling, milking practices, and cleanliness protocols
2. Identification of breeds, housing systems, and health management
3. Record maintenance – production, health, and breeding data
4. Calf management, feeding practices, deworming, and vaccinations
5. Visits to Milk Collection Centers and Cooperative Societies
6. Study of procurement systems, milk pricing, transportation logistics
7. Entrepreneurship exposure – setting up a small-scale dairy unit

Suggested Internship Locations:

1. Government and private dairy farms
2. Milk unions or cooperative societies (e.g., AMUL, Vijaya Dairy)
3. Milk chilling and processing plants
4. NDDB training centers, Veterinary hospitals, AI centers

- **Internship Diary** (Daily log of observations and activities)
- **Internship Report** (Typed, 15–20 pages summary with photos and observations)
- **Presentation/Viva** (Summarizing experiences and learnings)

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MODEL QUESTION PAPER - THEORY

Total Marks-80

Section – A (Marks: 8 × 4 = 32)

Attempt any EIGHT questions in short form

a)
b)
c)
d)
e)
f)
g)
h)

Section – B (Marks: 4 × 12 = 48)

Attempt the questions in Descriptive form

Q2. (a) .

OR

Q2. (b)

Q3. (a)

OR

Q3. (b)

Q4. (a)

OR

Q4. (b)

Q5. (a)

OR

Q5. (b)

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Annexure – I (Credits)
Proposed CBCS Structure from 2025-26 for Under Graduate Courses

Courses		Papers	Total Credits	Credits for each paper / Semester						Credits for each paper / Semester						Credits for each paper / Semester					
				BA						B.Com.						B.Sc.					
				I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
Core Courses DSC	Major-1	6	30	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Major -2	6	30	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Minor-1	4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
MIL/AEC (First Language)	English	4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
Second Language (Telugu, Hindi, Urdu, etc.)		4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
Multi-Disciplinary Course	MDC 1	1	4	-	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	4	-
Sec 1, 2		2	4					2	2					2	2					2	2
Sec 3, 4		2	4					2	2					2	2					2	2
Value added course (VAC)	VAC 1, 2	2	6	-	-	-	-	3	3	-	-	-	-	3	3	-	-	-	-	3	3
Internships	Internship / Project	1	4	-	-	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	4
Total Credits in each semester			142	25	25	25	25	21	21	25	25	25	25	21	21	25	25	25	25	21	21
Total Credits in UG				142						142						142					
Credits under Non-CGPA (Community engagement and service)		NSS /NCC /sports / Extra curricular	6	Upto 6 (2 in each year)						Upto 6 (2 in each year)						Upto 6 (2 in each year)					
		IKS	4	Upto 4 (2 in each, after I & II years)						Upto 4 (2 in each, after I & II years)						Upto 4 (2 in each, after I & II years)					