

**SWAMI RAMANAND TEERTH
MARATHWADA UNIVERSITY
NANDED**

**SYLLABUS
of**

**M.Sc. First Year
DAIRY SCIENCE**

**Semester Pattern
Effective from June 2014**

SYLLABUS
M.SC. DAIRY SCIENCE- 1ST YEAR
 (Sem.I & II)

ELIGIBILITY FOR ADMISSION :

The students who have completed, their B.Sc. degree with Dairy Science as one of the optional, B.Sc. (Agri), B.V. Sc. & A.H., B.Tech. (Dairy Technology) from any recognized university are eligible for admission to this P.G. degree course subject to admission rules of S.R.T. Marathwadha University, Nanded.

THE SCHEME OF SEMESTER EXAMINATION

Year	Semester	No. of Theory Papers	Marks of Theory Papers	No. of Practical Papers	Marks of Practicals	Total Marks
I st	1 st	04	50x4 = 200	02	50 x 2 =100	300
	2 nd	04	50x4 = 200	02	50 x 2 =100	300
II st	3 rd	04	50x4 = 200	02	50 x 2 =100	300
	4 th	03	50x3 =150	1+2* = 03	50 x 3 =150	150
	Total		750			1200

*Sem. IV Practical includes seminar + implant training and Dissertation.

- Two seminars 05 marks each _____ 05 x 2 = 10.
+
- Implant training six weeks along with report and completion certificate _____ = 15 Work load equals to ½ Practical.
- Dissertation includes research work, preparation of manuscript for 50 marks and viva-voce examination of 25 marks to be conducted Jointly with the internal and external examiner at the college _____ 50 + 25 = 75.

Dissertation is to be submitted in 4 copies with signatures of Guide, co-guide HOD and Principal. One copy is to be retained by the concerned student and 3 copies are to be submitted to the department. One copy is to be sent to the University alongwith Mark List. One copy to concerned guide and one to the college library through HOD.

Workload equals to 1 ½ Practicals

DAIRY SCIENCE
SEMESTER WISE OUT-LAY
TWO YEAR M.SC. DAIRY SCIENCE COURSE
M.Sc. DAIRY SCIENCE

4 Theory periods per paper / week.

1 practical of 3 hours for each paper/week.

Semester - I

Sr. No.	Paper No.	Title of the Paper	No. of Periods per week	No. of Practical per week	Marks	Hours of Exam
1	I	Advances in LPM	04	1 x 03	50	03
2	II	Market Milk Industry	04	1 x 03	50	03
3	III	Dairy Chemistry-I	04	1 x 03	50	03
4	IV	Dairy Technology-I	04	1 x 03	50	03

Semester - II

Sr. No.	Paper No.	Title of the Paper	No. of Periods per week	No. of Practical per week	Marks	Hours of Exam
5	V	Advances in Animal Nutrition and Breeding.	04	1 x 03	50	03
6	VI	Quality Assurance in Dairy Industry.	04	1 x 03	50	03
7	VII	Dairy Chemistry-II	04	1 x 03	50	03
8	VIII	Dairy Technology-II	04	1 x 03	50	03

Practical papers for I and II Sem.

Sr. No.	Paper No.	Title of the Paper	No. of Periods per week	Marks	Hours of Exam
9	IX Practical	Based on theory I & V	1 x 03	50	03
10	X Practical	Based on theory II & VI	1 x 03	50	03
11	XI Practical	Based on theory III & VII	1 x 03	50	03
12	XII Practical	Based on theory IV & VIII	1 x 03	50	03
Practical examination for I & II Semester will be conducted at the end of second semester only					
Total Workload 32 + 24 = 66 Periods			Total Marks		1200

M.SC. DAIRY SCIENCE – SECOND YEAR (2009-2010)

Semester - III

Sr. No.	Paper No.	Title of the Paper	No. of Periods per week	No. of Practical per week	Marks	Hours of Exam
13	XIII	Dairy Engineering – I	04	1 x 03	50	03
14	XIV	Dairy Microbiology – I	04	1 x 03	50	03
15	XV	Dairy Engineering – II	04	1 x 03	50	03
16	XVI	Dairy Business Management & Co-operation	04	1 x 03	50	03

Semester - IV

Sr. No.	Paper No.	Title of the Paper	No. of Periods per week	No. of Practical per week	Marks	Hours of Exam
17	XVII	Dairy Engineering –III	04	1 x 03	50	03
18	XVIII	Dairy Microbiology – II	04	1 x 03	50	03
19	XIX	Dairy Plant Management	04	1 x 03	50	03

M.Sc. Second year practical

Semester - III

Sr. No.	Paper No.	Title of the Paper	No. of Practical per week	Marks	Hours of Exam
20	XX	Practical based on paper – XIII & XXVII	1 x 03	50	03
21	XXI	Practical Based on paper – XIV & XVIII	1 x 03	50	03
22	XXII	Practical Based on paper – XV & XIX	1 x 03	50	03
23	XXIII	2 Seminars + 6 Weeks in-plants training + dissertation & Vi-voce	2 Seminar – 5 Marks each = 10 In-plants training- 15 Marks = 15 Dissertation work & Manuscript = 50 Vi-voce (Internal & External) = 25	100	

Total Work Load = 28 + 21 = 49 Periods

Work Load of Semester-I & Semester III = 16 + 12 + 16 + 09 = 53 Periods

Work Load of Semester-II & Semester IV = 16 + 12 + 12 + 16 + 09 = 49 Periods

SYLLABUS
M.SC. DAIRY SCIENCE- 1ST YEAR
(Sem.I & II)

**Theory Paper – I Title : Advances in Livestock Production and Management Periods/Week-4
Marks – 50**

Objectives : To provide recent knowledge of dairy farming.
 : To provide knowledge regarding animal management and production.

Unit - I : Perspectives of Dairy Farming in India.

- ▲ Livestock production : Recent trends, future prospectus.
A.H. & D. development during five year plans, role of different agencies in the development of livestock industry.
Contribution of livestock sector to GDP and national income.
Socio-economic impact and role in manpower employment.
- ▲ Sustainable animal production system.
- ▲ Farm stead management.

Unit - II : Livestock production.

- ▲ Resources and infrastructure.
- ▲ Introduction to livestock products technology.
- ▲ Environment synchronization for better productivity.
- ▲ Types of livestock farming, dairy farming systems.
- ▲ Study of different animal farm enterprises and characteristics of an ideal dairy farm.
- ▲ Sustainable livestock production.

Unit - III : Animal management.

- ▲ Farm animal behavior and management.
- ▲ General management practices for cattle/buffalo for better productivity.
- ▲ Requisites for successful dairy farm management.
- ▲ Material management and inventory control on a dairy farm.
- ▲ Features of mechanized and manual farm management shelter management.
- ▲ Milking management, mechanized and manual organic dairy production.
- ▲ Economics of calf, heifer and cow raising, breeding bull management.
- ▲ Preparation of project report for finance.
- ▲ Role of computers in animal production.

Reference Books :

- 1) Text books of animal husbandry by G. C. Banerjee.
- 2) Live-stock management S.K. Ranjhan.
- 3) Animal housing milk hygiene by – WHO
- 4) Feeds and feeding by – F.B. Morrison.
- 5) Modern dairy cattle management by – Davis.
- 6) Bovine production by V. D. Mudgal.
- 7) Dairy cattle science by – Ensminger.
- 8) Farm animal management practices by Jagdish Prasad.

MARKET MILK INDUSTRY

Theory Paper-II

Periods/week-4

Unit – I

Marks – 50

- ❖ Introduction to MMI
- ❖ Market milk Industry. Organized, Unorganized marketing system.
- ❖ Study of major aided projects such as NDDDB, OF, Technology mission in dairy development and National dairy plans.
- ❖ Milk Production, Utilization and consumption pattern, seasonal and regional variation.
- ❖ Dairy development policy in India.

Unit – II

- ❖ Straining, filltration, clarification of market milk.
- ❖ Reception and preliminary testing of incoming milk
- ❖ Methods of milk preservation – methods of cooling and chilling of milk, farm cooling, refrigeration, LP system.
- ❖ Bio-protective factors for raw milk preservation. Bio-Preservation of Milk-bactofugation.
- ❖ Homogenization of Milk.

Unit – III

- ❖ Processing of Milk-pasteurization of milk principle, methods, LTLT, HTST, in bottle pasteurization, UHT, Uperization, stassanization, vacration.
- ❖ Sterilization of milk.
- ❖ Manufacturing of special milks-Soya milk, Groundnut milk, irradiated milk, fortified milk.
- ❖ Milk distribution systems.
- ❖ Problems of return and unsold milk.

DAIRY CHEMISTRY-I

Theory Paper-III

Unit - I : General Milk Chemistry :

- ❖ Constituents of milk, Composition, Physical and Chemical Nature of Milk of Cow, Buffalo, Goat and Sheep.
- ❖ Physico-chemical properties of milk
- ❖ Nutritive value of milk
- ❖ Coagulation of Milk with Heat, acid, enzymes and alcohol.
- ❖ Newtonian and Non-Newtonian liquids, stocks law.

Unit - II : Chemistry of Milk proteins :

- ❖ Nomenclature.
- ❖ Classification.
- ❖ Significance
- ❖ Chemistry of casein micelle, it's structure, casein composition, fractions, properties and utility.
- ❖ Albumins, globulins and NPN compounds.
- ❖ Colloidal system – Types, properties.
- ❖ Milk as a colloidal system and it's stability.

Unit - III : Chemistry of Milk Lipids :

- ❖ Composition and classification of milk lipids.
- ❖ Significance.
- ❖ Properties.
- ❖ Structure of FG.
- ❖ Chemistry of FGM.
- ❖ Fatty acids and Factors affecting fatty acid composition.
- ❖ Phospholipids and their significance in dairy products.
- ❖ Fat contents.
- ❖ Rancidity and it's control.

DAIRY TECHNOLOGY - I

Theory Paper-IV

Periods/week-4

Unit – I	Technology of indigenous dairy products	Marks – 50
❖	An introduction to indigenous dairy products.	
❖	Heritage of Indian dairy products.	
❖	Classification of indigenous dairy products.	
❖	Study of different indigenous milk products : Khoa and Khoa based; Channa and Channa based Chakka and Chakka based, Pysam, Padusha, Ghever, Milkcake, Kunda, Rajbhog, Khirmohan.	
❖	Ghee : History, definition, composition, methods of manufacturing, grading, Renovation, quality parameters of ghee, like (P. value, R.M. Value, B.R. Reading, Iodine Value), defects and storage	
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Unit – II Technology of western dairy products.		
❖	Classification of western dairy products	
❖	Cream-Definition, Composition, methods of cream separation, types of cream, factors affecting cream skimming efficiency and defects in cream	
❖	Butter-History, definition, composition, types, churning theories, methods of manufacturing, overrun, defects and storage.	
❖	Cheese : History, definition, Composition, types, methods of manufacturing. Butter oil, Kefir, Kumiss, Yoghurt.	
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Unit – III Frozen dairy products		
❖	Ice-cream – History, development and status of ice-cream industry.	
❖	Definition, Composition methods of manufacturing and nutritive value.	
❖	Types and standards of Ice-cream.	
❖	Role of milk constituents in manufacturing of Ice-cream.	
❖	Study and role of dairy and non-dairy ingredients in Ice-cream.	
❖	Types of freezer	
❖	O.R. in Ice-cream and their control.	
❖	Packaging, Hardening storage and defects.	
❖	Kulfi, Chocoboar, Milk Ices and lollies, Softy ice creams.	

THEORY PAPER-V

(Sem. II)

Title : 1 Advances in Animal Nutrition and Breeding.

Periods/Week-4
Marks – 50

Unit - I : Animal feeds and feeding.

- ▲ Animal feed technology : scope and constraints.
- ▲ Livestock feed resources, present scenario of India.
- ▲ Feeding strategies to enhance animal productivity, New trends in feeding dairy animals.
- ▲ Energy terms, concept of metabolic body weight and size in animal nutrition.
- ▲ Feeding standards for different categories of livestock.
- ▲ Feed efficiency; Biotechnology for animal Nutrition.

Unit - II : Feed Technology

- ▲ Legal standards and quality control in feed industry.
- ▲ Feed formulations – feed processes : dry, wet processes, feed mixing. Roughage processing methods. Effects of feed and fodder processing on digestibility.
- ▲ Biotechnological approaches in manipulation of rumen ecosystem.
- ▲ Linear programming, formulation of least cost ration.

Unit - III : Animal breeding.

- ▲ Breeding plans for cattle and buffalo improvement in India.
- ▲ Study of bio-techniques in animal reproduction.
- ▲ Semen collection and A.I.
- ▲ Synchronization of oestrus, super ovulation, ETT.
- ▲ Synchronization of lactation and induced lactation.
- ▲ Cloning.
- ▲ Improvement of breeding efficiency.
- ▲ Heredity and environment interaction.
- ▲ Sustainable animal breeding.

Reference Book :

- ▲ Text book of animal husbandry by – G.C. Banerjee.
- ▲ Animal nutrition by - S.K. Ranjhan
- ▲ Livestock management by - N.R.S. Sastry, Thomas and Singh.
- ▲ Feeds and feeding by – F.B. Morrison.
- ▲ Modern dairy cattle management by – Davis.
- ▲ Dairy cattle feeding and management by – William N. Etages and Paul M. Revis.
- ▲ Livestock feeds and feeding Church O and B books Oregon (USA)

THEORY PAPER-VI

Title : Quality assurance in dairy industry.

Marks – 50

Four periods per week

Objectives :

- ▲ To impart the knowledge regarding importance of quality of milk.
- ▲ To inculcate the knowledge regarding recent trends in quality management and quality assurance.
- ▲ Principle and technical aspects of quality control for various dairy equipments.
- ▲ To study various test procedures related to maintenance of quality of milk.
- ▲ To make awareness about statutory regulations.

Topics

Unit - I

- ▲ Introduction to concept of quality.
- ▲ History, definition and importance of quality assurance (QA) in dairy industry.
- ▲ Milk sampling-procedures for chemical and microbiological analysis.

Unit - II

- ▲ Preparation of laboratory for quality control in dairy industry.
- ▲ Precautions while working in the laboratory.
- ▲ Methods of analysis of milk and milk products.
- ▲ Study of equipments-principles, operation and maintenance of various equipments.
- ▲ Quality requirements for raw milk and quality influences.
- ▲ Quality evolution of raw milk.
- ▲ Export potential in the global context.
- ▲ Quality assurance and hygiene in dairy plants.

Unit - III

- ▲ Quality and safety management systems in dairy industry.
- ▲ Concept of total quality management and quality assurance.
- ▲ Statutory regulations –
- ▲ Dairy processing and quality assurance.
- ▲ Quality assurance strategies.
- ▲ PFA specifications for milk and milk products.
- ▲ BIS standards for milk and milk products.
- ▲ AGMARK standards for milk and milk products.
- ▲ HACCP with advanced version.
- ▲ ISO-14000 (ISO 9000-2000)
- ▲ USFDA regulations.
- ▲ IDF regulations.

THEORY PAPER-VII DAIRY CHEMISTRY- II

Periods/week-4
Marks – 50

Objectives of the Course :

- ▲ To study the chemistry of milk carbohydrates and minor milk constituents.
- ▲ To study the significance of lactose in various milk products.
- ▲ To Study the chemical nature of minor milk constituents and their significance in product preparation.

Course content :

Unit – I Chemistry of milk carbohydrates :

- ▲ Classification of carbohydrates
- ▲ Chemical nature of lactose
- ▲ Properties of lactose
- ▲ Significance of lactose in fermented milk and infant food.
- ▲ Lactose intolerance.

Unit – II Chemistry of Minor Milk Constituents :

- ▲ Minerals in milk-major, minor and trace minerals in milk.
- ▲ Salt balance and heat stability-theory, factors affecting and control measures.
- ▲ Milk enzymes-classification, significance.
- ▲ Vitamins – Definition, classification, chemical nature, functions, deficiency symptoms and RDA.

Unit – III :

- ▲ Flavours in milk and milk products.
- ▲ Chemistry of important by products : whey, lactose, casein.
- ▲ Milk and metal relationship.
- ▲ Qualities of dairy metal.

DAIRY TECHNOLOGY - II

Semester-II Paper-VIII (Theory)

Periods/week-4

Unit – I	Condensed and evaporated milks :	Marks – 50
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- ❖ History, status and scope
- ❖ Physico chemical changes taking place during manufacturing of condensed milk.
- ❖ Heat stability of milk and condensed milk.
- ❖ Methods of manufacturing of condensed Milk, sweetened condensed milk and evaporated milk.
- ❖ Seeding crystallization and stability of evaporated milk.
- ❖ Defects in condensed milk, their causes and precaution.
- ❖ Packaging and storage.

Unit – II	Dried milk products :
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- ❖ History, status and scope.
- ❖ Types, composition, PFA/BIS and international standards.
- ❖ Manufacturing of SMP and WMP
- ❖ UF/RO techniques.
- ❖ Physico-chemical properties of dried milk.
- ❖ Packaging, marketing and defects.

Unit – III	Study of dairy byproducts :
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- ❖ History, status and scope.
- ❖ Casein – Types, methods of manufacturing and uses.
- ❖ Lactose – Methods of manufacturing and Uses.
- ❖ Whey – Composition and importance, whey beverages, whey concentrates and whey powder.
- ❖ Butter milk – composition and importance and uses.

Practical Paper –IX
(Based on theory paper – I and V)

1. Conventional and loose housing synchronized with environment.
2. Maintenance of sanitary and hygienic conditions at farms.
3. Mechanical disposal of waste and waste recycling.
4. Preparation of heat expectancy chart.
5. Ultra structure of mammary gland.
6. Machine milking-principle, operation, care and maintenance.
7. Clean milk production.
8. Detection and control of mastitis.
9. Collection of feeds and fodders, sampling techniques,
10. Feed processing.
11. Preparation of feed mixtures- study of feed processing mills.
12. Computation of ration and types of rations.
13. Use of agro- industrial byproducts in feeds: UROMOL.
14. Automation in animal feeding
15. Detection of aflatoxins in animal feeds.
16. Storage of feeds and fodders
17. Semen collection and evolution.
18. Pregnancy diagnosis.
19. Measuring breeding efficiency.
20. Cleaning, disinfection, cattle dips, foot, dips on farms.
21. Study of feedings and breeding records.
 - Visit to established dairy
 - Visit to agriculture collage.
 - Visit to A.I. centre.
 - Visit to feed factory.
 - Visit to ETT laboratory.

PRACTICAL PAPER - X
(Practical based on theory paper II & VI)

1. Layout for milk collection centre.
2. Receiving of milk and platform tests.
3. Sampling techniques.
4. Study of straining, filtration and clarification.
5. Chilling of milk.
6. Working of plate pasteurizer synchronized to homogenizer.
7. Study of milk separator.
8. Q.C. tests at collection centre.
9. Tests for detection of adulterants and preservatives.
10. Fluid milk packaging.
11. Study of CIP.
12. Study of can washing and crate washers.
13. Preparation of toned, Double toned and reconstituted milk.
14. Visit to milk collection centre.
15. Visit to village dairy co- operative society.
16. Prerequisites of quality control section.
17. Study of different instruments / equipments used QAL, like- Autoclave hot air oven, Incubator, Colorimeter, Centrifuges, Colony counter, TS apparatus, Analytical balances, pH meters, Moisture analyzer, Ele. Operated instruments like Milko- testers, Scanners etc.
18. Instrumental methods of analysis of milk and milk products
19. Visit to the dairy plants with ISO certification.

PRACTICAL PAPER - XI
(Based on theory papers III & VII)

1. Chemical tests of milk - Cob, alcohol test, pH, Acidity, sp. gravity
2. Determination of boiling point and freezing point of milks.
3. Determination of T.S. and SNF by lactometer and gravity metric method.
4. Determination of fat in milk and from selected dairy products.
5. Determination of viscosity.
6. Determination of electrical conductivity.
7. Determination of refractive index.
8. Determination of milk protein by Kjeldhal method.
9. Determination of casein by PAGE.
10. Preparation of acid casein.
11. Detection of adulterants and preservatives in milk.
12. Manufacture of lactose.
13. Manufacture of whey proteins by U.F.
14. Chemical analysis of whey.
15. Chemical analysis of butter milk.
16. Preparation of formula foods.
17. Study of dairy metals.
18. Visit to M.F. unit.
19. Visit to beverage industry.

Practical Paper-XII
(Based on DT-I & DT-II)

1. Quality of milk for milk product preparation.
2. Khoa making - Manual and mechanized.
3. Preparation of different sweet meats from Khoa.
4. Preparation of Dahi, Chakka, Shrikhand – Lassi.
5. Preparation of Rabri, Basundi, Khir, Pysam, Rasmalai , Yoghurt.
6. Preparation of Deshi butter.
7. Preparation of Channa, Paneer, Kalakand, Chhana podo, Rosogolla.
8. Economics of indigenous milk product preparation.
9. Quality parameters for indigenous milk products – sensory evaluation.
10. Packaging materials and packaging of indigenous milk products.
11. Technological innovations for traditional dairy products.
12. Preparation of special milks- toned, double toned milk, reconstituted and recombined milk.
13. Study of cream separator and types of cream - grading of cream.
14. Butter preparation- Creamery method, OR in butter.
15. Butter analysis for fat and moisture.
16. Ghee making- methods - quality- adulterants- detection.
17. Preparation of dairy by products- skim milk- casein, butter milk, Lassi, Limsi, use of Ghee residues.
18. Whey, whey beverages, WPC and WPI.
19. Determination of TS and moisture % in milk powders.
20. Quality determination of milk powder by solubility index.
21. Ice- cream making- calculation of mix, preparation of mix ageing, freezing- packaging of ice cream OR in ice - cream.
22. Preparation of casein.
23. Visits- Halwai shop.
 - Khoa making units.
 - Ice- cream plant, Kulfi unit.
 - Condensed milk plant.
 - Milk parlour.

Reference Books :

1. Out lines of Dairy Technology - S.K. De
2. Milk & Milk Products - Eckless, Combs & Macacy
3. Modern Dairy Products - Lampert
4. Dairy Chemistry - M.M. Rai.
5. Principals of Dairy Chemistry - Jeneess & Patton
6. A Text book of Dairy Chemistry - N.C. Ganguly
7. Fundamentals of Dairy Chemistry - Web & Jonson
8. Dairy Chemistry - Fox
9. Dairy Processing - James Warner
10. Indigenous milk products - ICAR pub
11. Hand book of Dairy Science - K.C. Mahanta
12. Dictionary of Dairying - Davis & Leonard Hill
13. Engineering for Food & Dairy Processing - E.M. Farrell
14. Dairy Plant-Management & Engineering - Tufail Ahemad
15. Text book of Practical Dairy Chemistry - N.K. Roy & D.C. Sen
16. Milk Testing - J.G. Davis
17. Dairy Microbiology - K.C. Mahanta
18. Dairy Bacteriology - Hammer
19. Fundamentals of Dairy Microbiology - J.B. Prajapati
20. Standard Methods for Examination of Dairy Products - Gary H. Richardson
21. Market Milk Industry - C.L. Rhodhouse & J.L. Henderson
22. Comprehensive Dairy Microbiology - Yadav, Batish and Grover
23. A Text Book of Animal Husbandry - G.C. Banerjee
24. The Fluid Milk Industry - Henderson
25. ISI Specifications - BIS Publication
26. Technology of Dairy plant operations - K. P. S. Sangwan.
27. technology of milk processing - C.P. Anantkrishnan, A. Khan and P.N. Padmanabhan
28. Milk and It's properties - S.M. Srivastava
29. Chemical & Microbiological Analysis of milk & milk projects. - Ramakant Sharma.

Dr. S. A. Kulkarni
Chairman
(Adhoc Board in Dairy Science)