

**SWAMI RAMANAND TEERTH
MARATHWADA UNIVERSITY
NANDED**

**SYLLABUS
of**

**M.Sc. Second Year
DAIRY SCIENCE**

**Semester Pattern
(CBCS Pattern)
Effective from June 2015**

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science

Post Graduate (PG) Programmes

DAIRY SCIENCE – CURRICULUM

w.e.f. Academic year 2014-15

M.Sc. Dairy Science Second Year curriculum

SEMESTER – III

An outline :

Paper No.	Name of Paper & No.	External (ESE)	Internal (CA)	Total
XI	Dairy Engineering-I	Credit – 3 75 Marks	Credit : 1 (25 Marks) Test 15 marks + Assignments 10 Marks	Credit :4 100 Marks
XII	Dairy Microbiology-I	Credit – 3 75 Marks	Credit : 1 (25 Marks) Test 15 marks + Assignments 10 Marks	Credit :4 100 Marks
XIII	Dairy Engineering-II	Credit – 3 75 Marks	Credit : 1 (25 Marks) Test 15 marks + Assignments 10 Marks	Credit :4 100 Marks
XII	Dairy Business Management and Co-operation	Credit – 3 75 Marks	Credit : 1 (25 Marks) Test 15 marks + Assignments 10 Marks	Credit :4 100 Marks
XI	Seminar	Credit – 1 25 Marks		Credit : 1
			Total For Semester – III	Credit : 17
SEMESTER IV				
XVI	Packaging and quality Assurance	Credit – 3 75 Marks	Credit : 1 (25 Marks) Test 15 marks + Assignments 10 Marks	Credit :4 100 Marks
XVII	Dairy Microbiology II	Credit – 3 75 Marks	Credit : 1 (25 Marks) Test 15 marks + Assignments 10 Marks	Credit :4 100 Marks
XVIII	Dairy plant management	Credit – 3 75 Marks	Credit : 1 (25 Marks) Test 15 marks + Assignments 10 Marks	Credit :4 100 Marks
XIX	Heritase Dairy Products of Indian – Elective	Credit – 3 75 Marks	Credit : 1 (25 Marks) Test 15 marks + Assignments 10 Marks	Credit :4 100 Marks
XX	Seminar	Credit : 1 25 Marks		Credit : 1
			Total For Semester – IV	Credit : 17
LAB COURSEWORK ANNUAL PRACTICAL				
LC-05	Lab Course work – 05 Based on XI + XVI	Credit – 3 75 Marks	Credit : 1 (25 Marks)	Credit :4 100 Marks
LC-06	Lab Course work – 06 Based on XII + XVII	Credit – 3 75 Marks	Credit : 1 (25 Marks)	Credit :4 100 Marks
LC-07	Lab Course work – 07 Based on XIII + XVIII	Credit – 3 75 Marks	Credit : 1 (25 Marks)	Credit :4 100 Marks
LC-08	Lab Course work – 08 Dissertation + in plant training of 6 week duration course work	Credit – 3 75 Marks	Credit : 1 (25 Marks)	Credit :4 100 Marks
Total For Lab Course Work (Annual)				Credit : 16
Total for M.Sc. II year : Sem. III + Sem. IV + Lab course work (Annual)				Credit : 50
Total for M.Sc. I year + II year.				Credit :100

Semester - III
Dairy Science
Theory Paper - XI
Dairy Engineering – I

Total Period : 45

Period per week – 04

Credits : 04

Objectives :

- ❖ To inculcate the knowledge regarding various engineering materials used in dairy industry.
- ❖ Installation and operations of various equipments and machines used in dairy plant.
- ❖ Unit operations.
- ❖ Various Lay-out procedures.

UNIT – I :

12

- ❖ **Dairy Engineering Materials, Lay-out and fluid flow.**
- ❖ Introduction to Dairy Engineering.
- ❖ Engineering properties of milk & milk products.
- ❖ Various materials for dairy plant, Machineries and equipments.
- ❖ Design and Lay-out of dairy plant (Chilling Centre, Mini dairy plant, Composite milk processing plant)

UNIT – II :

11

- ❖ **Utility / Services for dairy plant.**
- ❖ Water supply, Quality of water, water softening treatment for boiler use. Boiler safety devices.
- ❖ Study of boilers, Type, installation, working operation.
- ❖ Boiler fuels
- ❖ Steam pipelines – Installation, care and maintenance Boiler safety regulation.

UNIT – III :

11

- ❖ **Heat and heat transfer.**
- ❖ Heat transfer principle and laws.
- ❖ Types of heat exchangers, their installation and working
- ❖ Microwave heating of milk and milk products.
- ❖ Evaporators and dryers.
- ❖ Humidifiers.

Pumps and fluid flow.

- ❖ Study of pumps used in dairy industry.
- ❖ Fluid flows.
- ❖ Valves and pipe fittings.
- ❖ Electricity and power supply
- ❖ Types of motors and starters.

Reference Books.

- A text book of Dairy Engineering – C. N. Hall
- Engineering for Dairy and Food products – E.M. Farral
- Dairy plant Engineering and management – Tufail Ahmad.
- Food engineering and Dairy Technology – Ing. H.C. Kessler.
- Modern Dairy Technology and engineering – Harpar and Hall
- UHT Processing of milk and milk products.
- Heat transfer – C. P. Gupta and Rajendra Prasad.
- Principles of unit operations – Alon S. Fouretal
- Fluid mechanics – Yuan
- Process equipment Design – Hasse and Ruston
- Refrigeration, Air Conditioning and environmental pollution control – Kadabmi
- Engineering properties of foods – M.A. Rao and S.S.H. Razwi
- Dairy engineering technology and Engg. Fo dairy plant operations – C.P. Autkrishna and simha N.N.

Semester - III
Dairy Science
Paper - XII
Dairy Microbiology – I

Total Period : 45

Period per week – 04

Credits : 04

Objectives :

- ❖ To provide advanced knowledge of various aspects of dairy microbiology
- ❖ Study of advances in dairy microbiology
- ❖ To know recent techniques in microbiology
- ❖ Various Lay-out procedures.
- ❖ To study proposition of starter cultures.

Unit – I :

12

- ❖ **Historical and introductory Dairy Microbiology.**
 - Introduction to cell biology
 - Structural difference in Eukaryotic and prokaryotic cells.
 - Historical background of microbiology
 - Classification of various groups of microorganism associated with dairy industry.

Unit – II :

08

- ❖ **Fermentation.**
 - Desirable and undesirable formulation in milk of dairy products.
 - Causes, prevention and biochemical changes associated with fermentation.

Unit – III :

- ❖ **Starter Culture**
 - Importance of starter culture in dairy industry.
 - Propagation and preservation of dairy starters.
 - Recent developments in dairy starter industry, like starter concentration, starter distillates and direct-vat-set (DVS) cultures.
 - Study of yoghurt, kefir and Kumiss.

❖ Microbiology of milk

- Sources of milk contamination and their control.
- Microfora of raw milk
- Microflora of market milk.
- Microbiology of pasteurized of sterilized milk
- Diseases transited through milk and milk products.
- Milk products and human health.

Reference Books :

- ❖ Dairy microbiology I & II – R. K. Robinson
- ❖ Compressive dairy microbiology – Yadav, Batish and Grover.
- ❖ Fundamentals of Dairy microbiology : J. B. Prajapati
- ❖ Testing milk of milk product : Artheton and Newlender

Semester - III
Dairy Science
Paper - XIII
Dairy Engineering – II

Total Period : 45

Period per week – 04

Credits : 04

Objectives :

- ❖ To know the installation and working principles of various equipments and machineries.
- ❖ To know the conveying methods used in dairy plant.

Unit – I :

12

Equipments and machineries :

- ❖ Components, installation, working and maintenance of chillers.
- ❖ Filters, Types, installation, working and maintenance.
- ❖ Milk separators and clarifiers.
- ❖ Pasturizer, Vacreator.
- ❖ Milk homogenizer-types, working, cave and maintenance.

Unit – II :

10

Equipments and Milk storage:

- ❖ Butter churners – types, Installation, Working and maintenance.
- ❖ Ice-cream freezers – types and working.
- ❖ Ghee vat
- ❖ Cheese vat
- ❖ Milk storage tanks and milk silo's.

Unit – III :

10

Conveying systems:

- ❖ Definition and objectives.
- ❖ Types of conveyors used in dairy industry
- ❖ Maintenance of conveying system.
- ❖ Calculations of conveying load.

Washers :

- ❖ Can washers – Types, installation, working and care and maintenance.
- ❖ Filters, Types, installation, working and maintenance.
- ❖ Bottle washers – Types, installation, working and maintenance.
- ❖ Create washers – Types, installation, working and maintenance.
- ❖ Sonic vibrators.
- ❖ CIP system.

Reference Books.

- A text book of Dairy Engineering – C. N. Hall
- Engineering for Dairy and Food products – E.M. Farral
- Dairy plant Engineering and management – Tufail Ahmad.
- Food engineering and Dairy Technology – Ing. H.C. Kessler.
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- Fluid mechanics – Yuan
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- Refrigeration, Air Conditioning and environmental pollution control – Kadabmi
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- Dairy engineering technology and Engg. Fo dairy plant operations – C.P. Autkrishna and simha N.N.

Semester – III
Dairy Science
Theory Paper - XIV
Dairy Business Management and Co-operation

Total Period : 45

Period per week – 04

Credits : 04

Objectives :

- i) To study the challenges and opportunities of dairy entrepreneurs in India.
- ii) To know the various principle of cooperation and cooperative movement for dairy industry.
- iii) To study the demand and supply of milk and milk product.
- iv) To study financial management and cost accounting with respect to dairy industry.
- v) To study the marketing management of milk and milk products and pricing policies of milk procurement.

UNIT – I :

11

Business Administration and pricing policy :

- ❖ Resource planning and pricing policies of milk procurement.
 - ❖ Sources of finance : study of financing agencies for dairying.
 - ❖ Demand Analysis : Law of demand, Determinants of demand, types of demand, elasticity of demand, forecasting, etc. and law of supply.
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UNIT – II :

11

Finance Management :

- ❖ Financial management and cost Accounting : profit and loss statement, balance sheet, cash flow capital manage.
- ❖ Statements, BEP, inventory management, different cost concept, etc.

Marketing Management :

- ❖ Definition, scope, function and importance of marketing management.
- ❖ Market planning, Market segmentations, Marketing mix-4 Ps, Marketing research, etc. with respect to milk and milk products.
- ❖ Types o marketing strategies and different channels mostly used for milk procurement.
- ❖ Product recall strategy and market complaints redressed system.
- ❖ Advertisement and marketing channels in organized and unorganized sectors.
- ❖ Logistic management of milk and milk products.
- ❖ Recent trend in marketing and utilization of dairy products.

Co-operation :

- ❖ Definition and principle of cooperation – History and prospects.
- ❖ Structure of Dairy Cooperatives : Village level cooperatives, Taluka/District/Milk unions and state level marketing federation and their organization set up.
- ❖ Rights and duties of the chairmen, secretary and general body of the cooperative society.

Semester – IV
Packaging and Quality Assurance
Paper –XVI

Total Period : 45

Periods Per week : 04

Credits : 04

Objectives :

- ❖ To know the utilities of packaging necessary for dairy industry.
- ❖ To study the various packaging materials for milk and milk products.
- ❖ To know the trends in packaging materials in dairy industry.
- ❖ To know the importance of quality assurance in dairy sector.

Unit – I :

10

- ❖ Objectives of packaging.
- ❖ Packaging material used in dairy industry.
- ❖ Packaging of milk and it's types. Bottle capping and packaging, Tetra packs, cans, cones etc.
- ❖ Packaging of milk products.

Unit – II :

10

- ❖ Study of form, fill and seal machines (Polypacks)
- ❖ Automation in packing of milk
- ❖ Automation in packing of different milk products.
- ❖ Recent trends in packaging materials used in dairy industry.

Unit – III :

11

- ❖ Enrichment of shelf life of indigenous dairy products by the application of modern processing and packaging techniques.
- ❖ Sensory evaluation of Indian dairy products.
- ❖ Nutritional significance of unflavoured added dairy products.
- ❖ Reuse of packages, recycling of packaging materials and disposal of used packages.

- ❖ Strategies for globalization of Indian dairy products.
- ❖ 3-A sanitary standards for the hygienic packaging of milk and milk products.
- ❖ HACCP for dairy industry and International food laws.
- ❖ ISO standards and quality of dairy products.
- ❖ International food safety and Quality system certification.
- ❖ Prevention of food adulteration act and rules.
- ❖ FSSAI (Food safety standards Authority India) Regulation in dairy industry.
- ❖ Crime and punishment for adulteration in milk and milk products.

List of Books :

- ❖ Quality Assurance monograph SMC College of Dairy Science of Anand.
- ❖ ISI bulletin for analysis of milk and milk products – BIS publication.
- ❖ PFA and MMPO Handbook.
- ❖ Testing of milk and milk products – Atherton and Newlendor.
- ❖ Text book Dairy Chemistry – B. R. Ling.
- ❖ Food safety and standards Act 2006. Rules and Regulation – 2011 – P.M. Kulkarni
- ❖ Packaging Bulletin
- ❖ Handbook of pollution control management – Hurburt F. Bund.

Semester – IV
Dairy Microbiology - II
Paper –XVII

Total Period : 45

Periods Per week : 04

Credits : 04

Objectives :

- ❖ To know the microbiology of Indigenous milk products, western dairy products and by products
- ❖ To know microbiological standards for milk and milk products.

Unit – I : **11**

- ❖ **Microbiology of Indigenous dairy products.**
- ❖ Microbiology of khoa, Rabri, Basundi, Channa, Paneer, Kulfi etc.
- ❖ Microbiology of sweetmeats : Pedha, Burfi, Gulabjamun.

Unit – II : **12**

- ❖ **Microbiology of western Dairy products.**
- ❖ Microbiology of cream, Butter.
- ❖ Microbiology of dialed milks : WMP, SMP and formula foods, conversed milk.
- ❖ Microbiology of cheese.
- ❖ Microbiology of Ice-cream of other frozen products.

Unit – III : **11**

- ❖ **Microbiology of Dairy By products.**
- ❖ Microbiology of whey.
- ❖ Microbiology butter milk
- ❖ Microbiology of casein
- ❖ Microbiology of Ghee residue.

Unit – IV : **11**

- ❖ **Microbiological standards**
- ❖ Microbiological standards for milk and milk products. BIS standards.
- ❖ USDA / FDA standards, UK standards, USPHS, APHA Standards.
- ❖ ICMFS, IDF / ISO / AOAC standards.

Semester – IV
Dairy Science
Theory Paper - XVIII
Dairy Plant Management

Total Period : 45

Period per week – 04

Credits : 04

Objectives :

- i) To study the principles & functions of Dairy Plant Management.
- ii) To know the various ways and means of plant maintenance.
- iii) To know the recent concept in the production management and food hygiene.
- iv) To study the dairy plant design and types of dairy plant layout.
- v) To study the process of sanitations and dairy waste disposal.

UNIT – I :

12

General Dairy Management :

- ❖ Management and Administration.
- ❖ Personal management, manpower planning, recruitment, training, transfer, promotion policies, job specifications, job evaluation, job enhancement, job enrichment, MBO.
- ❖ Entrepreneurship Development.
- ❖ Entrepreneurial opportunities in India Dairying.
- ❖ Industrial legislation in India, particularly in dairy industry and statutory requirement for dairy industry-FSSAI, ISO-9001, ISO-22000, ISO-14000, ISO-50000, HACCP, GMP, GHP, CAC, etc.

UNIT – II :

11

Plant Design :

- ❖ Types of plant layout, location of plant and selection of sites.
- ❖ Maintenance of dairy plant flooring and drainage lines, water supply, boiler house, service lines for electricity, water, steam and refrigeration.
- ❖ Dairy Equipment maintenance, plant maintenance and efficiency factors.
- ❖ Food hygiene, personal hygiene, plant hygiene, etc.

Plant Management :

- ❖ Principles and functions of production management, product planning and control.
- ❖ Work study and measurement motion and time study, production efficiency and factors losses, personnel management.
- ❖ Material losses of dairy plant and hazardous processes.
- ❖ Uses of common lubricants (Food grade).

Cleaning, Sanitation and Dairy Waste Disposal :

- ❖ Different types of detergent and sanitizers required for cleaning in dairy industries.
- ❖ Cleaning in place and its types.
- ❖ Present trends in cleaning and sanitation in dairy plants i.e. Bio Detergents, ultrasonic technique, etc.
- ❖ Types of Dairy waste from different sections, waste treatment: primary and secondary treatment.
- ❖ RO-Technique for waste disposal, wastes recycling, etc.

Semester -IV
Dairy Science
Theory Paper - XIX
Heritage Dairy Products of India

Total Period : 45

Period per week – 04

Credits : 04

Objectives :

- i) To get acquainted to regional Indian milk products.
- ii) To study their method of production, and nutritive value.

UNIT – I :

12

- ❖ **Eastern regional milk products :** Pantooa, Rabari, Khir-mohan, Chana Murki, Chamcham, Channapoda, Bandal Cheese, Mistidoi, Rajbhog, Kamalbhog.

UNIT – II :

11

- ❖ **Western regional milk products :** Lal-mohan, Ghewar, Surtipaneer, Ujani Basundi, Gangakher Kalam, Kunthalgiri Peda, Khoajilebi.

UNIT – III :

10

- ❖ **Southern regional milk products :** Dharwad Peda, Thirttural, Kunda Phirmi, Paysum, Jilli, Mohandas.

UNIT – IV :

12

- ❖ **Northern regional milk products :** Kalajam, Kurchan, Bal-mithai, Lauki Kheer, Sohan Halwa, Lauki Ka Halwa, Padusha, Lucknowpeda, Agrapetha, Milk Cake.

Reference Book :

- i) Technology of Indian milk products – P.R. Aneja, B.N. Mathur, R.C. Chandan.
- ii) Handbook of milk processing Dairy products and packaging technology – EiRi Board..
- iii) Milk and milk products Technology – M. Raziuddin and Ashok Hembade.
- iv) Milk processing and Dairy products Industries – EiRi Board of Consultants and engineer.
- v) Technology advances in Indigenous milk products – Dr. J. David

M.Sc. II Year.
(Practical based on paper XI & XVI)
Laboratory Course Work - 05

One Practical of 3 Periods per week

Credits : 04

Practical's Engineering Materials

- ❖ Workshop study
- ❖ Layout for different types of dairy plants
- ❖ Study of flow patterns
- ❖ Study of Pumps (Reciprocating, non reciprocating, gear, pump, instant pumps) with their components, installation and working.
- ❖ Study of Valves
- ❖ Study of pipe fittings
- ❖ Study of compression, refrigeration system
- ❖ Study of refrigerant
- ❖ Study of Boiler, Types, Components, and working study of Boiler fuels
- ❖ Water softening treatment for boiler use
- ❖ Study of evaporators
- ❖ Study of Driers
- ❖ Study of compressors and humidifiers
- ❖ Study of process equipments: Chillers, Filters and clarifiers, Separators, Pasteurizers, Homogenizer
- ❖ Butter churners and accessories
- ❖ Storage tanks and milk silos,
- ❖ Packaging materials
- ❖ Bottle, Packaging, Capping, Polypack.
- ❖ Study of can washers
- ❖ Study of bottle and crate washers
- ❖ Study of CIP system
- ❖ Study of compression refrigeration and air conditioning
- ❖ Visits to processing plant: Engineering workshop, Boiler unit, Refrigeration unit etc.

M.Sc. II Year
Dairy Science
(Based on theory paper- XII & XVII)
Laboratory Course - 06

1 Practical per Week :

Credit : 04

Practical's :

- ❖ Preparation of reagents.
- ❖ Caliberation of dairy glass wares.
- ❖ Techniques adopted to sterilize glasswares and media ingredients.
- ❖ Various staining techniques used to study. Morphological characteristics of microorganisms.
- ❖ Study of general and selective media
- ❖ Microbiological analysis of milk & milk products by qualitative methods (SPC and DMC)
 - Cream
 - Condensed milk
 - Skim milk powder & whole milk powder.
- ❖ Determination of yeast and mold count in butter.
- ❖ Evidence of staphylococci and coliforms in milk products
- ❖ Study of spoilage type and pathogenic organisms associated with milk & milk products
- ❖ Identification and maintenance of microbial cultures.
- ❖ Propagation and preservation of dairy starters.
- ❖ Preparation of yoghurt, kefir, acidophil as milk and kumiss.
- ❖ Microbiological analysis of air, water and soil.
- ❖ Rinse and swab techniques
- ❖ Field visits: Vidhya Dairy, Ananad.

M.Sc. II Year
Dairy Science
(Based on Theory paper XIII & XVIII)
Laboratory Course : 07

Practical per week one

Credit : 04

Practical's

- ❖ Preparation of different type of plant lay-outs.
- ❖ Preparation of organizational charts.
- ❖ Preparation of inspection schedule and inspection charts.
- ❖ Study of maintenance of cold store and calculation of cooling load.
- ❖ Study of various dairy plant equipments and their maintenance.
- ❖ Study of CIP system
- ❖ Preparation of detergent & sanitizer solutions of desired strength.
- ❖ Study of repairs and overhauls.
- ❖ Study of effluent treatment plant.
- ❖ Study of process equipments like chillers, filters/clarifiers, separators, pasteurizers, homogenizers, butter churns & accessories, storage tanks & milk silos, vats, freezer, cheese equipments,
- ❖ Can washer, bottle & crate washers
- ❖ Study of compression, refrigeration and air conditioning.
- ❖ Study of condensing and vacuum pan.
- ❖ Study of conveying systems in dairy plant.
- ❖ Students visits to:
 - Maintenance department of dairy plant.
 - Workshops
 - Modern Dairy plant.