॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड – ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with'B++' grade

Fax : (02462) 215572

Phone: (02462)215542

Academic-1 (BOS) Section

website: srtmun.ac.in

E-mail: bos@srtmun.ac.in

विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरणानुसार पदव्युत्तर स्तरावरील प्रथम वर्षाचे अभ्यासक्रम शैक्षणिक वर्ष २०२३–२४ पासून लागू करण्याबाबत..

प रि प त्र क

संदर्भ:– १. जा.क्र.शै–१/एनईपी२०२०/S&T/अक्र/२०२३–२४/१३० दिनांक ३०/०६/२०२३

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, संदर्भीय परिपत्रकान्वये दिनांक १६ जून २०२३ रोजी संपन्न झालेल्या मा. विद्यापरिषदेच्या बैठकीतील ऐनवेळचा विषय क्र. ०५/५६–२०२३ अन्वये मान्यता दिल्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरणानुसार अभ्यासक्रम शैक्षणिक वर्ष २०२३–२४ पासून लागू करण्यात आलेले आहेत. तथापी वरील संदर्भीय परिपत्रक १ अन्वये प्रकाशित केलेल्या अभ्यासक्रमामध्ये अभ्यासमंडळानी किरकोळ दुरूस्ती करून अभ्यासक्रम सादर केला आहे. त्यानुसार दुरूस्तीसह खालील अभ्यासक्रम लागू करण्यात येत आहेत.

1. M. Sc. Dairy Science I year

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शैक्षणिक–१/परिपत्रक/एनईपीपीजी/S&T/
२०२३–२४/441

आपली विश्वासू

डॉ. संरिता लोसरवार
सहाय्यक.कुलसचिव

दिनांक : ०२.०२.२०२४.

प्रत माहिती व पुढील कार्यवाहीस्तव :

१) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) मा. प्राचार्य, सर्व संबधित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. यानां देवून कळविण्यात येते की, सदरील परिपत्रक विद्यापीठाच्या संकेतस्थळावर प्रसिध्द करण्यात यावे.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY

NANDED - 431606

Two Year Masters Programme

Subject: DAIRY SCIENCE

(Affiliated College)

Under the Faculty of Science & Technology
Effective from Academic Year 2023-24

(As per NEP-2020)

From the Desk of the Dean, Faculty of Science and Technology Swami Ramanand Teerth MarathwadaUniversity, Nanded,

Enduring to its vision statement "Enlightened Student: A Source of Immense Power", is trying hard consistently to enrich the quality of science education in its jurisdiction by implementing several quality initiatives. Revision and updating curriculum to meet the standard of the courses at national and international level, implementing innovative methods of teaching- learning, improvisation in the examination and evaluation processes are some of the important measures that enabled the University to achieve the 3Es, the equity, the efficiency and the excellence in higher education of this region. To overcome the difficulty of comparing the performances of the graduating students and also to provide mobility to them to join other institutions the University has adopted the cumulative grade point average (CGPA) system in the year 2014-2015. Further, following the suggestions by the UGC and looking at the better employability, entrepreneurship possibilities and to enhance the latent skills of the stakeholders the University has adopted the Choice Based Credit System (CBCS) in the year 2018-2019 at graduate and post- graduate level. This provided flexibility to the students to choose courses of their own interests. To encourage the students to opt the world-class courses offered on the online platforms like, NPTEL, SWAYM, and other MOOCS platforms the University has implemented the credit transfer policy approved by its Academic Council and also has made a provision of reimbursing registration fees of the successful students completing such courses.

SRTM University has been producing a good number of high caliber graduates; however, it is necessary to ensure that our aspiring students are able to pursue the right education. Like the engineering students, the youngsters pursuing science education need to be equipped and trained as per the requirements of the R&D institutes and industries. This would become possible only when the students undergo studies with an updated and evolving curriculum to match global scenario. Higher education is a dynamic process and in the present era the stakeholders need to be educated and trained in view of the self-employment and self-sustaining skills like start-ups. Revision of the curriculum alone is not the measure for bringing reforms in the higher education, but invite several other initiatives. Establishing industry-institute linkages and initiating internship, on job training for the graduates in reputed industries are some of the important steps that the University would like to take in the coming time. As a result, revision of the curriculum was the need of the hour and such an opportunity was provided by the New Education Policy 2020. National Education Policy 2020 (NEP 2020) aims at equipping students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. As a result the students will acquire expertise in specialized areas of interest, kindle their intellectual curiosity and scientific temper, and create imaginative individuals. The curriculum given in this document has been developed following the guidelines of NEP- 2020 and is crucial as well as challenging due to the reason that it is a transition from general science based to the discipline-specific-based curriculum.

All the recommendations of the Sukanu Samiti given in the NEP Curriculum Framework-2023 have been followed, keeping the disciplinary approach with rigor and depth, appropriate to the comprehension level of learners. All the Board of Studies (BoS) under the Faculty of Science and Technology of this university have put in their tremendous efforts in making this curriculum of international standard. They have taken care of maintaining logical sequencing of the subject matter with proper placement of concepts with their linkages for better understanding of the students. We take this opportunity to congratulate the Chairman(s) and all the members of various Boards of Studies for their immense contributions in preparing the revised curriculum for the benefits of the stakeholders in line with the guidelines of the Government of Maharashtra regarding NEP-2020. We also acknowledge the suggestions and contributions of the academic and industry experts of various disciplines. We are sure that the adoption of the revised curriculum will be advantageous for the students to enhance their skills and employability. Introduction of the mandatory On Job Training, Internship program for science background students is praise worthy and certainly help the students to imbibe firsthand work experience, team work management. These initiatives will also help the students to inculcate the workmanship spirit and explore the possibilities of setting up of their own enterprises.

Dr. L. M. Waghmare,
Dean, Faculty of Science and Technology

Dr. M. K. Patil,
Associate Dean, Faculty of Science and Technology
Two Year PG Credit Framework of Sci. & Tech.
Faculty of S.R.T.M.U. Nanded

From the Desk of the Chairman, Board of Studies of the Dairy Science

Preamble:

The emergence Dairy Science of many centuries ago is considered one of the most important scientific achievements. Since then,it has become a leading field in the Dairy Science, Food Industry and a popular course of study in higher institutions worldwide. Like every other B.Sc. programme in tertiary education, B.Sc. Dairy Science has its own set of different syllabi, which students must cover before they are allowed to graduate. The New Education policy presents an opportunity to shift paradigm from a teacher – centric to student centric higher education system in India. It caters for skill-based education. The learning outcomes- based curriculum framework for M. Sc. Dairy Science is intended to provide a comprehensive foundation to the subject and to help students develop the ability to successfully continue with further studies and research in the subject while they are equipped with required skills at various stages. Efforts .has been made to integrate use of recent technology in teaching and learning. The syllabus is designed to equip students with valuable cognitive abilities and skills so that they are successful in meeting diverse needs of professional careers in a developing and knowledge-based society. The curriculum considers the need to maintain globally competitive standards of achievement in terms of knowledge and skills in Dairy Science, Animal Husbandry, Animal Nutrition, Milk production and procurement and technical concept as well as develop scientific orientation, problem solving skills, human and professional values which foster rational and critical thinking in the students. This course serves a good opportunity in different fields in Dairy Science and Dairy Industry. By the end of the program, students will be able to:

- Understanding biochemical and physiological aspects of Dairy Products and developing Techniques
- perspective to identify innovative solutions for Two Year PG Credit Framework of Sci. & Tech. Faculty of S.R.T.M.U. Nanded

Dr. Pandurang Tukaram Gangasagare
Adarsh Education Society's Arts, Commerce and Science College, Hingoli
Chairman,
Board of Studies of the DAIRY SCIENCE
Swami Ramanand Teerth Marathwada University, Nanded.

Members of the Board of Studies in the subject of DAIRY SCIENCE under the faculty of Science and Technology

Sr. No.	Name of the Member	Designation	Address	Contact No.
1	Dr. S.N. Landge	Professor	Maharashtra Udayagiri Mahavidyalaya Udgir.	9673761858
2	Dr.R.S.Sonwane	Professor	Yeahwant Mahavidyalaya Nanded	8888592956
3	Dr. V.V.Niras	Professor	Vivakenand Mahavidyalaya Aurangabad	9422712087
4	Dr. G.K. Londhe	Professor	College of Agricultural Parbhani	9421449497

Objectives of the course

The course is forethought to acquaint the student's with

- Know farming aspects in livestock so as to prepare themselves for future prospects.
- Learner can know appreciate geographical distribution and trends in livestock populationgrowth
- Student's can understand the roles of livestock in National economic of their socio-economicaspects.
- Understand the sanitary and hygienic condition in Animal Farm.
- Student's can understand the nature and quality of ration required to the livestock.
- Student's can understand the adaptations and livestock farming in India.
- Sanitary and hygienic conditions in livestock farm.
- Learner can understand the Establishment of livestock farming.
- Student's can know the Care and management of farm livestock.
- Student's can understand the physiology of lactation

Outcomes of the course

After completing one can work as a livestock supervisor in a various well established dairyfarm and animal breeding farm.

- One can work as a Dairy Farm manager.
- Understanding concept of cattle and buffalo breeding.
- Understanding concept of conservation of Animal Genetic Resources.
- Job Opportunities as wage employment in Livestock assistant/Dairy farm assistant/Farmsupervisor/Farm assistant.
- Self-Employment as Dairy farm owner/ Fodder producer/Cattle feed.
- To prepare young and enthusiastic entrepreneur for self- employment through dairying anddairy associated activities.
- Job opportunities in milk processing plant/Milk products manufacturing unit.
- One can work as manager in Dairy plant.
- Job opportunities in quality control in manufacturing unit.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Faculty of Science & Technology

Credit Framework for Two Year PG Program

Subject : Dairy Science

Year & Level 1	Sem 2	Major Subjects (DSC) 3	Major Subjects (DSE) 4	RM 5	OJT/FP/CS 6	Research Project 7	Practical's 8	Credits 9	Total Credits 10
1	1	SMD DSC-101 (4Cr) SMD DSC-102 (4Cr) SMD DSC-103 (4Cr)	SMD DSCE 101 (3+1 Cr)	SMD DSC RM 104 (3 Cr)	--		SMD DSCP-101 (1Cr) SMD DSCP-102 (1Cr) SMD DSCP-103 (1Cr) SMD DSCEP-101 (1Cr)	22	44
	2	SMD DSC-201 (4Cr) SMD DSC-202 (4Cr) SMD DSC-203 (4Cr)	SMD DSCE 201 (3+1 Cr)	--	SMD DSC OJ 201 (3Cr)		SMD DSCP-201 (1Cr) SMD DSCP-202 (1Cr) SMD DSCP-203 (1Cr) SMD DSCEP-201 (1Cr)	22	
Exit option : Exit Option with PG Diploma *(after 2024-25)*									
2	3	SMD DSC-301 (4Cr) SMD DSC-302 (4Cr) SMD DSC-303 (4Cr)	SMD DSCE 301 (4 Cr)	--	--	SMD DSC RP 301 Research Project 4Cr	SMD DSCE-301 (1Cr) SMD DSCP-302 (1Cr)	22	44
	4	SMD DSC-401 (4Cr) SMD DSC-402 (4Cr)	SMD DSCE 401 (4 Cr)	SMD DSCPE- 403 Publication ethics (2 Cr)		SMD DSC RP 404 Research Project 6Cr	SMD DSCP-401 (1Cr) SMD DSCP-402 (1Cr)	22	
Total Credits		44	16	05	03	10	10		88

M.Sc. Dairy Science First Year Semester I (Level 6.0)

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/Week)	
			Theory	Practical	Total	Theory	Practical
Major	SMD DSC-101	Market Milk Process Technology (MMPT)	04	--	04	04	--
	SMD DSC-102	Dairy Chemistry (DC)	04	--	04	04	--
	SMD DSC-103	Technology of Indigenous and Value Added Dairy Products (TIVADP)	04	--	04	04	--
Elective (DSE)	SMD DSCE-101	Advances in Livestock Production Management (ALPM)	03	--	03	03	--
Research Methodology	SMD DSCRM-104	Research Methodology	03	--	03	03	--
DSC Practical	SMD DSCP-101	Lab 1/ Based on Theory Paper SMD DSC-101 (MMPT)	--	01	01	--	02
	SMD DSCP-102	Lab 2/ Based on Theory Paper SMD DSC-102 (DC)	--	01	01	--	02
	SMD DSCP-103	Lab 3/ Based on Theory Paper SMD DSC-103 (TIVADP)	--	01	01	--	02
DSE Practical	SMD DSCEP-101	Elective Lab 4/Based on Elective Paper SMD DSE-101 (ALPM)	--	01	01	--	02
Total Credits			**18**	**04**	**22**	**18**	**08**

M.Sc. Dairy Science First Year Semester I (Level 6.0)
Examination Scheme

[20% Continuous Assessment (CA) and 80% End Semester Assessment *(ESA)*]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits of individual paper)

Subject (1)	**Course Code (2)**	**Course Name (3)**	**Theory**				**Practical**		**Total Col (6+7) Col (8+9) (10)**
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	
Major	SMD DSC-101	Market Milk Process Technology (MMPT)	20	20	20	80	--	--	100
	SMD DSC-102	Dairy Chemistry (DC)	20	20	20	80	--	--	100
	SMD DSC-103	Technology of Indigenous and Value Added Dairy Products (TIVADP)	20	20	20	80	--	--	100
Elective (DSE)	SMD DSCE-101	Advances in Livestock Production Management (ALPM)	15	15	15	60	--	--	75
On job Training/ Field Project/ Case study/RM	SMD DSCRM 104	Research Methodology	15	15	15	60	--	--	75
DSC Practical	SMD DSCP-101	Lab 1/ Based on Theory Paper SMD DSC-101 (MMPT)	--	--	--	--	05	20	25
	SMD DSCP-102	Lab 2/ Based on Theory Paper SMD DSC-102 (DC)	--	--	--	--	05	20	25
	SMD DSCP-103	Lab 3/ Based on Theory Paper SMD DSC-103 (TIVADP)	--	--	--	--	05	20	25
DSCE Practical	SMD DSCEP-101	Elective Lab 4 /Based on Elective Paper SMD DSCE-101 (ALPM)	--	--	--	--	05	20	25

➢

M.Sc. Dairy Science First Year Semester II (Level 6.0)

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/Week)	
			Theory	Practical	Total	Theory	Practical
Major	SMD DSC-201	Quality Assurance in Dairy Industry (QADI)	04	--	04	04	--
	SMD DSC-202	Adulterants and Contaminants in Milk and Milk Products (ACM&MP)	04	--	04	04	--
	SMD DSC-203	Special Milks and Western Dairy Products (SM&WDP)	04	--	04	04	--
Elective (DSE)	SMD DSCE-201	Advances in Animal Nutrition and Breeding (AANB)	03	--	03	03	--
On Job Training/ Field Project/ Case Study	SMD DSCOJT 201	On Job Training (OJT)/ Field Project (FP) / Case Study (CS)	--	03	03	03	--
DSC Practical	SMD DSCP-201	Lab 5/ Based on Theory Paper SMD DSC-201 (QADI)	--	01	01	--	02
	SMD DSCP-202	Lab 6/ Based on Theory Paper SMD DSC-202 (ACM & MP)	--	01	01	--	02
	SMD DSCP-203	Lab 7/ Based on Theory Paper SMD DSC-203 (SM&WDP)	--	01	01	--	02
DSCE Practical	SMD DSCEP-201	Elective Lab 8 /Based on Elective Paper SMD DSE-201 (AANB)	--	01	01	--	02
Total Credits			**15**	**07**	**22**	**15**	**11**

M.Sc. Dairy Science First Year Semester II (Level 6.0)
Examination Scheme

[20% Continuous Assessment (CA) and 80% End Semester Assessment (ESA)]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits of individual paper)

Subject (1)	**Course Code (2)**	**Course Name (3)**	**Theory**				**Practical**		**Total Col (6+7) Col (8+9) (10)**
			Continuous Assessment			ESA			
			Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	
Major	SMD DSC 201	Quality Assurance in Dairy Industry (QADI)	20	20	20	80	--	--	100
	SMD DSC 202	Adulterants and Contaminants in Milk and Milk Products (ACM&MP)	20	20	20	80	--	--	100
	SMD DSC 203	Special Milks and Western Dairy Products (SM&WDP)	20	20	20	80	--	--	100
Elective (DSE)	SMD DSCE 201	Advances in Animal Nutrition and Breeding (AANB)	15	15	15	60	--	--	75
On job Training/ Field Project/ Case study	SMD DSCOJT 201	On Job Training (OJT)/ Field Project (FP) / Case Study (CS)	15	15	15	60	--	--	75
DSC Practical	SMD DSCP-201	Lab 5/ Based on Theory Paper SMD DSC-201 (QADI)	--	--	--	--	05	20	25
	SMD DSCP-202	Lab 6/ Based on Theory Paper SMD DSC-202 (ACM & MP)	--	--	--	--	05	20	25
	SMD DSCP-203	Lab 7/ Based on Theory Paper SMD DSC-203 (SM&WDP)	--	--	--	--	05	20	25
DSCE Practical	SMD DSCEP-201	Elective Lab8 /Based on Elective Paper SMD DSE-201 (AANB)	--	--	--	--	05	20	25

M.Sc. DAIRY SCIENCE- 1ST YEAR

(Semester - I)

Theory Paper SMD DSC-101- : MARKET MILK PROCESS TECHNOLOGY

Periods/weeks-4 Credits :4

Objective :

- To study the scope of milk and its processing.
- To study the quality control aspect of market milk.
- To Study the special milk processing.

Unit 1 :

- Present status related to milk production, processing by organized Unorganized and private sector, Milk utilization pattern scope for export of market milk, Seasonal and regional variation
- Technology mission on dairy development in India and abroad in relation to past present and future- i.e. operation flood programme, MMPO etc.
- Procurement pattern of milk- organized, unorganized and private sector

Unit II :

- Pricing policy for procurement of milk
- Role of bulk coolers in extension of shelf life and reduction of losses of raw milk
- Alternative practices for preservation of raw milk i.e. LP system, zero-energy chamber
- Quality assessment of milk- Chemical and microbial standards

Unit III :

- Quality control measures for market milk: milk distribution systems, HACCP etc.
- Processing of liquid milk: cooling, separation, standardization, homogenization, pasteurization and alternative processes like UHT, sterilization, bactofugation, packaging and cold storage
- Disposal pattern of market milk in organized and unorganized sector

Unit IV :

- Special milks: Processes, Standards, Soya milk, Groundnut milk
- Shelf life- Flavour, tonned, low fat, fortified milk etc.
- Problems of unsold and returned milk- Definition, courses consequences etc.
- Utilization of unsold and returned milk: neutralization, reprocessing, product manufacturing, quality check

Reference Books :

1. Quality Assessment of milk and milk products-D.K.Thompkison

2. Sukumar De (2006) Outlines of Dairy Technology. Oxford Univ. Press, New Delhi.
3. Henderson, J.L. (1971) Fluid milk industry. The AV Publ. Co. Inc. Westport Connecticut.
4. Robinson, R.K. (1986) Modern Dairy Technology Vol. l. Elsevier Applied Science, London.
5. Harper W.J. and Hall C.W. (1981) Dairy Technology and Engineering.
6. Aneja R.P., Mathur, B.N; Chandan R.C. and Banerjce A.K. (2002) Technology of Indian Milk Product.
7. The market milk industry – Chester Linwood Roadhouse
8. Quality management in dairy industry – SMC College Anand

Theory Paper- SMD DSC-102 – DAIRY CHEMISTRY

Periods/weeks-4 Credits : 04

Objectives :

- 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.

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. A1 and A2 Milk

Unit - II : Chemistry of Milk proteins :

- Nomenclature.
- Types of Proteins.
- 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 :

- Definition, Composition and classification of milk lipids.
- Significance, Physical properties of milk Lipids.
- 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.

Unit – IV Chemistry of milk carbohydrates:

- Definition, Classification of carbohydrates
- Chemical Structure and form of lactose
- Properties of lactose, State in milk
- Significance of lactose in fermented milk and infant food.
- Lactose intolerance, Uses of Lactose.

Reference Books

1. Eeckles.CH.Combs, W.B. and Macy. H (1955), Milk and Milk products, Tata McGraw Hill Publishing Co.Pvt.Ltd, New Delhi.
2. Mathur MP, Roy DD and Dinkar P, 1999. Textbook of Dairy Chemistry. ICAR.
3. Sukumar De1980, Outlines of Dairy Technology, Oxford University Press, New Delhi.
4. Walstra, p.and Jenness, R. (1984) Dairy Chemistry and Physics. Wiley- Inter Sci. Publ., John Wiley and Sons, USA.
5. Webb, B.H., Johnson, A.H., and Alford, J.A. (Eds) 2008. Fundamentals of Dairy Chemistry, CBB Publishers and Distributors, New Delhi.
6. Wong N.P, Jenness. R. Keeney.M. Marth E.H 1998, Fundamentals of Dairy Chemistry, CBB Publishers and Distributors, New Delhi.
7. Wong, N.P; Jenness, R;Keeny, M.and Elemer, H.M. 1998 Fundamentals of Dairy chemistry 3rd end Van Nostrand Rcinhold co. New York, USA
8. Walstra, P and Jenness, R; 1984 Dairy chemistry land physics. John wilay and sons, New York,USA
9. Fox, P.F; (1982) Development in Dairy Chemistry-2 Lipids Applied Science Publisher London and New York.
10. Fox, P.F; and Mewamy PLH; 1997 Dairy chemistry & Biochemistry Applied science publication, London.
11. H.A. Mc kenzie; 1971 Milk Proleins Vol. I &II, Academic press New York.
12. Dairy Chemistry - M.M. Rai.
13. Principals of Dairy Chemistry - Jeneess & Patton
14. A Text book of Dairy Chemistry - N.C. Ganguly
15. Fundamentals of Dairy Chemistry - Web & Jonson
16. Dairy Chemistry - Fox

Theory Paper-SMD DSC -103

Technology Of Indigenous and Value Added Dairy Products

Periods/week-4 Credits : 04

Unit – I Technology of indigenous dairy products

- An introduction to indigenous dairy products.
- Present status of traditional dairy products, globalization of traditional dairy products, plans and policies of government and developmental agencies
- 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, lodine Value), defects and storage

Unit – II

- Khoa : Classification and types, standards, methods of manufacture and preservation, factors, affecting yield of khoa
- Mechanization in manufacture of khoa.
- Cost of production of khoa.
- Process schedule of heat-desiccated, coagulated and fermented traditional dairy products, process improvement of milk sweets.

Unit – III

- New products based on fruits, vegetables and cereals, application of microwave heating for industrial production of traditional dairy products.
- Kheer and pysam : product description methods of manufacture, innovations, in manufacturing, packaging process, interaction between milk and cereal constituents, rheological changes during manufacture and storage.

Unit – IV

- In can sterilization of kheer.
- Cost of manufacture and storage of indigenous milk products.
- Factors affecting of production.
- Process improvement of traditional milk products.

Reference Books

1. Dairy Processing - James Warner
2. Indigenous milk products - ICAR pub
3. Hand book of Dairy Science - K.C. Mahanta
4. Dictionary of Dairying - Davis & Leonard Hill
5. Milk and Milk Products Technology -Mohd.Raziuddin and Ashok S.Hembade

Theory Paper – SMD DSCE-101
Advances in Livestock Production and Management
Periods/Week-4 Credits : 03

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.
- Smart Dairy Farming

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.

Unit - III : Sustainable livestock production.

- 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.

Unit –IV : Animal Management

- 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 Jagdish Prasad.

Curriculum Details:

SMDDSCRM-101: ***Research Methodology -03 CREDITS***

Module No.	Unit No.	Topic	No. of hours required to cover the contents
1. 0		**Research Methodology**	**10 Hours**
	1.1	Meaning of research, Objectives of research, Types of research,	
	1.2	Research approaches, Significance of research, Research methods versus methodology, Research and scientific methods,	
	1.3	Research processes, Criteria for good research	
	1.4	Research problem, Selecting the problem, Necessity of defining the problem, Techniques involved in defining a problem	
2.0		**Research Design and Sample Surveys**	**12 Hours**
	2.1	Meaning and need for research design, features of a good design.	
	2.2	Important concepts relating to research design: Dependent and independent variables, Extraneous variables, Control, Research hypothesis, Experimental and non-experimental hypothesis – Testing research, Experimental and control group	
	2.3	Different research designs: Research design in case of exploratory research studies, Research design in case of hypothesis- testing research studies, basic principles of experimental designs, Important Experimental Designs	
	2.4	Sampling Design, steps in sample design, criteria of selecting a sampling procedure, characteristics of a good sample design, different types of sample design	
3.0		**Data Collection and Data Processing**	**12 Hours**
	3.1	Measurements in Research, Measurement Scales, Sources of errors in measurement	
	3.2	Collection of primary data: Observation Method, Interview Method, through questionnaires, through schedules, difference between questionnaire and schedule	
	3.3	Collection of secondary data, Selection of appropriate methods for data collection, Case study method	
	3.4	Data processing, processing operations: editing, coding, classification, tabulation, graphical representation, types of analysis, Statistics in research, Dispersion and Asymmetry, Measures of Relationship, Regression Analysis	
4.0		**Testing of Hypothesis and Chi-Square Test**	**11 Hours**
	4.1	Basic Concepts Concerning Testing of Hypotheses, Procedure and Flow diagram for Hypothesis Testing, Measuring the Power of a Hypothesis Test, Tests of Hypotheses , Hypothesis Testing of Correlation Coefficients and Limitations of the Tests of Hypotheses	
	4.2	Chi-Square Test: Chi-Square Test for Comparing Variance, Chi-square as a Non-parametric Test, Conditions for the Application of Chi-Square Test, Steps Involved in Applying Chi-square Test, Important Characteristics of Chi-Square Test and caution in using Chi-Square test. Relationship between Spearman's r's and Kendall's, Characteristics of	

		Distribution-free or Non-parametric Tests	
	4.3	Analysis of Variance (ANOVA), Analysis of Co-Variance (ANOCOVA), Distribution-free Tests, its importance	
	4.4	Multivariate Analysis Techniques, Characteristics and Applications, Classification of Multivariate Techniques, Variables in Multivariate Analysis, Important Multivariate Techniques.	
		Total	**30 Hours**

Text Books:

1. **C. R. Kothari,** ***Quantitative Technique,*** New Delhi, Vikas Publication House

Reference Books:

1. **Michael Alley**, ***The Craft of Scientific Writing (3rd Edition)***, Springer, New York, 1996
2. **Philip Reubens** (General editor), ***Science and Technical Writing – A Manual of Style (2nd Edition)***, Routledge, New York, 2001.

Course Structure:

SMDDSCRM-105: ***Research Methodology***

Course Code (2)	**Course Name (3)**	**Theory**				**Practical**		**Total [Col (6+7) / Col (8+9)] (10)**
		CA						
		Test I (4)	**Test II (5)**	**Avg (T1+T2)/ 2 (6)**	**ESA (7)**	**CA (8)**	**ESA (9)**	
SMDDSCRM-105	Research Methodology	15	15	15	60	--	--	75

Teaching Scheme

Course Code	**Course Name (Paper Title)**	**Teaching Scheme (Hrs.)**		**Credits Assigned**		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
SMDDSCRM-105	Research Methodology	03	-- 17	03	--	03

Laboratory Course Work-1

SMD DSCP-101 Practical (based on theory paper SMD DSC-101)

Credits: 01

Sr. No.	Title of Practical	Credit
1	To study receiving of milk and platform tests	01
2	To study Sampling techniques of milk	
3	To study straining, filtration and clarification of milk	
4	To study Chilling of milk at dairy plant	
5	To study Working of plate pasteurizer synchronized to homogenizer	
6	To study Cleaning and sanitization of dairy equipments at plant	
7	To study Determination of milk fat and SNF	
8	To study Determination of Acidity and PH of milk samples	
9	Visit to Dairy plant	

Laboratory Course Work-2

SMD DSCP-102 Practical (based on theory paper SMD DSC-102)

Credits: 01

Sr. No.	Title of Practical	Credits
1	To study chemical tests of milk - Cob, alcohol test and sp. gravity	01
2	To study determination of boiling and freezing point of milks	
3	To study determination of fat from selected dairy products	
4	To study determination of viscosity of milk samples	
5	To study determination of electrical conductivity of milk samples	
6	To study determination of refractive index of milk samples	
7	To study determination of protein by Kjeldhal method of milk samples	
8	To study determination of T.S. and SNF by lactometer and gravity method of milk samples	
9	Visit to Dairy plant	

Laboratory Course Work-3

SMD DSCP-103 Practical (based on theory paper SMD DSC-103)

Credits: 01

Sr. No.	Title of Practical	Credit
1	To study Khoa manufacturing by mechanized method	01
2	To study preparation of peda and gulabjamun from Khoa	
3	To study the preparation of Dahi, Chakka, Shrikhand and Lassi.	
4	To study the preparation of Khir, Pysam, Rasmalai	
5	To study the preparation of Deshi butter	
6	To study the preparation of Kalakand, Chhana podo, and Rosogolla	
7	To study the ghee preparation (Traditional and Advanced)	
8	To study the preparation of dairy by products- skim milk- casein, butter milk, Lassi, Limsi, Ghee residues	
9	Visit to Dairy plant	

Laboratory Course Work-4

SMD DSCEP-101 Practical (based on theory paper SMD DSCE-101)

Credits: 01

Sr. No.	Title of Practical	Credits
1	To study the conventional and loose housing system	01
2	To study the maintenance of sanitary and hygienic conditions at farms	
3	To study the collection of feeds and fodders, sampling techniques	
4	To study Feed processing	
5	To study preparation of feed mixtures	
6	To study computation of ration and types of ration	
7	To study the detection of aflatoxins in animal feeds	
8	To study the storage of feeds and fodders	
9	Visit to feed processing plant	

(Semester - II)

THEORY PAPER-SMD DSC - 201
Title : Quality Assurance in Dairy Industry.

periods / week-4 Credits : 04

Objectives :

- To impart the knowledge regarding importance of quality ofmilk.
- 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.

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.
- Preparation of laboratory for quality control in dairy industry.
- Precautions while working in the laboratory

Unit - II

- 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.

Unit-IV

- 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 .SMD DSC-202
Adultrants and Contaminants in Milk and Milk Products

Credits : 04

Periods / week-4

Objectives

- To understand the fundamentals of food quality and control procedures.
- To provide hands on training about adulteration and detection methods.
- This course provides knowledge on various adulterants that added to milk and milk products.
- It provides knowledge to students on various tests to detect adulterants.

Unit I

- Adulteration and contaminants: Definition, classification of adulterants, List of foods commonly adulterated, harmful effects of adulterants and contaminants.
- Food laws – adulteration acts. Adulteration of milk Products:Vanaspati – animal body fats – vegetable oils in fat rich products– detecting methods - health effects.
- Effects and health impacts of artificial/synthetic colour and flavours in milk and milk products.

Unit II

- Quality testing of market milk: use of bio protective factors for preservation of raw milk: effects on physiochemical, microbial and nutritional properties of organic milk.
- Status of preservation of raw milk.

Unit III

- Adulteration of carbohydrates in milk: starch, sugar, glucose and Dextrin/Maltodextrin – detecting methods - health effects.
- Adulteration of Fertilizers and salts in milk: urea, pond water, ammonium compound and common salt – detecting methods - health effects. Detergents in milk.

Unit IV

- Adulteration of neutralizer and preservative in milk: sodium hydroxide, sodium carbonate - sodium bicarbonate - formaldehyde - hydrogen peroxide – MRL- Detecting methods - health effects.
- Permitted preservatives and its limits.

Reference Books

1. Early, R. (1995). Guide to Quality Management Systems for the Food Industry, Blackie, Academic and Professional, London
2. Farrington and Woll. 2010. Testing milk and its products, Axis Books Publ, Jodhpur.
3. Gould, W.A. and Gould, R.W. 1988. Total Quality Assurance for the Food Industries, CTI Publications Inc, Baltimore
4. Ramakant Sharma 2006, Production, processing and quality of milk products International book distributing Co, Lucknow.
5. SandeepTomar. 2013, Dairy products research and analysis, Oxford book company, Jaipur.
6. Srilakshmi, B. 2005. Food Science, New Age International (P) Ltd., Publishers, New Delhi.

Theory Paper SMD DSC-203
Special Milks and Western Dairy Products

Periods/week-4 Credits : 04

Unit – I Condensed and evaporated milks :

- 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 :

- 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- 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.

Unit – IV- 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.

Theory Paper SMD DSCE-201
Advances in Animal Nutrition and Breeding.

Periods/Week-4 Credits : 03

Unit - I : Animal feeds and feeding.

- Animal feed technology : scope and constraints.
- Nutrition of Lactating cows, Nutrition of Dry Cows.
- Feedings strategies to enhance animal productivity, New trends in feeding dairy animals- Hydrophonix, Azola etc.
- Nutrition of replacement heifers, Nutrition of bulls.
- Feeding and Managing Dairy Cattle.
- Feeding standards for different categories of livestock.

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.

- Methods of Animal Breeding
- Breeding strategies and programs for cattle & buffaloes.
- Study of bio-techniques in animal reproduction.
- Semen collection and A.I.,

Unit-IV: Modern Techniques in Animal Reproduction

- 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 Books

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

SMDDSCOJT/Field Project /Case Study 201

Credits-03

Laboratory Course Work-5

SMD DSCP-201 Practical (based on theory paper SMD DSC-201)

Credits: 01

Sr. No.	Title of Practical	Credit
1	To study Prerequisites of quality control section	
2	To study Q.C. tests at milk collection centre	01
3	To study Microscopic Count, MBR, Resazurin test	
4	To study CIP of milk processing plant	
5	To study Standardization of milk using Pearson Square method	
6	To study Neutralization of unsold & returned acidic milk	
7	To study different instruments / equipments used in quality control laboratory	
8	To study various instrumental methods of analysis of milk and milk products	
9	Visit to Dairy plant	

Laboratory Course Work-6

SMD DSCP-202 Practical (based on theory paper SMD DSC-202)

Credits: 01

Sr. No.	Title of Practical	Credits
1	To study determination of preservatives from milk and milk products	01
2	To study preparation of acid casein.	
3	To study detection of adulterants and preservatives in milk	
4	To study manufacture of lactose.	
5	To study determination of adulterants from dairy products	
6	To study chemical analysis of butter milk.	
7	To study preparation of formula foods	
8	To study various metals used in dairy industry	
9	Visit to Dairy plant	

Laboratory Course Work-7

SMD DSCP-203 Practical (based on theory paper SMD DSC-203)

Credits: 01

Sr. No.	Title of Practical	Credit
1	To study preparation of special milks- flavoured milk, reconstituted andrecombined milk	01
2	To study cream separator and grading of cream	
3	To study preparation of soya milk	
4	To study preparation of Groundnut milk	
5	To study determination of TS and moisture % in milk powders	
6	To study quality determination of milk powder by solubility index	
7	To study calculation of mix, preparation of mix ageing, freezing packaging of ice cream	
8	To study butter analysis for fat and moisture	
9	Visit to Dairy plant	

Laboratory Course Work-8

SMD DSCEP-201 Practical (based on theory paper SMD DSCE-201)

Credits: 01

Sr. No.	Title of Practical	Credits
1		01
2	To study ultra structure of mammary gland	
3	To study the clean milk production	
4	To study detection and control of mastitis disease	
5	To study collection and evaluation of semen	
6	To study pregnancy diagnosis in dairy animals	
7	To study breeding efficiency of dairy animals	
8	To study cleaning ,disinfection, cattle dips, foot, dips at farm	
9	Visit to AI centre/cattle breeding farm/ETT laboratory	

Reference Books

1. Outlines 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. Milk and Milk Products Technology -Mohd.Raziuddin and Ashok S.Hembade
22. Market Milk Industry - C.L. Rhodhouse & J.L. Henderson
23. Comprehensive Dairy Microbiology - Yadav, Batish and Grover
24. A Text Book of Animal Husbandry - G.C.Banerjee
25. The Fluid Milk Industry - Henderson
26. ISI Specifications - BIS Publication
27. Technology of Dairy plant operations - K. P. S. Sangwan.
28. Technology of milk processing - C.P. Anantakrishnan, A. khan and
29. Milk and It's properties - S.M. Srivastava
30. Chemical & Microbiological Analysis of milk & milk projects. - Ramakant Sharma.

DAIRY SCIENCE

List of Refereed, Peer reviewed and Indexed Journals with ISSN No

01	Journal of Food Science of Technology	:	ISSN 0022-115
02	Asian Journal of Dairy & Food Research	:	ISSN 09760563
03	The biosphere	:	ISSN 22517677
04	Journal of Animal production Advances	:	ISSN2251-7219
05	Journal of Animal Science Advance	:	ISSN1811-9751
06	International Journal of Dairy Science	:	ISSN1557-4571
07	American Journal of food Technology	:	ISSN2141-2448
08	International Journal of Livestock production	:	ISSN1996-0794
09	African Journal of food science	:	ISSN 09715436
10	Indian Journal of Dairy and Bioscience	:	ISSN 22517685
11	Journal of Veterinary Advances	:	ISSN 09788988
12	Veterinary would (International Journal)	:	ISSN0972-8988
13	Journal of Dairy Science	:	ISSN0022-0302
14	Karnataka Journal of Agricultural Sciences	:	ISSN 13006045
15	American, European Journal Agricultural & Environmental Science	:	ISSN 18186769
16	New Zealand Journal of Dairy Science & Technology	:	ISSN 00288268
17	International Journal of Dairy Technology	:	ISSN 14710307
18	Journal of food science	:	ISSN 17503841
19	Pakistan Journal of Nutrition.	:	ISSN 16805194
20	International Journal of Food science and Technology	:	ISSN 13652621
21	Food science and Biotechnology	:	ISSN 20826456
22	Food Science and Nutrition	:	ISSN 248-7177
23	Emerald Nutrition and food science	:	ISSN 00346659
24	Dairy Science and Technology	:	ISSN 19585586
25	Italian journal of Animal Science	:	ISSN 15944077
26	Japanese journal and veterinary research	:	ISSN 00471917
27	Indian veterinary Journal ISSN001964799	:	
28	Indian Journal of Animal Nutrition	:	ISSN0970-3209
29	Patron	:	ISSN 09762310
30	International Journal of Agriculture innovations and Research	:	ISSN2319-1473
31	Indian Dairyman	:	ISSN0019-4603
32	Indian Journal of Dairy Science	:	ISSN0019-5146
33	Animal Nutrition and Feed Technology	:	ISSN0972-2963
34	Asian Journal of Microbiology, Biotechnology	:	ISSN0972-3005
35	National Journal of life Sciences	:	ISSN0972-995X

36	Asian Academic Research Journal of multidisciplinary	:	ISSN2319-2801
37	periodic Research	:	ISSN2231-0045
38	Journal of International Research for multidisciplinary (Impact Factor : 1.393)	:	ISSN2320-5083
39	Golden Research Thoughts	:	ISSN2231-5063
40	Indian Streams research Journal	:	ISSN2230-7850
41	Asian Resonance	:	ISSN0976-8602
42	Review of Research Journal 894X	:	ISSN2249-

Dr. P. T. Gangasagare Chairman
(BOS in Dairy Science)