Bachelor of Vocational Programme

in

Dairy Production and Technology

SYLLABUS

(With effect from July 2021)

The Gandhigram Rural Institute

(Deemed to be University)

Gandhigram, Dindigul Dist – 624 302.

Tamil Nadu.

B.Voc. Dairy Production and Technology

Syllabus Outline - I Year

Course code	Category	Title of Course	Credits	NSQF	Job role
I Semester					
21ENGV0101	GEC	Foundational English-I	3	**4**	**Milk Procurement Assistant**
21DPTV0101	GEC	Dairy Development Plans	4		
21DPTV0102	GEC	Milk Hygiene & Public Health	4		
21YOGU0001	GEC	Yoga	1		
		Total	**12**		
21DPTV0103	SDC	Milk Procurement	4		
21DPTV0104	SDC	Dairy Cattle Production	4		
21DPTV0105	SDC	Practical I - Dairy Cattle Production	4		
21DPTV0106	SDC	Experiential Learning - Dairy Farming Practices	6		
		Total	**18**		
		Grant total	**30**		
II Semester				**NSQF**	**Job role**
21ENGV0202	GEC	Foundational English-II	3	**5**	**Chilling Plant Technician**
21DPTV0207	GEC	Rural Resource Appraisal & Case study	3		
21DPTV0208	GEC	Adulterants and contaminants in milk	2		
21DPTV0209	GEC	General Microbiology	3		
		Total	**11**		
21DPTV0210	SDC	Dairy Engineering-I (Refrigeration and Chilling Equipment)	3		
21DPTV0211	SDC	Dairy Chemistry	2		
21DPTV0212	SDC	Dairy Microbiology	2		
21DPTV0213	SDC	Practical II - Dairy Chemistry	3		
21DPTV0214	SDC	Practical III - Dairy Microbiology	3		
21DPTV0215	SDC	Inplant training – Chilling centre	6		
		Total	**19**		
		Grant total	**30**		

B.Voc. Dairy Production and Technology

Syllabus Outline - II Year

Course code	Category	Title of Course	Credits	NSQF	Job role
		III Semester			
21DPTV0316	GEC	Environmental Studies and Disaster Management	4	**6**	**Milk Processing Plant Supervisor and Quality Controller**
21NSSU0001/ 21	GEC	NSS / Santhi Sena	1		
21SPOU0001/ 21FATU001	GEC	Sports and Games/ Fine arts	1		
21CSAV03A2	GEC	Web Designing	4		
21DPTV0317	GEC	General Laboratory Practices	2		
		Total	**12**		
21DPTV0318	SDC	Dairy Engineering -II (Boiler & Operation and maintenance of dairy equipments)	3		
21DPTV0319	SDC	Dairy Technology - I (Market milk)	3		
21DPTV0320	SDC	Milk Processing and Preservation	3		
21DPTV0321	SDC	Practical IV - Market milk	3		
21DPTV0322	SDC	Inplant Training -Milk processing	6		
		Total	**18**		
		Grant Total	**30**		
		IV Semester			
21DPTV0423	GEC	IT Application in Dairy industry	4		
21DPTV0424	GEC	Occupational Health and Safety in Dairy Industry	3		
21ENAV0001	GEC	Energy Auditing	1		
21APRU0005	GEC	Introduction to Statistics	2		
21GTPU0001	GEC	Gandhi's Life, Thought & Works	2		
		Total	**12**		
21DPTV0425	SDC	Dairy Plant Design and Layout	3		
21DPTV0426	SDC	Dairy Plant Management	3		
21DPTV0427	SDC	Food Safety and Quality Standards	3		
21DPTV0428	SDC	Practical V - Dairy Plant Management	3		
21DPTV0429	SDC	In plant training - Quality Control	6		
		Total	**18**		
		Grant total	**30**		

B.Voc. Dairy Production and Technology

Syllabus Outline - III Year

Course code	Category	Title of Course	Credits	NSQF	Job Role
V Semester				**7**	**Dairy Production Manager and Entrepreneur**
21DPTV0530	GEC	Dairy Economics, Marketing and Entrepreneurial Skills	3		
21DPTV0531	GEC	Waste Disposal and Effluent Treatment	3		
21DPTV0532	GEC	Packaging and Judging of Milk Products	3		
		Total	**9**		
21DPTV0533	SDC	Dairy Technology-II (Fat and protein Rich dairy products)	3		
21DPTV0534	SDC	Dairy Technology-III (Traditional dairy products)	3		
21DPTV0535	SDC	Dairy Technology-IV (Cultured, frozen and dried milk products)	3		
21DPTV0536	SDC	Practical VI - Product Development I	6		
21DPTV0537	SDC	Practical VII - Product Development II	6		
		Total	**21**		
		Grant total	**30**		
VI Semester					
21DPTV0638	GEC	Dairy Novelties and Modeling	5		
		Total	**5**		
21DPTV0639	SDC	Inplant training -Overall Dairy Industry	25		
		Total	**25**		
		Grant total	**30**		

Distribution of Contact hours in a Semester

Semester	General Education Component (GEC) (Hours/ Week)	Skill Development Component (SDC) (Hours/ Week)	TOTAL Hours/ Week
I	12	18	30
II	11	19	30
III	12	18	30
IV	12	18	30
V	9	21	30
VI	5	25	30
TOTAL	61	119	180

Scheme of Evaluation

Scheme of Evaluation for I Semester

Course code	Category	Title of Course	Credits	Marks		
				Mid Sem	End Sem	Total
21ENGU01F1	GEC	Foundational English -I	3	40	60	100
21DPTV0101	GEC	Dairy Development Plans	4	40	60	100
21DPTV0102	GEC	Milk Hygiene & Public Health	4	40	60	100
21YOGU0001	GEC	Yoga	1	50	-	50
		Total	**12**	**170**	**180**	**350**
21DPTV0103	SDC	Milk Procurement	4	40	60	100
21DPTV0104	SDC	Dairy Cattle Production	4	40	60	100
21DPTV0105	SDC	Practical I - Dairy Cattle Production	4	60	40	100
21DPTV0106	SDC	Experiential Learning - Dairy Farming Practices	6	100	-	100
		Total	**18**	**240**	**160**	**400**
		Grant total	**30**	**410**	**340**	**750**

Scheme of Evaluation for II Semester

Course code	Category	Title of Course	Credits	Marks		
				Mid Sem	End Sem	Total
21ENGU01F2	GEC	Foundational English-II	3	40	60	100
21DPTV0207	GEC	Rural Resource Appraisal & Case study	3	100	-	100
21DPTV0208	GEC	Adulterants and contaminants in milk	2	20	30	50
21DPTV0209	GEC	General Microbiology	3	40	60	100
		Total	**11**	**200**	**150**	**350**
21DPTV0210	SDC	Dairy Engineering-I (Refrigeration and Chilling Equipment)	3	40	60	100
21DPTV0211	SDC	Dairy Chemistry	2	20	30	50
21DPTV0212	SDC	Dairy Microbiology	2	20	30	50
21DPTV0213	SDC	Practical II - Dairy Chemistry	3	60	40	100
21DPTV0214	SDC	Practical III - Dairy Microbiology	3	60	40	100
21DPTV0215	SDC	Inplant training – Chilling centre	6	100	-	100
		Total	**19**	**300**	**200**	**500**
		Grant total	**30**	**500**	**350**	**850**

Scheme of Evaluation for III Semester

Course code	Category	Title of Course	Credits	Marks		
				Mid Sem	End Sem	Total
21DPTV0316	GEC	Environmental Studies and Disaster Management	4	40	60	100
21NSSU0001	GEC	NSS / Santhi Sena	1	50	-	50
21SPOU0001	GEC	Sports and Games/ Fine arts	1	50	-	50
21CSAV03A2	GEC	Web Designing	4	40	60	100
21DPTV0317	GEC	General Laboratory Practices	2	50	-	50
		Total	**12**	**230**	**120**	**350**
21DPTV0318	SDC	Dairy Engineering -II (Boiler & Operation and maintenance of dairy equipments)	3	40	60	100
21DPTV0319	SDC	Dairy Technology - I (Market milk)	3	40	60	100
21DPTV0320	SDC	Milk Processing and Preservation	3	40	60	100
21DPTV0321	SDC	Practical IV - Market milk	3	60	40	100
21DPTV0322	SDC	Inplant Training -Milk processing	6	100	-	100
		Total	**18**	**280**	**220**	**500**
		Grant Total	**30**	**510**	**340**	**850**

Scheme of Evaluation for IV Semester

Course code	Category	Title of Course	Credits	Marks		
				Mid Sem	End Sem	Total
21DPTV0423	GEC	IT Application in Dairy industry	4	40	60	100
21DPTV0424	GEC	Occupational Health and Safety in Dairy Industry	3	40	60	100
21ENAV0001	GEC	Energy Auditing	1	50	-	50
21APRU0005	GEC	Introduction to Statistics	2	20	30	50
21GTPU0001	GEC	Gandhi's Life, Thought & Works	2	50	-	50
		Total	**12**	**200**	**150**	**350**
21DPTV0425	SDC	Dairy Plant Design and Layout	3	40	60	100
21DPTV0426	SDC	Dairy Plant Management	3	40	60	100
21DPTV0427	SDC	Food Safety and Quality Standards	3	40	60	100
21DPTV0428	SDC	Practical V - Dairy Plant Management	3	60	40	100
21DPTV0429	SDC	In plant training - Quality Control	6	100	-	100
		Total	**18**	**280**	**220**	**500**
		Grant total	**30**	**480**	**370**	**850**

Scheme of Evaluation for V Semester

Course code	Category	Title of Course	Credits	Marks		
				Mid Sem	End Sem	Total
21DPTV0530	GEC	Dairy Economics, Marketing and Entrepreneurial Skills	3	40	60	100
21DPTV0531	GEC	Waste Disposal and Effluent Treatment	3	40	60	100
21DPTV0532	GEC	Packaging and Judging of Milk Products	3	40	60	100
		Total	**9**	**120**	**180**	**300**
21DPTV0533	SDC	Dairy Technology-II (Fat and protein Rich dairy products)	3	40	60	100
21DPTV0534	SDC	Dairy Technology-III (Traditional dairy products)	3	40	60	100
21DPTV0535	SDC	Dairy Technology-IV (Cultured, frozen and dried milk products)	3	40	60	100
21DPTV0536	SDC	Practical VI - Product Development I	6	60	40	100
21DPTV0537	SDC	Practical VII - Product Development II	6	60	40	100
Total			**21**	**240**	**260**	**500**
Grant total			**30**	**360**	**440**	**800**

Scheme of Evaluation for VI Semester

Course code	Category	Title of Course	Credits	Marks		
				Mid Sem	End Sem	Total
21DPTV0638	GEC	Dairy Novelties and Modeling	5	100	-	100
		Total	**5**	**100**	**-**	**100**
21DPTV0639	SDC	Inplant training -Overall Dairy Industry	25	200	-	200
		Total	**25**	**200**	**-**	**200**
		Grant total	**30**	**300**	**-**	**300**

Scheme of Evaluation - Abstract

Semester	General Education Component (GEC) (Marks)	Skill Development Component (SDC) (Marks)	TOTAL Marks
I	**350**	**400**	**750**
II	**350**	**500**	**850**
III	**350**	**500**	**850**
IV	**350**	**500**	**850**
V	**300**	**500**	**800**
VI	**100**	**200**	**300**
TOTAL	**1800**	**2600**	**4400**

SEMESTER - I

Semester I

21ENGV0101 FOUNDATIONAL ENGLISH -I (3 CREDITS)

OBJECTIVES

- To help the students understand the intricacies of english grammar for everyday use.
- To help them improve their essential language skills in English.

LEARNING OUTCOME

- Students know improve the English language skills with very limited abilities to use the language;
- Students focus on the language skills of the learners in a graded manner.

THEORY

Unit I : **Grammar:** Nouns and Pronouns, Adjectives and Determiners, Verbs and Tenses, Auxiliary Verbs

Unit II : **Listening:** Descriptions, Story Narrations, Short Speeches

Unit III : **Reading and Vocabulary:** Reading comprehension passages, Vocabulary building

Unit IV : **Speaking Skills:** Face to Face Conversation, Descriptions, Telephone Conversation

Unit V : **Writing Skills:** Paragraph writing, Note making, Short Narrative Essays

TEXTBOOKS

Foundational English I Textbook/Course Material - Prepared by the school.

REFERENCE BOOK

Sargeant and Howard. *Basic English Grammar Book 2*. Irvine: Saddleback, 2007. Print.

Semester I

21DPTV0101- DAIRY DEVELOPMENT PLANS (Credits 4)

Objectives

- To enlighten the students about the dairy development.
- To understand the organizational structure of dairy co-operatives at village, district and state levels.

Learning Outcomes

- Students learn about the role of dairying and status of milk production in India
- Students will acquire skill on dairy cooperative functions and management system
- Students will know about the government and institutional activities and schemes related to dairy development.

Unit I : Role of dairying in Indian economy and rural development. Dairying as source of additional income and employment. Advantages in dairying – Distinct features. Principle involved in successful dairying. Total milk production in country and state with reference to Global milk production – Per capita availability of milk – consumption pattern – annual rate of growth of milk production. Adopt New Technologies: Utilize advancements in technology for improved breeding - health management - milking efficiency.

Unit II : Dairy development programme implemented in India. Operation flood programme. Key village scheme - Intensive Cattle Development Programme (ICDP) - Intensive Dairy Development Programme (IDDP). Institution for dairy development: NDRI, NDDB, IDC,TCMPF, NLM, Rastriya Gokula mission, and Animal Husbandry Scheme Implemented in Tamil Nadu. Pradhan Mantri Krishi Sinchai Yojana (PMKSY) - Focuses on increasing the area under irrigation and improving water use efficiency, which indirectly benefits dairy farmers by ensuring better feed resources. Rural Infrastructure Development Fund (RIDF) - Provides financial support for building infrastructure such as milk processing plants, cold storage facilities, and transportation networks.

Unit III : Cooperative dairying – structure of dairy cooperatives, objectives and functions, primary milk cooperative societies, district milk producer's cooperative union, state level federations. ANAND pattern and perspectives.

Governments support cooperative dairying through policies, subsidies, and programs designed to promote cooperative structures, improve infrastructure, and provide financial assistance.

Unit IV : National Dairy Plans: NDPI – NPBB and DD – CCDO- Dairy development under various five year plans- Expenditure on Animal husbandry and Dairying during various plans – Important developments in Different five year plans. National Dairy Plan (NDP): The NDP is implemented in phases, focusing on increasing productivity through improved breed quality, feed, and veterinary care - emphasizes strengthening the dairy infrastructure - milk processing and marketing.

Unit V : Dairy problems; Resource inadequacy, Strategies and Policies: SWOT analysis of Indian dairy industry. Addressing these challenges requires a multifaceted approach, including technological innovation, improved management practices, supportive policies, and effective infrastructure development. By tackling these issues, the dairy industry can enhance its sustainability, efficiency, and overall impact.

References

Textbooks

1. Dairy India Year Book. 2007 & 2017. P.R. Gupta Publ., New Delhi.
2. Anantha Krishnan, C.P., (1991), Technology of milk processing, Sri Lakshmi Publications, Chennai -10.
3. Mudgal, V.D., Singhal, K.K. and Sharma, D.D. 1995. Dairy animal production.1st ed. International Book Distributing Co., Lucknow.
4. Sastry, N.S.R. and Thomas, C.K. 1996. Livestock Production Management. Kalyani Publ., New Delhi.

Reference books

1. Banerjee, G.C. 1998. A Textbook of Animal husbandry. Oxford and IBH Publ. Co. ltd., New Delhi.
2. Nataraj, B.S. 2007. Marketing of milk and milk products: opportunities for entrepreneurship. In: Souvenir, National workshop on Entrepreneurship Development in Dairy and Food Industry, NDRI, Karnal, December 2005.

3. Ramakant Sharma 2006 “Production, processing quality of milk products” International book distributing co.

Website

- http://ecoursesonline.iasri.res.in/course/
- https://agrimoon.com/book/

Semester I

21DPTV0102 – MILK HYGIENE AND PUBLIC HEALTH (Credits 4)

Objectives

- To provide knowledge in hygiene practices so as to improve health status of animal and to produce clean milk
- To discuss the importance of hygiene and sanitation of milk handling at different levels
- To explain public health administrative set up in Centre- State-District-Block- village levels.

Learning Outcome

- Students will attain knowledge on various sources of contamination.
- Students acquire knowledge on various hygiene practices to be carried out in farm.
- Students will learn on the process and importance of cleaning and sanitization.
- It provides information about the public organizations involved in hygiene practices.

Unit I **Dairy Hygiene:** Water Hygiene: Definition, water requirement - water quality and uses of water in Dairy farm. Air Hygiene: Definition, Quality of air - indoor and outside air to animal house. Animal hygiene, Milker hygiene and Utensils/equipment hygiene. Ventilation of animal house. Environmental pollution – causes and effects. Impacts of climate change and coping mechanism in livestock. Regular Testing: Conduct regular testing of milk for contaminants, such as bacteria, antibiotics, and residues.

Unit II **Dairy Farm Waste Management**: Waste from livestock production - solid waste

and liquid waste - Method of disposal. General principles of drainage system and traps. Construction of manure pit - Composting, vermin-composting, biogas production and value added manure management - Fly control methods. Manure and Waste Disposal: Properly manage and dispose of manure and other waste products to prevent environmental contamination and health risks.

Unit III **Cleaning and sanitation:** Sanitizers and Disinfectants: definition - types - ideal properties of sanitizer and disinfectants - principles of cleaning and sanitation - application to dairy farm premises and dairy plant. CIP: definition, applicable to dairy machineries. Hygienic handling: methods of cleaning dairy equipment. Record Keeping: Maintain accurate records of hygiene practices, equipment cleaning schedules, and test results to track compliance and identify areas for improvement.

Unit IV **Historical development of public health:** Changing concepts of public health. Various committees on health development in India. Public Health set up at State-District –block level - Village level - organization- functions. Public Health Laws: Definition – importance – Statutory laws - The Tamil Nadu Public Health Act. Epidemiology: The study of disease patterns, causes, and effects in populations. Preventive Medicine: Strategies and practices aimed at preventing disease and promoting health.

Unit V **Public health associated with milk:** Indian scenario of milk hygiene and public health. Heavy metal contamination in milk and milk products. Drugs, toxicity, allergy - limitation and precautions. Public Awareness Campaigns: Educating consumers about safe milk handling practices, such as proper refrigeration and avoiding raw milk consumption, is crucial for preventing foodborne illnesses.

References

Textbooks

1. Jagadish Prasad, 2002. Principles and practices of Dairy Farm Management, 3rd Ed. Kalyani Publishers, Ludhiana.
2. Harry S. Mustard.,(1960) An Introduction to Public Health, The Macmillan Co., New York.

3. V.K.Muthu., (2005) A Short Book of Public Health, JAPEE Brother Medical Pub.(P)Ltd New Delhi.
4. Singh, R.R.B., Sabikhi, L., Patil, G.R. and Sharma, N. 2003. Clean Milk Production – Strategies and Interventions. NDRI Publication No. 10/2003

Reference books

1. ICAR, 2013. Hand book of Animal Husbandry, 4thEd.ICAR Publication, Pusa, New Delhi.
2. Sastry, N.S.R., C.K.Thomas and R.A.Singh, 2015. Livestock Production Management, 4thEd.Kalyani Publishers, New Delhi.
3. Banerjee, G.C., 2006. Text book of Animal Husbandry 8thEd.Oxford and IBH Publishing Company Ltd., New Delhi.

Website

- http://ecoursesonline.iasri.res.in/course/index.php?categoryid=11
- https://agrimoon.com/book/

Semester I

21YOGU0001 YOGA (Credit 1)

Semester	**I**	**Course Code**	**21YOGU0001**
Course Title	**Yoga Education**		
No. of Credits	**0+1**	**No.of Contact hours per week**	**1**
New Course / Revised Course	**Revised Course**	**Percentage of Revision effected**	**20**
Category	**Non-credit course**		
Scope of the Course	**Value-Added Courses imparting transferable and life skills**		
Cognitive Levels addressed by the Course	**K-1 & K-2**		
Course Objectives	**The Course aims to** gain the practical knowledge about Yogic Practices		

Unit	**Content**	**No of Hours**
I	**History of Yoga** - Definition – Aims and Objectives - Yoga as an ideal system of physical culture - Difference between practice of Asanas and Physical Exercise.	**2**
II	**Schools of Yoga:** Patanjaliyoga – Astangayoga – Tantrayoga – Mantrayoga – Hathayoga – Layayoga - Rajayoga – Jnanayoga – Bhaktiyoga – Karmayoga – Loosening Exercises in yoga – Suryanamaskar.	**4**
III	**Asanas Practice:** Meditative Asanas: Sukhasana – Ardha Padmasana – Padmasana –Vajrasana – Standing Asanas: Tadasana –Trikonasana- Parivrtta Trikonasana – Vrikshasana –Sitting Asanas: Baddha konasana – Janusirasana – Paschimottanasana – Ustrasana – Vakrasana – Gomukhasana.	**3**
IV	**Asanas Practice:** Prone Asanas: Makarasana – Bhujangasana – Shalabhasana – Dhanurasana - Supine Asanas: Pavanamuktasana –	**3**

	Sethubandasana – Navasana –Savasana – Yoga and postural deformities - text neck.	
V	**Pranayama Practice:** Sectional Breathing - Nadisuddhi – Bhramari – Bhastrika - Kapalabhati – Introduction to Bandhas – Mudras –Dharana (Trataka) – Dhyana – Jalaneti -Importance of pranayama practice for Covid19.	**4**
References	**Text Books:** 1. Chandrasekaran K, (1999), Sound Health Through Yoga, Prem Kalyan Publications, Sedapatti. 2. Iyengar B.K.S, (2000), Light on Yoga, Harpine Collins Publication, New Delhi, 2000. 3. Nagarathnam H R. & Dr.H R Nagendra (2015) Promotion of positive health swami vivekanandha yoga prakashana, Banglore. 4. Swami Satyananda Saraswati, (2008): Asana Pranayama Mudra, Bandha (IV Revised Edition): Bihar School of Yoga, Munger, India.	
	References Books:	
	1. Chandara Shekar K., 2003, Yoga for Health, , Khel Sahitya Kendra, Theni. 2. Indira Devi, 2002, Yoga for You, , Jaico Publishing House, Chennai. 3. Maharishi Patanjali, 2003, Yoga for All, Sahni Publications. 4. Pandit.M.P.1987, Yoga for the Morden Man, Sterling Publishers Private Limited, New Delhi. 5. Swami Kuvalayananda, 1993, Asanas, Kaivalayadhama, Lonavla. 6. Vivekananda Kendra Prakashan, (2009), Yoga, Chennai. 7. Yoga for Health, 2003, Institute of Naturopathy & Yogic Sciences, Bangalore.	
	Web Resources: 1. https://kdham.com/ 2. http://www.biharyoga.net/	
Course Outcomes	Students should be able to 1. Understand concept of yoga. 2. Demonstrate the suryanamaskar and various asanas. 3. Perform meditation techniques. 4. Realize the benefits of mudras and bandhas **5.** Assess the difference between the asanas and physical exercises.	

Semester I

21DPTV0103 - MILK PROCUREMENT (Credits 4)

Objectives

- To discuss the concept and importance of milk procurement
- To provide knowledge on methods and techniques of milk procurement, milk transport and distribution.

Learning Outcome:

- Students will learn on various historical facts which are important for dairy development.
- Students get to know on various activities like collection, pricing, distribution and transportation of milk to chilling centers.

Unit I : **Introduction:** Status and importance of milk procurement in India and Tamilnadu. Milk procurement and pricing pattern in India. The milk procurement system in India and Tamil Nadu is vital for ensuring a stable supply of milk, supporting the livelihoods of millions of farmers, and contributing to the nutritional well-being of the population. Both regions have established robust

Unit II : **Milk production:** Principles of milk production- selection of milk shed area – milking practices - milk handling. **Milk Production**: India produces over 200 million metric tons of milk annually, with a diverse range of dairy products

Unit III : **Milk procurement:** Source of milk procurement – classification. Organization of rural milk procurement. Collection of milk – definition - classification- methods, milk collection centers and their functions. Cooperative Structure: The milk procurement system in India is largely organized through cooperative societies, which have been instrumental in the development of the dairy sector.

Unit IV : **Transportation of milk:** Modes of transport – earlier methods – recent developments – selection of mode of transportation of milk. Tankers and Bulk Milk Transport: Transported in bulk using insulated tankers that are designed to maintain the milk at a low temperature - tankers are equipped with cooling systems - to keep the milk at or below 4°C (39°F) during transit.

Unit V : **Distribution of milk:** Importance – raw milk distribution – attribution of pasteurized milk – bulk distribution – retail distribution of pasteurized milk – consideration for organizing and distribution. Real-Time Monitoring: Advanced technologies, such as GPS tracking and temperature monitoring systems, help manage the distribution process more effectively by providing real-time data on transport conditions.

References:

Text books:

1. Dairy India year book 2007 & 2017, A- 25 Priyadarshinivihar, Delhi 110092, India.
2. Ramasamy. D. 1999. Dairy technologist hand book, International book distributing Co. Luknow.
3. Robinson (1986), Modern Dairy Technology, Vol.I, Advances in Milk Processing, Chapman and Hall India, Madras.
4. Sukumar De (1980), Outlines of Dairy Technology, Oxford University Press, New Delhi
5. Walstra, P. Wouters, J.T.M. and Geurts, T.J. 2006. Dairy Science and Technology. CRC Press, New York.

Reference book

1. Jagadish Prasad (1992), Principles and Practices of Dairy Farm Management, Kalyani Publishers, Ludhiana.
2. W.E.peterson 2006 Dairy Science its principles of practice in production, management and processing – Vol II, Asiatic publishing house, New Delhi.
3. Ibraheem kutty, sheeba khamer (2004), milk production and processing, Daga Publishing house, NewDelhi.

Website

- http://ecoursesonline.iasri.res.in/course/
- https://agrimoon.com/book/

Semester I

21DPTV0104 - DAIRY CATTLE PRODUCTION (Credits 4)

Objective

- The Dairy Cattle Production course is designed to impart technical knowledge and skills required to successfully run a dairy farm enterprise by developing competencies concerning the selection and breeding of dairy cattle, management of animals of different physiological status, nutrition, health, housing and feeding.
- To provide hands-on experiences with the principles and practices essential in the production of clean milk for personal economic development in particular and community development in general.

Learning Outcome

1. Identify various breeds of cattle and buffalo by viewing photographs or live animals.
2. Identify the signs of estrus and right time for insemination
3. Know the correct amount and time frame for colostrum intake
4. Ability to prepare plans for housing of dairy cows

Units:

I. **Breeds:** Introduction – Advantages of dairying – role of dairying in Indian Economy – Livestock census – milk production and availability - Meaning of commonly used terms - Zoological classification of bovine - classification of breeds of cattle - Indigenous and exotic breeds: Red Sindhi – Sahiwal - Gir – Kangayam – Jersey - Holstein Friesian - Brown Swiss. Buffalo – Murrah – Surti - Nili-Ravi. Selection of dairy cattle – choice of breed. Other Notable Breeds : Pardus - Origin – Characteristics - Milk Production. Normande- Origin – Characteristics - Milk Production. Ayshire (British) - Origin – Characteristics - Milk Production.

II. **Cattle Breeding:** Male and female reproductive system - oestrous cycle - signs of heat -concept of breeding – Inbreeding – Out breeding – Crisscrossing - Triple crossing – Grading up - Breeding efficiency - Artificial Insemination - Advantages of AI over natural breeding-Semen collection-evaluation-Dilution of semen-Freezing technique- Thawing of frozen semen – Insemination - Advantages and disadvantages of frozen semen – Handling of LN_2 containers. Cattle breeding is a vital aspect of improving livestock production, health, and adaptability. By utilizing various

breeding methods and technologies, farmers and breeders can enhance the genetic quality of their herds, meet production goals, and address specific challenges. Effective cattle breeding requires careful planning, management, and ongoing evaluation to ensure optimal outcomes.

III. **Management of calf, heifer and pregnant animals:** Care of calf at birth – Muconium - Colostrum feeding - System of raising calves - Milk replacer - Calf starter - Common ailments and their control – Heifer management - Management of pregnant animals – signs pregnancy and diagnosis of pregnancy – feeding of pregnant cows – care of expectant cows - care at and after calving – Management of dry cows - abortion – retention of placenta. Managing calves, heifers, and pregnant cows requires a comprehensive approach that includes proper feeding, health care, housing, and breeding management.

IV. **Management of Lactating Animals**: Anatomy of Mammary gland and physiology of milk secretion - factors affecting milk yield and quality – General care of lactating animals - Strategies to improve fat and SNF content of milk - Production of clean milk and organic milk – preparation for milking – methods of milking. Cleaning and disinfection of dairy farm and milk room and record management. Milk fever - mastitis. Managing lactating animals requires a comprehensive approach that includes proper nutrition, milking practices, health care, reproductive management, and housing. By focusing on these aspects, dairy farmers can maximize milk production, ensure animal well-being, and maintain a productive and profitable dairy operation.

V. **Zootechny and Housing**: Handling and restraining of dairy cow – casting – putting nose ring and string – dehorning – castration – dentition and ageing – Identification of dairy cow – tattooing – branding – Selection of site for the farm buildings – planning and designing construction details – Foundation – wall, floor, roof, manger, drain – Types of animal housing – conventional barn – loose housing. Smart Housing Systems Automated Systems: Utilize automated feeding, watering, and climate control systems to enhance efficiency and animal welfare. Monitoring Technology: Implement sensors and monitoring systems to track environmental conditions, animal health, and productivity in real-time.

References

Text books

1. ICAR, 2013. Hand book of Animal Husbandry, 4th Ed. ICAR Publication, Pusa, New Delhi.
2. Banerjee, G.C., 2006. Text book of Animal Husbandry 8th Ed.Oxford and IBH Publishing Company Ltd., New Delhi.
3. Jagadish Prasad, 2002. Principles and practices of Dairy Farm Management, 3rd Ed. Kalyani Publishers, Ludhiana.

Reference book:

1. Sastry, N.S.R., C.K.Thomas and R.A.Singh, 2015. Livestock Production Management, 4th Ed.Kalyani Publishers, New Delhi.
2. Ranjhan, S.K., and N.N.Pathak, 2003. Text book on buffalo production, 4 Ed. Vikas Publishing House Pvt. Ltd., New Delhi

Website:

- TNAU agritech portal
- www.agrimoon.com

Semester I

21DPTV0105 - PRACTICAL - I (Credits 4)

(DAIRY CATTLE PRODUCTION)

1. Familiarizing with body parts of a cow
2. Identification of breeds of cattle and buffalo
3. Estimation of body weight by body measurement
4. Heat detection in cows and buffaloes
5. Demonstration of semen collection and evaluation
6. Demonstration of insemination
7. Restraining of dairy cattle
8. Ear tagging and tattooing
9. Dentition, ageing and dehorning
10. Casting and Castration
11. Preparation of plans for housing of dairy cattle
12. Hands on training in milking
13. Visit to a Dairy farm.
14. Preparation of project for starting a dairy farm

Semester I

21DPTV0106 – EXPERIENTIAL LEARNING I (Dairy Farming Practices) (Credits 6)

Objective

To provide practical exposure on managing a dairy farm

Learning Outcome

- Students will attain practical knowledge by performing assigned work.
- Students will learn to manage the cattle that infected with diseases and during pregnancies.
- Students will learn documentation at farm level
- Students will get to know about the fodder and management of fodder produced.
- Students will gain knowledge on marketing of farm milk.

Work Plan

Students have to undergo Experiential learning at GRI dairy farm and a private sector dairy farm. They have to study and gain skills on managing dairy farm. They have to gain knowledge on the following exercise at dairy farm. Also students are admitted to maintain and manage the farm activities, carry out collection of milk and sales of collected milk.

Cattle management

1. Recognize different cattle and buffalo breeds
2. Calculate feed and fodder requirement for different classes of animals
3. Vaccination of animals
4. First aid and treatment of basic health problem
5. Diagnose heat period
6. Artificial insemination techniques and pregnancy diagnosis
7. Assisting the animal during parturition
8. Removal of retained placements

Farm management

1. Maintenance of dairy equipment
2. Milk collections and transportation
3. Establishing dairy farm
4. Maintenance of stores for dairy farm and dairy plant
5. Maintaining of records and registers

6. Advertisement for dairy farm and dairy plant
7. Conducting farmers training
8. Techniques for improvement of milk production
9. Techniques in disposal of farm waste
10. Raising of calves, heifers
11. Disposal of dead animals
12. Transportation of semen.

Fodder production and management

1. Production of fodder crops
2. Planning and layout of dairy farms
3. Formulation of cattle feeds

Assessment

Students who underwent the experiential learning should submit a report based on the daily routine activities that performed by them at the farm with the details of date and timing. After the successful completion of experiential learning at farm the evaluation will be done on the basis of following criteria.

Evaluation of Experiential Learning Programme

S.No.	**Parameters**	**Max. Marks**
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business networking skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
	Total	**100**

SEMESTER - II

Semester II

21ENGV0202 FOUNDATIONAL ENGLISH - II (3 CREDITS)

OBJECTIVES

- To help the students understand the intricacies of english grammar for everyday use.
- To help them improve their essential language skills in English.

LEARNING OUTCOME

- Students know improve the English language skills with very limited abilities to use the language.
- Students focus on the language skills of the learners in a graded manner.

THEORY

Unit I : **Grammar:** Prepositions and Prepositional phrases, Conjunctions, Direct and Indirect speech, Sentences, Punctuation

Unit II : **Listening Skills :** Long Narratives, Recorded speeches, Movie clips

Unit III : **Reading and Vocabulary:** Reading comprehension passages, Vocabulary building

Unit IV : **Speaking Skills:** Narrations, Public speaking, Debate/Turn Coat

Unit V : **Writing Skills:** Precis Writing, Personal Letter Writing, General Essay Writing

TEXTBOOKS

Foundational English II Textbook/Course Material - Prepared by the school.

REFERENCE BOOK

Sargeant and Howard. *Basic English Grammar Book 2*. Irvine: Saddleback, 2007. Print.

Semester II

21DPTV0207 -RURAL RESOURCE APPRAISAL & CASE STUDY (Credits 3)

Objective

- To learn the real dairying situation at rural level
- To know the status of animal husbandry at village level
- To know the milk production details at village level

Learning Outcome

- Students will get expose to the current scenario of dairy in rural and urban area.
- Students will acquire knowledge about the health, maintenance and various milking practices carried out in farm.
- It provides practical knowledge to students by engaging themselves in field work.

Work Plan

The students should get exposed to field experience through Rural Resource Appraisal programme. Students will stay with farmers in a village and study the agro dairy practices carried out by the farmer. A separate record note book should be submitted by the students to record the socioeconomic status of farmers, dairy farming system, livestock production, cattle population, animal feeding methods, animal health awareness, milking practices, milk production, sale and economic details, clean milk production, milk consumption and value addition in the sample field selected by the students. Each student is expected to do an individual case study. The evaluation will be made purely on internal basis by the course teacher.

Tools used may be survey by questionnaire, interview schedule and PRA techniques.

Semester II

21DPTV0208 - ADULTERANTS AND CONTAMINANTS IN MILK (Credits 2)

Objectives

- To understand the fundamentals of food quality and control procedures.
- To provide hands on training about adulteration and detection methods.

Learning Outcomes

- This course provides knowledge on various adulterants that added to milk
- 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. Managing adulteration and contamination in dairy products - crucial for ensuring food safety- maintaining consumer trust- protecting public health - adherence to regulatory standards - implementation of good practices - ongoing monitoring and testing - producers can prevent and control these issues effectively. Education, transparency- vigilance - key to safeguarding the quality and safety of dairy 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 milk. Status of preservation of raw milk. Quality testing of market milk involves a comprehensive set of procedures designed to ensure that milk is safe, nutritious, and free from contaminants or adulterants. By implementing rigorous testing methods and adhering to regulatory standards, producers and processors can maintain high-quality milk that meets consumer expectations and ensures public health. Regular testing, along with proper handling and storage practices, is essential for maintaining milk quality and safety throughout its supply chain.

Unit III : **Carbohydrates adulterated in milk:** carbohydrate: starch, sugar, glucose and Dextrin/ Maltodextrin – detection methods - health effects. Carbohydrate adulteration in milk is a serious issue that can compromise the quality and

safety of dairy products. By employing various detection methods, adhering to regulatory standards, and implementing robust prevention measures, stakeholders can safeguard milk quality and ensure consumer safety. Regular testing, strict quality control, and consumer education are key components in addressing and preventing milk adulteration.

Unit IV : **Neutralizer and preservative adulterated in milk**: Sodium hydroxide, sodium carbonate - sodium bicarbonate - formaldehyde - hydrogen peroxide – MRL- Detection methods - health effects. Permitted preservatives and its limits. Neutralizers and preservatives, when used improperly, can significantly impact the quality and safety of milk. Rigorous testing, adherence to regulatory standards, and implementation of good manufacturing practices are essential to ensure that milk remains safe and of high quality. By employing advanced detection methods and maintaining transparency, producers can prevent adulteration and protect consumer health.

Unit V : **Other Adulterants:** fertilizer, salts, urea, pond water, ammonium compound and common salt – detection methods - health effects. Detergents in milk. Vanaspati – animal body fats – vegetable oils in fat rich products– detection methods - health effects. Effects and health impacts of artificial/synthetic colour and flavours in milk and milk products. Automated Testing: Utilize automated systems for detecting preservatives and neutralizers, which offer high accuracy and efficiency. Real-Time Monitoring: Implement real-time monitoring systems to track the levels of neutralizers and preservatives during milk processing.

References:

Text 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.

Reference books

1. IDF. (1991). Residues and Contaminants in Milk and Milk Products. Special Issue. Int. Dairy Fed., Brussels.
2. IDF .(1991). Detection and confirmation of inhibitors in milk and milk products. IDF Bulletin No. 258.
3. IDF. (1997). Monograph on Residues and Contaminants in Milk and Milk Products. Special Issue. Int. Dairy Fed., Brussels.
4. ISI. (1981). Handbook of food analysis. IS: SP: 18, Part XI. Dairy Products. Bureau of Indian Standards, New Delhi.
5. Wadhwa, B.K., Sharma, V. and Sharma, R. (2002). Status and control of pesticide residues in milk and milk products. *Indian Dairyman*.54(3)59-63

Website

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- https://agrimoon.com/book/

Semester II

21DPTV0209 - GENERAL MICROBIOLOGY (Credits 3)

Objective

- To facilitate the students to learn and understand about the microorganisms.
- To facilitate the students to handle the bacteriological equipment and apparatus.

Learning Outcomes

This course provides knowledge on microbes and their role

- Students to gain the knowledge on different methods of testing
- Students to learn the application of microbiology

I. Introduction to Microbiology: Microbes - Niches of Microorganisms in the living world- Evolution of Microbiology – Distribution of Microorganisms and their role in carbon, nitrogen and phosphorus cycles. Advances in microbiological techniques and applications continue to drive innovations in healthcare, agriculture, and environmental management.

II. Classification of Micro Organisms: Major characteristics of Microorganisms - Prokaryote and eukaryote- aerobes and anaerobes - Microbial Taxonomy - Nomenclature and elementary classification and characters of Bacteria, Fungi, Viruses and Mycoplasma. The classification of microorganisms is a complex and evolving field that involves multiple criteria, including morphology, genetic makeup, metabolic capabilities, and ecological roles. Accurate classification helps in understanding microbial diversity, studying their roles in various environments, and applying this knowledge in fields such as medicine, agriculture, and industry.

III. Microbial Growth: Methods of Measurement of growth of microorganisms – Factors influencing growth of microorganisms-microbial growth curve -Principles of Serial dilution - Isolation of Microorganisms from water and soil - Streak Plate and Pour Plate Method - Spread Plate Method- Principles of simple and differential staining. By understanding and controlling these factors, scientists and engineers can optimize microbial growth for various applications in medicine, industry, and environmental management. Accurate measurement and effective control strategies are essential for harnessing the benefits of microbial growth while minimizing potential risks.

IV. Nutrition and Culture of Microorganisms: Nutritional requirements of microorganisms -Culturing of microorganisms –Types and Preparation of culture media – Methods of growing microorganisms-Continuous culture- Batch culture - Methods of preservation of cultures. Controlling measures for micro organisms. Understanding microbial nutrition and culture is fundamental to microbiology and has wide-ranging implications for research, medicine, industry, and environmental science. Proper cultivation techniques and media selection are crucial for studying microorganisms and harnessing their potential for various applications.

V. Applied Microbiology: Application in food industry – Fermentation and its products– Application in Dairy industry – Application in waste management – Application in Biotechnology. Hygiene and Sanitation - Microbial Monitoring: Assesses microbial contamination in food, water, and public spaces to ensure safety and hygiene. Sanitation Practices: Develops and implements effective sanitation protocols to prevent microbial contamination and disease spread.

References

Text Books

1. Pelczar.Reid and Chan, 1977 - Microbiology, Tata McGraw-Hill Publishing company Ltd., New Delhi.

   Reference books:

2. Jamaluddin and Naveen malaviya 2018 - General Microbiology-Scientific publishers-New Delhi.

Reference Book

1. Cappuccino and Sherman 2004 “Microbiology – a laboratory manual”, Pearson Education publication, New Delhi.
2. R M Shukula 2001 “Microbiology” Dominant publishers, New Delhi

Web site:

- microbiologynote.com

Semester II

21DPTV0210 - DAIRY ENGINEERING - I

(REFRIGERATION AND CHILLING EQUIPMENT) (Credits 3)

Objective

- To understand the principles of Refrigeration.
- To obtain knowledge on working at chilling plant.
- To gain skills on repair and maintenance of refrigeration and cooling unit.

Learning Outcome

- Students acquire knowledge on types of refrigeration cycles
- Students will learn the process of refrigeration
- Students will learn on various tools and equipments involved in chilling process
- Students get practice on working of BMC and chilling centre and also cleaning and sanitation process of BMC.

Unit I : **Introduction:** Basic refrigeration cycle and concepts, standard rating of refrigerating machines: Air Conditioning – Importance of refrigeration in dairy industry. Methods of refrigeration: Units of refrigeration. The basic refrigeration cycle is a fundamental concept in thermal management and HVAC (Heating, Ventilation, and Air Conditioning) systems. By understanding the cycle's components and processes, one can grasp how refrigeration systems work to maintain desired temperatures and manage heat in various applications.

Unit II : **Refrigeration cycles:** Different types of refrigeration cycles - Vapour compression refrigeration system –compressor, condenser and evaporator– types of evaporators – block diagram of vapour compression refrigeration system – desirable characteristics of refrigerants – properties of refrigerants and comparison. The vapor-compression refrigeration system is a widely used and effective method for cooling and climate control. By understanding its components, cycle, and principles, one can better appreciate how refrigeration systems operate and how they can be optimized for various applications. Regular maintenance and consideration of environmental factors are key to ensuring the efficient and sustainable operation of these

systems.

Unit III : **Refrigeration plant and control devices:** Automatic expansion valve – solenoid valve- pressure control and thermostat. Common troubles in refrigeration system. Cooling tower. Ice bank systems. Factors affecting the performance of refrigeration plant- Efficient use of refrigeration. A refrigeration plant relies on a variety of components and control devices to operate efficiently and effectively. Understanding these components and their roles helps ensure that the system maintains the desired temperature, operates safely, and optimizes performance. Control devices play a critical role in regulating temperature, pressure, and flow, while advanced monitoring and management systems provide comprehensive oversight and optimization of refrigeration operations.

Unit IV : **Refrigeration in milk processing** milk tankers, Bulk milk cooler – construction and operation, Chilling plant – construction, hygiene and sanitation, safety precaution at cold storage, types of chillers, tests to check leakage of refrigerants – bubble test, halide torch test, Nesseler's reagent test, sulphur candle test, electronic test detector, Merits and demerits of refrigeration in milk. Refrigeration is integral to milk processing, ensuring the preservation, safety, and quality of milk throughout its journey from collection to consumption. By utilizing various refrigeration systems and technologies, the dairy industry can effectively manage temperature, maintain product quality, and adhere to safety standards. Efficient refrigeration practices not only extend shelf life but also contribute to the overall sustainability and effectiveness of milk processing operations.

Unit V : **Care and maintenance:** Cleaning and sanitation of BMC and chilling plant, precaution to be taken by workers, factors affecting refrigeration. Post-monsoon and flood cleanup: During and after the monsoon, BMC is tasked with clearing debris, mud, and waste caused by flooding to prevent water stagnation and maintain hygiene.

References

Textbooks

1. Arora, S. C. and Domkundwar, S. 1989. A Course in Refrigeration and air conditioning. 5th ed. Dhanpat Rai and Sons, Delhi.
2. Arora, C. P. 2000. Refrigeration and air conditioning. Tata McGraw-Hill, New Delhi.
3. Ballaney, P. L. 1992. Refrigeration and air conditioning. Khanna Publ., New Delhi.
4. Prashad, M. 2007. Refrigeration and air conditioning. New Age International, New Delhi.
5. Jorden, R. C. and Priester, G. B. 1957. Refrigeration and air conditioning. Prentice-Hall, New Delhi.

Reference books

1. James. N. Marner (1975), Principles of dairy processing, wiley eastern limited, New Delhi.
2. Ramasamy D, 1999. Dairy Technologists Hand Book, International Book Distributing Co, Lucknow
3. Tuffel Ahmad 1995, Dairy Plant Engineering and Management, KitabMachal Distributers, New Delhi

Website

- http://ecoursesonline.iasri.res.in/course/view.php?id=84
- https://agrimoon.com/book/

Semester II

21DPTV0211 - DAIRY CHEMISTRY (Credits 2)

Objectives

- To understand the physiochemical components present in milk
- To study the structure, role, and chemical interactions of milk

Learning Outcome

- Students will gain knowledge on various components present in milk.
- Students will acquire knowledge on various physical and chemical properties of milk.
- Students will learn various methods to analysis the proximate composition of milk.

Unit I : **Composition of milk**: Milk - definition – Gross composition of milk (cow, buffalo, goat, sheep and human) - Nutritive value of milk and energy calculation. Colostrum: composition – importance of colostrum. Factors influencing the composition of milk. Factors affecting quality of milk yield. Physical properties of milk. Species Variations: Composition varies between species. For example, cow's milk, goat's milk, and human milk each have different levels of fat, protein, and lactose.

Unit II : **Milk Carbohydrates**: Definition, classification, Lactose structures, physical forms, status of lactose in milk, uses of lactose. Milk carbohydrates, primarily lactose, are essential for energy, calcium absorption, and gut health. Understanding the composition and role of milk carbohydrates helps in managing lactose intolerance, improving dairy product formulation, and enhancing nutritional benefits.

Unit III : **Milk fat:** Definition, composition and size of fat globules, fat soluble vitamins, phospholipids. Properties of milk fat- density, Refractive index, Iodine value, RM value, Polenske value and Saponification value. Milk fat is a vital component of milk, contributing to its flavor, texture, and nutritional profile. Its composition includes a mix of triglycerides and fatty acids, with varying impacts on health.

Unit IV : **Milk Proteins:** Classification, isolation, major and minor milk proteins – Properties of milk proteins – hydration and solubility. Milk proteins, primarily casein and whey, are fundamental to milk's nutritional and functional properties. Casein provides a slow, sustained release of amino acids, making it beneficial for muscle maintenance and satiety, while whey proteins offer rapid absorption and functional benefits in food processing.

Unit V : **Minor constituents:** Definition, types of enzymes - functions – influence of processing parameters and effect on storage. Minerals and vitamins of milk: distribution of major minerals in milk- trace elements in milk. Minor constituents in milk, although present in smaller quantities, are vital for its nutritional value, functional properties, and overall quality.

References:

Text 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 Dinakar P.1999. *Textbook of Dairy Chemistry*. ICAR.
3. Sukumar De (1980), 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., Johonson, 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.

Reference Book

1. Fox, P.F. (Ed). (2006). Developments in Dairy Chemistry. Applied Sci. Publ., NewYork.
2. Jenness, R. and Patton, S. (1984). Principles of Dairy Chemistry. Wiley Eastern Pvt. Ltd, New Delhi.

Website

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- https://agrimoon.com/book/

Semester II

21DPTV0212- DAIRY MICROBIOLOGY (Credits 2)

Objective

- To understand about various microbes and their characters
- To understand the merits and demerits of microbes in the field of dairy
- To gain knowledge on various test for estimation of microbes

Learning Outcome

- Students will learn various microbes, their characters and taxonomy nomenclature.
- Students will learn about various methods to detect the microorganisms.
- Students will get knowledge about importance of microbes in dairy processing.

Unit I : **Introductory dairy microbiology:** Introduction and significance of dairy microbiology, classification of microenvironment, characteristics of spoilage and pathogenic microorganisms, characteristics of dairy associated bacteria, fungi and viruses. Microorganisms in dairy products, their roles in processing, and their impact on product quality and safety. Understanding these aspects is crucial for ensuring the safety, quality, and nutritional value of dairy products. Advances in microbiology continue to drive innovations in dairy processing and product development.

Unit II : **Microbiology of Milk:** Microorganisms associated with in raw milk and their significance, sources of contaminations, food infection, food intoxication and toxi-infection, milk borne diseases and implications. Microbiological standards for raw and heat processed milk, FSSAI standards and grading. MBRT. Microorganism roles in dairy processing, and their impact on milk safety and quality. Effective microbial control through pasteurization, sanitation, and quality testing is essential to ensure the safety and quality of dairy products. Advances in dairy microbiology continue to drive innovations in product development and safety.

Unit III : **Microbial spoilage of milk:** role of microbes in spoilage of milk, Physiological grouping; acid producing, gas producing, flavour producing, colour fermentations, proteolytic, lipolytic, sweet curdling, ropiness - causes

and preventive measures. Mastitic milk. Microbial spoilage of milk involves various microorganisms, each contributing to spoilage through different mechanisms such as protein and fat degradation, carbohydrate fermentation, and gas production. Effective management of spoilage requires understanding these microorganisms, controlling environmental factors, and employing preventive measures like pasteurization and proper storage. Ensuring milk safety and quality is essential for both consumer health and product longevity.

Unit IV : **Fermentation Process and starter cultures:** Starter culture: Definition – Classification - propagation and preservation methods - factors affecting activity of starter cultures – characteristics of good starter culture. Process and mechanisms of milk fermentation - abnormal fermentations. The proper selection and management of starter cultures, along with precise control of fermentation conditions, are essential for producing high-quality dairy products. Understanding the roles and functions of these cultures helps in optimizing fermentation processes and ensuring the safety and consistency of dairy products.

Unit V : **Microbial action in dairy industry**: Introduction, Microbial interactions, antimicrobial substance in milk, bio-preservation, Inhibitors in milk. Bactofugation process. Microbial action in the dairy industry is crucial for both the production and quality of dairy products. Microorganisms, including bacteria, yeasts, and molds, play significant roles in fermentation, spoilage, and even safety of dairy products.

References:

Text books:

1. Fernandes, R.2009 . Microbiology Hand book: Dairy Products. Royal Society of Chemistry, Revised ed., London
2. Foster E.M (1957) Dairy Microbiology, Prentice Hall Inc, USA.
3. Ramasamy, D., 1999, Dairy Technologist's Hand Book, International book distributing Co., Lucknow.
4. Srivastava.L. (2002)., Hand Book of Milk Microbiology, Daya Publishing House, Delhi.

Reference books

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2. Yadav, J.S. (1993) A Comprehensive Dairy microbiology, Metropolitan Book Co. Pvt Ltd, 1, NetajiSubashMarg, New Delhi-11002, India.
3. Mani. A., A.M. Selvaraj, L.M. Narayanan, N.Arumugam, Microbiology (General and Applied), Saras Publication, A.R.P. Camp road, Periavilai, Kottar (PO), Nagercoil, KanyakumariDist – 629 002.

Website

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- https://agrimoon.com/book/

Semester II

21DPTV0213 - PRACTICAL II (DAIRY CHEMISTRY) (Credits 3)

Objectives

- To practice on methodology of sampling
- To practice on various methods to detect the composition of milk
- To practice on platform test

Learning Outcome

- Students will gain practical knowledge on proximate, adulterants and preservatives in milk.
- Students will gain knowledge on handling of equipments and devices in chemical analysis.

1. Sampling of milk for physical and chemical examination
2. Platform tests for milk
3. Sediment test
4. Clots on boiling
5. Determination of specific gravity of milk by lactometer
6. Estimation of fat by Gerber's method
7. Estimation of fat by milkotester
8. Estimation of lactose
9. Estimation of protein
10. Estimation of Total Solids and SNF
11. Determination of titratable acidity in milk
12. Determination of heat stability of milk by Alcohol test
13. Detection of adulteration and preservatives in milk

Semester II

21DPTV0214 - PRACTICAL - III (DAIRY MICROBIOLOGY) (Credits 3)

Objective

- To get knowledge on various equipments used in microbiology laboratory
- To gain practice on various microbial tests

Learning Outcome

- Students will gain practical knowledge on handling of microbial equipments
- Students will get practiced on various microbial analysis

1. Familiarity with common equipments used in microbiology lab
2. Handling of microscopes.
3. Cleaning and sterilization of glasswares
4. Preparation of dilution blank,agar plates and agar slants
5. Preparation of various agar.
6. Gram staining techniques.
7. Methylene blue reduction test (MBRT)
8. Resazurin Test
9. Standard Plate count test(SPC)
10. Direct microscopic (DMC) test
11. Coliform count
12. Yeast and Moulds

Semester II

21DPTV0215 - INPLANT TRAINING (CHILLING CENTRE) (Credits 6)

Objective

- To provide practical exposure in refrigeration and chilling operations in milk chilling centre

Learning Outcome

- Students will attain practical knowledge by performing assigned work.
- Students will learn to operate RMRD, chilling unit and BMC.
- Students will learn documentation of milk at reception unit.

Work Plan

Students have to undergo In-Plant training in milk collection and chilling centre and they have to study and gain skills on repair/ maintenance of various equipments and machineries and they have to gain knowledge on the following operations of chilling plant.

1. Reception of milk –collection of milk at reception dock.
2. Sampling milk- labeling of sample and storing for analysis
3. Quality analysis at reception dock – platform tests
4. Can washers – sanitizing solution preparation
5. Study the filters and clarifiers arranged in reception.
6. Chiller
    a. Parts of chillers
    b. Dismantling of chiller plates
    c. Assembling of chiller plates
7. Study the flow of milk through chiller
8. Study of cream separator and parts-assembling
9. Study the refrigeration section
    a. Compressor
    b. Evaporation coil
    c. Fixing pipe flow lines
    d. Installation at chilling plant
10. Study on refrigeration control devices
11. BMC

a. Construction
b. Temperature gauge
c. Pressure gauge
d. Insulation

12. Documentation and record keeping
    a. Process parameters
    b. Quantity and quality of milk and storage
13. Study on malfunction of
    a. Can washers
    b. Chiller
    c. BMC
14. Calibration of equipments and gauges-
15. Cleaning and sanitizing
    a. Preparation of solutions
    b. Procedure for cleaning and sanitization of process area
    c. Procedure for cleaning and sanitation of BMC and chilling section
    d. Maintenance of personal hygiene
    e. Check for sources of contamination
16. Safety precaution
    a. Check for safety measurements
    b. Check for leakage of refrigerant
17. Calculation of ton of refrigeration
18. Exercise on checking leakage of refrigerants – bubble test, halide torch test, nesslers reagent test, sulphur candle test ,electronic test detector

Assessment

Students who underwent the In-Plant training should submit a report based on the daily routine activities that performed by them in the chilling centre. Also, they should submit report on the daily activities that they carried out with the details of date and timing. After the successful completion of In-Plant training an examination along with a viva voce will be conducted and evaluated.

SEMESTER - III

Semester III

21DPTV0316 - ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

(Credits 4)

Objectives

- To learn the importance in conservation of environment and natural resources
- To learn causes effects and control measures of environment pollution
- To understand the concepts of disaster management and preparedness to overcome

Learning Outcome

- Students will learn about the importance of environment and ecosystem.
- This course provides knowledge about the social issues and management of disaster.

Unit I	:	**Natural resources :** Introduction to environment and natural resources (definition, scope and important) - forest resources: use and over-exploitation of forest resources and its impact on forest and tribal people-Water Resources : Use and over – exploitation of water and impact – Land degradation and soil- erosion, desertification-Food resources: Effects of modern agriculture, fertilizer- pesticide problems-energy Resources: Growing energy needs renewable and non renewable energy source-use of alternative energy sources. Natural resources are fundamental to human existence and economic development. Their responsible management is crucial to ensure their availability for future generations.
Unit II	:	**Ecosystem and Biodiversity:** Concept of an ecosystem-structure and function of an ecosystem – energy flow in the ecosystem –Food chains, food webs and ecological pyramids- types of ecosystem- Biodiversity: genetic, species and ecosystems diversity, India as a mega- diversity nation –treats to biodiversity: habit loss, poaching of wild life, man-wild conflicts; Endangered and endemic species of India – Conservation of Biodiversity: I-Situ and Ex-Situ conservation of biodiversity. Ecosystem and biodiversity are fundamental concepts in ecology that describe the interactions between living organisms and their environments, as well as the variety of life forms present in a given area. Understanding these concepts is crucial for environmental

		conservation, sustainable development, and managing natural resources.
Unit III	:	**Environmental Pollution:** Causes, effects and control measure of Air Pollution, Water pollution, Soil Pollution, Noise Pollution and Nuclear hazards, Solid waste management, Global environmental problems. Addressing pollution requires a combination of regulatory measures, technological innovations, sustainable practices, and public awareness.
Unit IV	:	**Social Issues and the Environment**: Sustainable development, Rural Urban problems related to environment, Water management and rain water harvesting – Environment ethics: Issues and possible solutions, Environmental Protection Policy, Acts and Legislation, Population and the Environment – Environmental and Population concern: Environment and human health, Environment education at various levels. By focusing on sustainable development, effective policies, education, and innovative solutions - equitable and healthy future.
Unit V	:	**Disaster Management:** Disaster: Meaning and concepts, types, cause and management –Effects of disaster on community, economy, environment-Disaster management cycle: early response, rehabilitation, reconstruction and preparedness- vulnerability Analysis and role of community in Disaster Mitigation-The Disaster Management Authority: National, state and District level –III effects of fireworks. Disaster management is a multifaceted field that involves preparing for, responding to, recovering from, and mitigating the effects of disasters.

References:

Text books:

1. A text book of Environmental Studies , 2005, ErachBharueha, UGC, University press, New Delhi.
2. A text book of Environmental Studies, 2003, Thangamani and Shyamala, PranavSynicate, Publication Division, Sivakasi
3. A text book of Environmental Studies, 2006, Asthana,D.K., MeeraAsthana, S. Chand & Company Ltd., New Delhi.

Reference book

1. Environmental Studies, 2005, Benny Joseph, Tata Macgraw – Hill Publishing Company, New Delhi
2. Panchayats in Disaster: Preparedness and Management, 2009, palanithurai, G., Concepts Publishing company

Semester III

21NSSU0001 NSS (Credit 1)

Objectives

- To know the history, philosophy, principles of NSS and working with people
- To know the role and responsibility of volunteers.

Learning Outcome

- Student able to know to know the history, philosophy, principles of NSS and working with people, role and responsibility of volunteers.

Unit I : NSS - History, Philosophy, Principles and objectives

Unit II : Working with people— Methods and Techniques

Unit III : NSS - Regular Programme: objectives, activities - role and responsibilities of volunteers

Unit IV : **:** NSS Special Camping Programme: objectives, activities - role and responsibilities of volunteers

Unit V : Evaluation of the NSS activities - Tools and Techniques

References:

Text books:

1. Advi Reddy, 1996, Extension Education Babatal Publications, Hyderabad
2. Narayanasamy, N, M.P.Boraian and R. Ramesh, 1997, Participatory Rural Appraisal, GRU, Gandhigram.
3. National Service Scheme Manual1 1997. Department of Youth Affairs and Sports,

Ministry of Human Resource Development, Government of India.

4. Supe, S.V. 1995, Extension Education, Sterling Publications, Madras

Semester III

SHANTI SENA (Credit 1)

Unit I : Shanti Sena- Meaning and conceptual frame work - historical development

Unit II : Shanti Sena in India and abroad- Contributions of Mahatma Gandhiji, Khan Abdul, Ghaffar Khan, VinobaBhave and Jeyaprakash Narayan

Unit III : Organisation and functions of Shanti Sena- Shanti Kendras, All India ShanthiSena Mandal; Peaceful resolution of conflicts, Peace Making, Alternative to Defense and Violence.

Unit IV : Experiments in Modem times- World Peace Brigade, Peace Brigade International, U.N. Peace Keeping Force, Truth and Reconciliation Commission and Experiments of Gandhigram Rural Institute

Unit V : Skills and Training for Shanti Sena- Skills of First Aid and Skills for management, Peace Making Skills(Conflict Resolution and Counseling Transforming oneself into a ShandSaink.

Semester III

21SPOU0001 SPORTS AND GAMES (Credit 1)

Semester	**II**	**Course Code**	**21SPOU0001**
Course Title	**Sports and Games**		
No. of Credits	**0+1**	**No.of Contact hours per week**	**1**
New Course / Revised Course	**Revised Course**	**Percentage of Revision effected**	**30**
Category	**Foundation course (Optional Course)**		
Scope of the Course	**Skill Development**		
Cognitive Levels addressed by the Course	**K-1 & K-2**		
Course Objectives	**The Course aims to** Gain knowledge about the Fitness, Sports and Games		

Unit	**Content**	**No of Hours**
I	Concept of Health Related Fitness (HRF) Test – Assessment of HRF test.	**3**
II	Introduction to Yo -Yo tests - Basic skills in Kabaddi.	**4**
III	Fundamental skills in Field Hockey / Volleyball	**3**
IV	Introduction to Track and Field Events - Procedure for 4 X100 Meters Relay - Tournaments (Intramural and Extramural tournaments) - Methods to draw the fixture for knockout and league tournaments.	**3**
V	Introduction to Common athletic injuries and first-aid - Recreational activities (Minor games) – Basic skills in Shot put / Javelin throw.	**3**
References	**Text Books:** 1. Bonnie Kenny and Cindy Gregory, (2006), Volleyball (Steps to Success), (3ED), Human Kinetics Publishers, Champaign, USA. 2. Elizabeth Anders and Sue Myers, (2008), Field Hockey (Steps to Success), Human Kinetics Publishers, Champaign, USA. 3. James R.Morrow, Jr., Allen W.Jackson, James G.Disch and Dale.P.Mood, (2000), Measurement and Evaluation in Human Performance, (2ED), Human Kinetics Publishers, Champaign, USA. 4. Ken O. Bosen, (1973), Track & Field Fundamental Techniques NIS Publications, Patiala.	

	5. Rule Book, (2014), Provinces battling for the Indigenous Games champs trophy.
References Books:	**1.** Kamlesh, M.L.,(1987), Management Concepts Physical Education and Sport Metropolitan Book Co., Pvt., Ltd., Nethaji Subhash Marg, New Delhi. **2.** Thirunarayanan, C. and Hariharan, S., (1989), Methods in Physical Education, C.T. & S.H., Publications, Karaikudi.
	Web Resources: 1. https://www.iaaf.org/home 2. http://www.indiankabaddi.org/
	3. http://khokhofederation.in/ 4. https://www.olympic.org/the-ioc 5. https://www.topendsports.com/testing/tests/yo-yo-endurance.htm
Course Outcomes	Students should be able to 1. Assess the fitness level. 2. Demonstrate skills in indigenous game. 3. Demonstrate skills in major Sport and game. 4. Learn the basic skills involved in field event. 5. Know about recreational games and latest fitness assessment tools.

Semester III

FINE ARTS (Credit 1)

Objectives

A general survey course to introduce the students to Indian Art.

- To understand the basics of Art History, Aesthetics and Art Appreciation.
- Theoretical, social and cultural dimensions of the production of art and architecture.

Learning Outcome

- Student will acquire knowledge and skill on Indian art, history and aesthetics, Indian architecture and Trends and development of Indian architecture.

Unit I : **Art History and Aesthetics:** What is art and what is art History? What constitutes art and how do we define it? The Classical Concept of art. Theory of Art as Expression. Aesthetic theories of Art.

Unit II : **Indian Art:** Do art and architecture perform functions and have a role to play in society? The role and importance of the museum as a site for cataloguing and preserving art, and projecting certain defined notions that have a bearing on the study of art and architecture will also be focused upon

Unit III : **Indian Architecture:** Prescriptive texts and the making of early Indian art and architecture. Was the science' of art and architecture developed as a concomitant of the artistic and architectural developments in early India?

Unit IV : **Types of Architecture:** Domestic (dwellings), public institutional (step-wells, rest-houses, hospitals) and religious institutional will be focused upon. The focus will be on the material sources at particular monument sites such as Sanchi, Amaravati, Ajanta, Ellora, Khajuraho, Tanjavur, Mahabalipuram, SravanaBelagola, Bhubaneshwar and Mount Abu. (There may be other sites added or dropped from this list depending on the newer literature available.)

Unit V : **Trends and Developments:** How do we understand the different structures that emerge over a long period of time within a monument or when a monument no longer has a living significance for the people in its vicinity?

Are symbols remnants of the primitive mentality or do they also evolve over time? How do we understand ornamentation? Finally, is there an Indian art and architecture?

References:

Text books:

1. Brancaccio, Pia (2011) The Buddhist Caves at Aurangabad: Transformations in Art and Religion. Leiden & Boston: Brill.
2. Brockman, Norbert C. (2011) Encyclopedia of Sacred Places. Vol. 1: A-M. Second Edition, California: ABC-CLIO, LLC,
3. Burton-Page, John (2008) Indian Islamic Architecture. Forms and Typologies, Sites and Monuments. Ed. George Michell. Leiden & Boston: Brill.
4. Elgood, Heather (2000) Hinduism and the Religious Arts. London & New York: Cassell.
5. Tillotson, GHR, Paradigms of Indian Architecture: Space and Time in Representation and Design, Curzon, 1997,
6. Vatsyayan, Kapila, The Square and the Circle of the Indian Arts, Abhinav., Delhi, 1997.
7. Wagoner, Philip B., 'Ananda K. Coomaraswamy and the Practice of Architectural History', Journal of the Society of Architectural Historians, vol. 58, no. 1, 1999.

Semester III

21CSAV03A2 - WEB DESIGNING (Credits 4)

Cognitive Level	**K-1** Recall the basic definitions and terminologies of computer. **K-2** Summarize the knowledge in web programming **K-3** Prepare web pages related to their field using HTML
Course Objectives	**The Course aims to** • Introduce the concepts of internet and terminologies. • Enlarge the web designing concepts • Provide an in-depth training with HTML and JavaScript

UNIT	CONTENT
I	**Introduction to Computer and HTML**
	• Introduction to Internet and Website, Web development tools • HTML : Introduction - Head and Body Sections • Designing Title - Designing Headings • Designing Body Section – Alignment and Formatting Tags • Paragraph Tags
II	**Ordered List, Tables and Forms**
	• Ordered and Unordered List • Tables - Using Colors • Embedding Images and Videos • Hyperlink • Forms and Frames: Form Elements • Buttons - Frame Layouts • Floating Frames.
III	**Cascade Style Sheet**
	• Introducing Cascading style sheet • Formatting colors and background • Formatting Heading, Paragraph text • Formatting Table

	• Formatting images • More CSS Techniques
IV	**JavaScript**
	• Introduction to Java Script • Anatomy of a Script • Variables, Operators and Events • Polyfills • JavaScript Libraries • Database connection with JavaScript
V	**XML**
	• XML: Introduction - Syntax • XML Document Structure • Document Type Definitions • Some Simple DTD Examples.
Reference Books	Learning Web Design, Jennifer Niederst Robbins, O'Reilly Publication, 2018 JavaScript and JQuery, Jon Duckett, Wiley, 2014 Web coding Bible, Chong Lip Phang, Chong Lip Phang, 2015
Course Outcomes	**On completion of the course, students should be able to** **CO1:**Recall the fundamental concept of computer, Internet and Websites **CO2:** Be familiar with the web programming concepts **CO3:**Able to write web programs **CO4:** Understand the data manipulation using Scripting language **CO5:**Build a simple web site

Semester III

21DPTV0317 - GENERAL LABORATORY PRACTICES (Credits 2)

Objectives

- To acquaint the students about the basics of commonly used techniques in laboratory
- To practicing the handling techniques of laboratory instruments used for analysis of milk and milk products.

Learning Outcomes:

- From this course, students will get well trained on handling of various equipment and devices in laboratory.
- Students will learn on calibration of various equipment and devices.

1. Practice the general laboratory procedures, care and maintenance of research equipments and safety measures while in lab.
2. Preparation of buffers
3. Determination of pH using pH meter.
4. Practicing and handling of centrifuge and water bath.
5. Practicing and handling of viscometer and flame photometer.
6. Practicing and handling of calorimeter.
7. Practicing and handling of different types of microscope and colony counter.
8. Practicing and handling of autoclave and muffle furnace.
9. Practicing and handling of laminar air flow chamber and Incubator.
10. Practicing and handling of hot air oven and micro oven.
11. Practicing and handling of advanced lab equipments for estimation of milk constituents in dairy products.
12. Handling of Soxplus
13. Handling of Kelplus
14. Handling of Fibroplus
15. Safe disposal of chemicals and glasswares.

References:

Text books:

1. Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press.
2. Gabb MH &Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.
3. Settle F.1997. Handbook of Instrumental Techniques for Analytical Chemistry. Hall International.

Semester III

21DPTV0318 - DAIRY ENGINEERING - II (Credits 3)

(BOILER & OPERATION AND MAINTENANCE OF DAIRY MACHINERIES)

Objectives

- To provide engineering knowledge on constructions and operations related to milk processing machineries.
- To provide knowledge on heat transfer mechanisms and working principles of dairy industry machineries.

Learning Outcomes

- This course provides knowledge on working principles of various dairy processing equipments including pasteurizer, homogenizer, heat exchangers, condensing equipments.
- Students will get knowledge on handling of equipments related to dairy process.

Unit I : **Milk reception dock Machineries:** Methods employed for measuring milk, Constructional details of milk transport tankers, storage/silo tank, refrigerated storage tank, processed tank, aseptic tank and can washer. Proper management and maintenance of these components are vital for the overall efficiency and quality of dairy operations.

Unit II : **Steam and steam generators/boilers:** Wet, dry and superheated steam; Formation of Steam, use of steam tables. Boiler: Types of boiler, Types of fuels, constructional features and operations of vertical fire tube, horizontal return flow and automatic boilers. Performance and efficiency of boiler. Pressure Management: Regularly monitor and manage boiler pressure to prevent explosions and ensure safe operation.

Unit III : **Heat Exchanger:** Mechanisms of heat transfer – Effectiveness of heat exchanger, types of heat exchanger: tubular heat exchangers, shell and tube and concentric tubes; plate heat exchanger – merits and specifications; comparison of direct and indirect heating system. Understanding the different types of heat exchangers, their applications, and maintenance requirements is essential for optimizing performance and ensuring

efficiency. Proper selection, operation, and upkeep of heat exchangers contribute to energy savings, product quality, and overall process efficiency.

Unit IV : **Processing machineries:** Pasteurizer: components involved in operation and maintenance of LTLT, HTST pasteurizers, advantages and disadvantages. Sterilizer and Retort sterilizer. Cream separator and Homogenizer: types, accessories, components involved in operation and maintenance of cream separator and homogenizer. From milk reception and pre-processing to fermentation, cheese making, and packaging, each piece of equipment plays a critical role in the dairy production process. Understanding the functions and applications of these machines helps in optimizing dairy operations, improving product quality, and ensuring compliance with safety and hygiene standards.

Unit V : **Condensing and drying equipments:** Multiple effect evaporator and accessories. Equipments for drying of milk: roller drier, spray drier and their accessories. Fill pack machines- milk sachet and aseptic filling machines and their maintenance. Condensing and drying equipment are essential in the dairy industry and other sectors for processing dairy products and ensuring they meet required specifications for shelf life, quality, and usability. These processes are particularly important in the production of dairy powders, evaporated milk, and concentrated products.

References:

Text books:

1. Tuffel Ahmad 1995, Dairy Plant Engineering and Management, Kitab Machal Distributers, New Delhi
2. James. N. Marner (1975), Principles of dairy processing, wiley eastern limited, New Delhi.
3. Ramasamy D, 1999. Dairy Technologists Hand Book, International Book Distributing Co, Lucknow

Reference books:

1. Sukumar De 1980, Outlines of Dairy Technology. Oxford University Press, New Delhi.

2. GostaBylund (1995), Dairy processing hand book, Tetra pak processing systems AB, Swedwn

3. Ahmad, T. 1985. Dairy Plant Systems Engineering. Kitab Mahal Publ., Allahabad.

Website

- http://ecoursesonline.iasri.res.in/course/view.php?id=74/84
- https://agrimoon.com/book/

Semester III

21DPTV0319 - DAIRY TECHNOLOGY - I (MARKET MILK) (Credits 3)

Objectives

- To provide the knowledge about the liquid milk processing and preservation.
- To enlighten the students about the market available processed/special milk.

Learning Outcomes

- Students gain knowledge about types of market milk available in market and their importance.
- This course provides details about the manufacturing process of different market milks.
- Students will learn about the process flow of market milk and difference between manufacture milk.

Unit I : **Market milk**: definition – Status of market milk industry in India and abroad –Indian standards – State wise standards. FASSI Standards. Market milk is a fundamental product in the dairy industry, requiring careful handling from farm to consumer to ensure quality, safety, and freshness. Processing, packaging, and distribution play crucial roles in delivering high-quality milk to consumers. Understanding market milk's characteristics, processing methods, distribution channels, and current trends helps in appreciating its importance in daily life and its impact on the dairy industry.

Unit II : **Processed milk:** Pasteurized milk –definition –objectives- types of pasteurized milk – method of preparation –storage – purpose – merits and

demerits. Homogenized milk – definition – factors influencing homogenization – method of manufacture of homogenized milk- storage – purpose – merits and demerits. Understanding the characteristics, processing methods, and applications of processed milk helps in appreciating its importance in the dairy industry and its impact on consumer health and convenience.

Unit III : **Standardized milk:** Scope, definition, standards, method of preparation, storage and nutritional value of Standardized milk – Cow milk – Toned milk – Double toned milk – Full cream milk- Skimmed milk – Recombined milk – Reconstituted milk. Understanding the standardization process helps in appreciating its importance in maintaining product quality and meeting market demands.

Unit IV : **Value added milk:** Scope, definition, standards, types, method of preparation, storage and nutritional value of Sterilized milk – Flavoured milk – UHT processed milk – MF and UF milk – Vitaminised/irradiated milk – Mineral fortified milk – Filled milk – Soft curd milk. Value-added milk encompasses a range of milk products enhanced to offer additional benefits or features. Whether through fortification, flavoring, functional ingredients, or special processing methods, value-added milk caters to diverse consumer needs and preferences.

Unit V : **Modified milks:** Humanized milk: Low fat milk – lactose free milk - Designer milk: definition –objectives- method of preparation – purpose – merits and demerits – nutritional value and therapeutic benefits. Understanding these products helps in appreciating their role in the dairy industry, addressing market demands, and contributing to consumer health and satisfaction.

References

Text books

1. Anantha Krishnan, C.P., (1991), Technology of milk processing, Sri Lakshmi Publications, Chennai -10.
2. Dairy India year book 2007 & 2017 A- 25 Priyadarshinivihar, Delhi 110092, India.

3. Eeckles.CH.Combs, W.B and Macy.H (1955), Milk and Milk Products, Tata McGraw Hill Publishing Co.Pvt.Ltd., New Delhi.
4. Ramasamy. D. 1999. Dairy technologist hand book, International book distributing Co. Luknow.
5. Robinson (1986), Modern Dairy Technology, Vol.I, Advances in Milk Processing, Chapman and Hall India, Madras.
6. Sukumar De (1991), Outlines of Dairy Technology, Oxford University Press, New Delhi.

Reference book

1. Aneja, R.P. 1994. Dairying in India – A Success Story. Publication No. 1994/4. Asia Pacific Association of Agricultural Research Institutions (APAARI), Bangkok.
2. Thompkinson, D.K. and Sabikhi, L. 2012. Quality Milk Production & Processing Technology. Xxvii+ 274 pp. New India Publishing Agency, New Delhi

Website

- http://ecoursesonline.iasri.res.in/mod/page/view.php?id=6099
- https://agrimoon.com/book/

Semester III

21DPTV0320 - MILK PROCESSING AND PRESERVATION (Credits 3)

Objectives

- To enable the students to acquire skill in processing of milk
- To gain knowledge on various methods of milk processing.

Learning Outcomes

- This course provides details about various processes involved in reception area and processing area.
- Students will get knowledge on various process including pasteurization, standardization and cream separation
- Students will learn about various equipments such as pasteurizer, homogenizer, cream separator, clarifier and filters

Unit I : **Milk reception:** concept – unloading– sampling – basics involved in platform test – weighing, measuring and recording. Straining - filtration and clarification of milk - mechanism. By focusing on rigorous testing, proper handling, and compliance with standards, the milk reception process helps maintain the integrity of dairy products and safeguards consumer health. Understanding the details of this process underscores its importance in delivering high-quality dairy products to the market.

Unit II : **Preservation:** Definition - types of milk preservation. Chilling – meaning - methods of chilling – importance of milk chilling - merits and demerits – Cold storage chain. By employing a variety of techniques such as refrigeration, pasteurization, drying, fermentation, and advanced packaging methods, the dairy industry ensures that milk remains safe, nutritious, and enjoyable for consumers. Understanding these preservation methods helps in appreciating their role in the dairy supply chain and their impact on product quality and consumer satisfaction.

Unit III : **Heat treatment of milk:** pasteurization – history – objectives of pasteurization – definition - types – mechanism – advantages and disadvantages. Critical factors of HTST**.** Heat treatment of milk is a fundamental process in dairy processing that enhances safety, extends shelf

life, and maintains quality. By employing various methods such as pasteurization, sterilization, and UHT processing, the dairy industry ensures that milk is safe for consumption and retains as much of its nutritional and sensory properties as possible. Understanding these methods helps appreciate their role in delivering high-quality dairy products to consumers.

Unit IV : **Separation of milk**: working principle – types of separation - advantages and disadvantages - uses. Homogenization – definition – types – mechanism of homogenization – effect of homogenization on milk - merits and demerits – uses

Unit V : **Sterilization** - concept – scope of sterilized milk - method of producing sterilized milk - types – mechanism. UHT Milk-Definition- Types of UHT processing- Packaging - Stassanization milk process.

References

Text books

1. Anantha Krishnan, C.P., (1991), Technology of milk processing, Sri Lakshmi Publications, Chennai -10.
2. Eeckless C.H, W.B Combs and H.Mecy (1955), Milk and Milk Products, Tata McGraw Hill Publishing Co.Pvt.Ltd. New Delhi.
3. Ramasamy, D (1999) Dairy Technologist's Hand Book, International Book distributing Co, Lucknow.
4. Sukumar De (1980) Outlines of Dairy Technology, Oxford University Press, New Delhi.

Reference book

1. W.E.Peterson,Ph.D(2005) vol-2 Dairy Science its principles and practice production, management of processing- Asiatic publishing house-New Delhi
2. Walstra, P. Wouters, J.T.M. and Geurts, T.J. 2006. Dairy Science and Technology. CRC Press, New York.

Website

- www.agrimoon.com

Semester III

21DPTV0321 - PRACTICAL - IV (MARKET MILK) (Credits 3)

Objectives

- To learn about various processes involved in market milk

Learning Outcomes

- Students learn on various procedures for preparation of various market milk.
- Students gain knowledge on various parts involved in milk processing.

1. Sampling of milk
2. Plat form test
3. Preparation of pasteurized milk
4. Phosphatase test
5. Preparation of homogenized milk
6. Preparation of recombined milk
7. Preparation of reconstituted milk
8. Preparation of sterilized milk
9. Preparation of flavored milk
10. Turbidity Test
11. Standardization of milk
12. Modified test
13. Hands on training on liquid milk processing

Semester III

21DPTV0322 - IN PLANT TRAINING (Credits 6)

(MILK PROCESSING)

Objective

- Students have to undergo In-plant training at an established dairy unit and should learn about all the following procedure.

Learning Outcome

- Students will acquire practical knowledge by performing assigned work.
- Students will learn about various processes including pasteurizer, homogenizer, packaging section, cream separation, freezing, condensing and evaporation.
- Students will learn documentation and record keeping of all standards at various processes.

Work Plan

1. Reception
    a. Record milk inlet – RMRD section.
        i. Record the details of milk route and cans.
        ii. Weighing and fat percentage of inlet milk.
        iii. Study the flow of milk from RMRD to Silo – flow diversion valve – pump- sensors involved in process flow.
    b. Laboratory
        i. confirm the quality of received milk
        ii. analysis of proximate composition
2. Clean in Place
        i. Preparation of cleaning and CIP solutions and concentration.
        ii. Proper usage of cleaning and sanitizing solution.
        iii. Washing of milk cans and crates.
        iv. Understand CIP and study the process of CIP
3. Processing
    a. Pasteurizer
        i. Record the temperature and document the recorded temperature.
        ii. Study the inflow and outflow line of milk, steam and cold water.

iii. Practice on dismantling and arrangement of pasteurizer flow line.
iv. Study on accessories fitted to pasteurizer.

b. Homogenizer
    i. Record the inlet milk temperature, pressure and document the recorded values.
    ii. Study the inflow and outflow line of milk.
    iii. Practice on repairing, dismantling and arrangement of homogenizer.
    iv. Study on accessories fitted to homogenizer.

c. Standardization
    i. Learn the calculations of standardization process for preparation of various types of milk and milk products.

d. Cream separation
    i. Study on various parts of cream separator.
    ii. Cleaning and sanitize cream separator.
    iii. Dismantling and arrangement of cream separator.

e. Packaging
    i. Run the packaging machine
    ii. Learn about the construction of equipment.
    iii. Learn inlet and outlet flow of milk.
    iv. Calculate the package losses at processing time

f. Freezing
    i. Study on freezing process, freezing unit, cold storage.
    ii. Practice on operating ice-cream making machine and ageing tank.

Assessment:

Students who underwent the In-plant training should submit a report based on the daily routine activities that performed by them in the dairy processing unit. Also, they should submit report on the daily activities that they carried out with the details of date and timing. After the successful completion of In-plant training an examination along with a viva voce will be conducted and evaluated.

SEMESTER - IV

Semester IV

21DPTV0423 - IT APPLICATION IN DAIRY INDUSTRY (Credits 4)

Objectives

- To make the students to be familiar with multimedia
- To enable the students with the knowledge of network, internet and its application to dairy industry

Learning Outcome

- Students will get to know about the involvement of computers in dairy processing.
- This course also provides the knowledge on various softwares used at dairy industry.
- Students will get to know about the automation processes in dairy field.

Unit I : **Information Technology:** Concept – Strength of IT – Importance of computerization in Dairy industry – IT application in dairying – ERP (Enterprise Resource Planner) application at Amul Dairy. Automated Milking Systems: Advanced milking machines use sensors and software to monitor milk production, quality, and animal health. Systems like robotic milking systems can operate 24/7 and adjust to individual cows' needs.

Unit II : **Special instruments for the dairy industry:** E-nose and E-tongue – concept - principles - applications in food industry. Sensors: Electrochemical sensors – Optical odor sensors. Robotics: features of robots – application of robots in Dairy and food processing operations. Tracking and Traceability: IT systems track the movement of milk from farms to processing plants and then to consumers.

Unit III : **Dairy process modeling:** Introduction – Process modeling: Fundamentals of process modeling – deductive modeling – inductive or empirical modeling (advantages and Disadvantages) Kinetic modeling – Heat and mass transfer modeling – supervisory control and data acquisition (SCADA). CAD, SAP and CAM in dairy industry. Farm Management Software: Comprehensive systems manage various aspects of dairy farming, including breeding, health records, milk production, and financials.

Unit IV : **Plant Automation:** Meaning & Definition – types of automation systems – fixed automation – programmable automation – flexible automation – integrated automation – necessity of automation advantages of automated systems.

Unit V : **Case Studies:** 1. System analysis for milk procurement and billing system, 2. Design for milk procurement and billing system. Database design for milk system.

References:

Text books:

1. Balagurusamy, E 2009. Fundamentals of Computer Tata Mcgraw – Hill, New Delhi
2. Britz.T.J and Robinson, R.K.(2001), Advanced Dairy Science & Technology, Bkachevell Publication, UK.
3. Rajan, E.G 2003 Information Tech. BS Publication, Hyderabad.
4. Rajaraman,V, 2002 Fundamentals of Computer. 3rd ed. Prentice Hall of India, New Delhi.
5. Tanenbrm, A.S. 2006 Computer Networks. 3rd ed. Person Education, New Delhi.

Semester IV

21DPTV0424 - OCCUPATIONAL HEALTH AND SAFETY IN DAIRY INDUSTRY

(Credits 3)

Objectives

- To learn safety precautions in handling dairy equipment
- To learn first aid methods and practice it on and off the field

Learning Outcomes

- Students will learn on various hazards that plays major role in dairy industry.
- Students will acquire knowledge on how to handle the various hazards.
- Students get to know about the safety and precautions to be carried in industry.

Unit I : **Safety and Health :** Introduction to Safety Management, Safety Management, Safety Policy under Factories 1948 Act, Dangerous Machineries Act, Safety Committee, Safety Review, Responsibility of Management, Safety Officers Duties & Responsibilities, Safety Targets, objectivess, Standards, Practices and Performances. Motivation & Communication as part of Safety Programme. Safety and health are critical concerns that span across various aspects of production, processing, and distribution. Ensuring the safety and health of both the dairy products and the people involved in their production is essential for maintaining quality and compliance with regulations.

Unit II : **Occupational Hazards:** Basics Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards and Thermal Hazards. Occupational health, Occupational hygienic and Occupational Diseases/Disorders prevention. By addressing these occupational hazards through preventive measures, safety protocols, and proper training, the dairy industry can create a safer and healthier working environment, reducing the risk of injuries and improving overall operational efficiency.

Unit III : **Accident and Safety:** Need for Personal Protection Equipment, Selection, Use, Care and Maintenance of Respiratory and Non-respiratory Personal Protective Equipment, Non-respiratory Protective Devices of the operator,

Accident insurance Schemes. Accidents and safety in the workplace are critical concerns in the dairy industry. Ensuring a safe working environment involves identifying potential hazards, implementing preventive measures, and having protocols in place to respond effectively to accidents.

Unit IV : **First Aid:** Burns, Fractures, Toxic Ingestion, bleeding, wounds and Bandaging, Artificial Respiration, Techniques of Resuscitation. First aid is essential for providing initial care in emergencies and injuries before professional medical help arrives. In the dairy industry, where accidents and injuries can occur frequently due to physical activity, machinery, and chemicals, having a well-prepared first aid plan is crucial.

Unit V : **Safety Health Practices:** Health-Cleanness, Disposal of Waste, Ventilation and Temperatures, Dust and Fumes, Drinking Water, Lighting, Latrines and urinals. Safety – Fencing of machineries, Work on or near machinery in motion, Hoists and lifts, Pressure plants, Floors, Stairs and means of escape, Protection against fumes and & gases, Safety offers. Welfare – Washing facilities in Dry clothing, Storming, Sitting, First Aid Appliances, Canteen, Shelters for rest and lunch, Creches, Welfare offers, Right and Obligation of workers.

References:

Text books:

1. Ahuja, First Aid, Published by Jaypee Publication – 2nd Edison.
2. Parle & Parle, Preventive and Social Medicine, Published by Benaurus Publication, 23rd Edison.

Website:

https://labour.gov.in

Semester IV

21ENAV0001 ENERGY AUDITING (Credit 1)

Learning Outcomes

- Students will get to know about the various resources of energy that aid in dairy processing
- This course will provide basic ideas about the Electricity and its transformations.
- Students will learn on concepts related to auditing principles of energy and energy management.

Unit I : **Energy scenario :** Commercial and non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, air pollution, climate change, energy security, energy conservation and its importance, energy strategy for the future, energy conservation act 2001 and its features.

Unit II : **Basics of energy & its various forms:** Electricity basics – DC and AC currents, electricity tariff, load management and maximum demand control, power factor. Thermal basics – fuels, thermal energy content of fuels, temperature and pressure, heat capacity, sensible & latent heat, evaporation, condensation, steam, moist air, humidity and heat transfer, units and conversion.

Unit III : **Energy management and audit:** Definition, energy audit – need, types of energy audit, energy management (audit) approach – understanding energy costs, benchmarking, energy performance

Unit IV : **Energy action planning :** Key elements, force field analysis, energy policy purpose, perspective contents, formulation, ratification, organizing, location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability, motivating – motivation of employees, information system designing barriers, strategies, marketing and communicating, training & planning.

Unit V : **Global environmental concerns:** United Nations framework convention on climate change (UNFCC), Kyoto protocol, conference of parties (COP), clean development mechanism (CDM), Prototype carbon fund (PCF), sustainable development.

References:

Text books:

1. Bureau of Energy Efficiency. Guide Book for National Certification Examination for Energy Managers and Energy Auditors
2. PATRICK, Energy Conservation Guidebook, 2nd Edition, The Fairmont Press, Inc., 1993.

Semester IV

21APRU0005 INTRODUCTION TO STATISTICS (Credits 2)

Cognitive Level	**K-1** Understand the origin, significance, and scope of Statistics.	
	K-2 Know the significance of presenting data in the form of tables and diagrams.	
	K-3 Learn computational aspects of basic statistical measures.	
Course Objectives	**The Course aims** • To enable students to be familiar with basic concepts and terms and the uses of statistics in quality control • To develop skills among the students to carryout analysis using appropriate statistical tools	
UNIT	**Content**	**No. of Hours**
I	Introduction to Statistics – Collection, Classification and Tabulation of data – Frequency distribution – Graphical and Diagrammatic representation of data and uses of diagrams, graphs.	**12**
II	Descriptive Statistics – Measures of Central Tendency; Measures of Dispersion - Range, Standard Deviation, Co-efficient of variation – Simple problems.	**13**
III	Population and samples – Selection of sample – Random samples – Standard error – Type I Error and Type II Error – Test of Hypothesis - Basic concepts: Types of tests; F-test and Chi-square test of significance.	**13**
IV	Correlation - Definition, Types of Correlation – Karl Pearson's correlation coefficients, Spearman's Rank Correlation coefficients. Regression - Concept, Definitions – Simple regression equations – fitting of regression equation, Simple Problems.	**13**
V	Quality control charts – Introduction, process control, control charts, and control limits and specification limits, product control – Types of control charts: $\overline{X}$ and R chart – P, c and np chart – Simple problems.	**13**
References	• Krishnanswamy,O.R, Methodology of Research in Social science, Himalaya Publishing House, Bombay, 2002. • Verma B.L, Shukla G.D and Srivastava.R.N, Biostatistics – Perspectives in Health Care; Research and Practice, New Delhi: CBS Publishers & Distributors, 1993. • Veer Bala Rastogi, Biostatistics, Medtech publication, (3rd revised Edition), 2017. • Qazi Shoeb Ahmad, Viseme Ismail, Biostatistics, University Science press, new Delhi, (1st Edition), 2008. • Siegel, Sideny, Non-Parametric Statistics for Behavioral Sciences, New Delhi: MCGraw Hill, 2006.	
Text Books	• Gupta. C.B, An Introduction to Statistical Methods, New Delhi: Vikas Publishers, (23rd Ed), 2004. • Gupta. S.P, Statistical Methods, New Delhi: Sultan Chand, 2017.	

	• Goon, A.M., M. K. Gupta and B. Das Gupta, Fundamentals of Statistics- Vol. II., World Press, Ltd, Kolkata. 2016. • Hogg. R.T. and A.T. Craig. A.T, Introduction to mathematical Statistics, (7thEd), 2012. • Rangaswamy, A Textbook of Agricultural Statistics, (3rd Ed), New Age International Publishers, New Delhi, 2020.
Websites	• https://www.biostat.washington.edu/about/biostatististics • https://www.agrimoon.com/wp-content/uploads/Statistics.pdf • https://fac.ksu.edu.sa/sites/default/files/stat_-book_introduction_to_statistics.pdf
Course Outcomes	On completion of the course, students should be able to do CO1: Solve problems using appropriate statistical measures CO2: Create and interpret visual representation of statistical data CO3: Acquire knowledge on different types of error and tests CO4: Learn about correlation and Regression and their applications CO5: Prepare different quality control charts such as $\overline{X}$*,R, P,np and c chart.*

Semester IV

21GTPU0001 – GANDHI'S LIFE, THOUGHT AND WORK (2 Credits)

OBJECTIVES

- To enable students to understand and appreciate the principles and practices of Gandhi and their relevance in the contemporary times.
- To develop character and attitude to follow Gandhian values and responsibilities in their personal and social life.

Specific Objectives of Learning:

This will make the students:

- To understand the life of Gandhiji in-depth.
- To get introduced to the relevant Gandhian philosophies.
- To apply the Gandhian concepts in the relevant context.
- To envision the Gandhian socio-economic, political and cultural ideas.
- To get educated on Gandhian lines in a multi-dimensional way.

Unit–1 : Life of Gandhi in brief: Early life in India – London Phase – South African Adventure - Struggle for total freedom in India – Martyrdom

Unit–2: Concepts of Gandhi's Philosophy, Truth and Nonviolence, Ends and Means, Right and Duties, Simple Living and High Thinking

Unit–3: Gandhi's concepts and their applications: Sarvodaya, Satyagraha, Santhi Sena Constructive Work

Unit–4: Gandhian Vision of Society: Self and society - Communal harmony, removal of untouchability and Equality of sexes – Policies: Decentralization of power, Gram Swaraj (Panchayatui Raj) and good governance - Economics of Swadeshi, Trusteeship, Bread Labour and Self-employment.

Unit–5: Gandhian Dimension of Education: Basic Education, Adult Education, Pluralism - Multilingualism, Religions and interfaith relations- Health; Diet, Nature Cure, Education on Health, Sanitation and Hygiene.

References:

- M.K. Gandhi: (1983), An Autography of the Story of My Experiments with Truth, Navajivan Publishing House, Ahmadabad.
- M.K. Gandhi: (1951), Satyagraha in South Africa: Navajivan Publishing House, Ahmadabad.
- M.K. Gandhi: (1983), Constructive Programme" Its Meaning and Place. Navajivan Publishing House, Ahmadabad.
- M.K. Gandhi: (1948) Key to Health, Navajivan Publishing House, Ahmadabad.

- M.K. Gandhi: (1949), Diet and Diet Reforms, Navajivan Publishing House, Ahmadabad.
- M.K. Gandhi: Basic Education, Navajivan Publishing House, Ahmadabad.
- M.K. Gandhi: (2004), Village Industries, Navajivan Publishing House, Ahmadabad.
- M.K. Gandhi: (1962), Hindi Swaraj, Navajivan Publishing House, Ahmadabad.
- M.K. Gandhi: (2004), Trusteeship Dreams, Navajivan Publishing House, Ahmadabad.
- M.K. Gandhi: (2001), India of my Dreams, Navajivan Publishing House, Ahmadabad.
- M.K. Gandhi: Self Restraint Vs. Self Indulgence, Navajivan Publishing House, Ahmadabad.
- Arunachalam: Gandhi: (1985), The Peace Maker, Gandhi Samarak Nidhi, Madurai.
- R.R. Prabhu & UR Rao. The Mind of Mahatma Gandhi, Navajivan Publishing House.

Semester IV

21DPTV0425 - DAIRY PLANT DESIGN AND LAYOUT (Credits 3)

Objectives

- To give an opportunity for students to understand about the construction of dairy plant
- To understand about various factor to be considered on constructing the plant

Learning Outcomes

- Students acquire knowledge on arrangements of equipments in dairy plant
- Students get idea about the various factors influence the construction of dairy plant
- It provides knowledge on indoor arrangements of dairy plant.

Unit I : **Introduction:** Type of dairies, reception flexibility. Classification of dairy plants, Location of plant, location problems, selection of site. Dairy building planning, plant site selection basis of dairy layout, importance of planning, principles of dairy layout. Space requirements for dairy plants, estimation of service requirements including peak load consideration. Effective planning, layout design, and service requirement estimation are crucial for the successful operation of dairy plants, ensuring efficiency, compliance, and flexibility to meet market demands.

Unit II : **Designing sections of layouts:** General points of considerations for designing dairy plant, floor plant types of layouts, service accommodation, single or multilevel design. Arrangement of different sections in dairy, fitting the process sections, utility/service sections, offices and workshop. Designing the sections of layouts for a dairy plant involves creating a functional and efficient arrangement of spaces that cater to various operations, ensure smooth workflows, and comply with health and safety standards.

Unit III : **Planning of layout:** Arrangement of equipment, milk piping, and material handling in dairies, Common problems, and office layouts- flexibility. Development and presentation of layout, model planning, and use of planning

table in developing plot plant and detailed layout. Planning the layout of a dairy plant involves creating a well-organized, efficient space that facilitates smooth operations, maintains high hygiene standards, and meets safety and regulatory requirements.

Unit IV : **Construction materials:** Choice of building construction materials, floors, general requirement of dairy floor finishes, floors for different section of dairy. Foundations, walls doors and windows, Drains and drain layout for small and large dairies. Ventilation, fly control, rodent control and illumination in dairy plants. Selecting the appropriate building construction materials for a dairy plant is crucial to ensure durability, hygiene, safety, and efficiency.

Unit V : **Drawing of layout:** Measurements in drawing, Design and layout of: Milk collection/chilling centre; Fluid milk plant (small, medium and large); Single product dairy (i) Cheese, (ii) ice-cream, (iii) butter and (iv) ghee; Composite dairy plant. AutoCAD: Widely used for detailed and precise architectural drawings. Allows for layering and annotation. Revit:: Provides tools for building information modeling (BIM), useful for complex layouts. SketchUp: User-friendly for 3D modeling and conceptual layouts. Visio or Similar Diagramming Tools: Useful for simpler, less detailed layouts or flow diagrams.

References:

Text books:

1. Tuffel Ahmad 1995, Dairy Plant Engineering and Management, Kitab Machal Distributers, New Delhi
2. LalatChander, 2009, Dairy plant layout and Design.
3. Shivashaya singh-2013 Dairy Technology- New India publishing agency- INDIA.
4. Sukumar De 1980, Outlines of Dairy Technology. Oxford University Press, New Delhi.
5. Suni.M., Patel .A.G, Bhadania-2016-Dairy plant Design and layout – ICAR-Publications

Website:

- www.agrimoon.com

Semester IV

21DPTV0426 - DAIRY PLANT MANAGEMENT (Credits 3)

Objectives

- To make up the basic knowledge of management and maintenance of dairy plant and mechanics followed in dairy industry.
- To make up the basic knowledge of layout facilitates in dairy industries.

Learning Outcomes

- Students will learn on managerial strategies in dairy plant.
- Students will get to know about the quality control and quality assurance.
- This course provides knowledge for students on break even analysis, Human resources management and related skills.

Unit I : **Process Strategy and Forecasting:** Process strategy – Operation strategy – Product design – Process selection. Focuses on optimizing production processes, choosing appropriate technologies, ensuring quality control, and maintaining equipment. Involves production planning, technology selection, process optimization, and staff training.

Unit II : **Quality and Performance Management:** Quality – Quality policy – Quality analysis – Quality Assurance – Operation performance – Human Resource Management- Lean Manufacturing – CIP. Standard Operating Procedures (SOPs): Develop detailed SOPs for every stage of production, including milk reception, processing, packaging, and storage. Quality Control Checks: Implement routine checks and tests at critical points (e.g., raw milk testing, pasteurization monitoring, final product testing).

Unit III : **Decision Analysis and Financial Management:** Approaches to Decision making – Break Even analysis –Methods of Economic analysis**.** By integrating effective decision analysis with robust financial management practices, a dairy plant can make informed decisions that optimize operations, improve financial

performance, and achieve long-term success.

Unit IV : **Store keeping and Inventory Management:** basic concepts of store keeping – Layout of store –Inventory Management – Types – objectives – Classification of inventory. By effectively managing store keeping and inventory, a dairy plant can improve operational efficiency, reduce costs, and ensure that products are available to meet customer demand. Integrating the practices with advanced technology and continuous improvement strategies enhances overall performance and competitiveness.

Unit V : **Production management:** Production planning and Control - forecasting – Aggregate Planning-Work motion and time study- Plant Maintenance- Prevention and Break-down maintenance - Safety hazards -hazards prevention security for plant machinery. Effective production management ensures that dairy products are produced efficiently, meet quality standards, and are delivered to customers on time. By integrating planning, control, improvement, and compliance practices, dairy plants can achieve operational excellence and enhance their competitive edge in the market.

References:

Text books:

1. Ananthakrishnan .C. P and N. N. Sinha (1987), Technology and Engineering of Dairy Plant Management, Lakshmi Publication, Ansari road, Delhi.
2. James. N. Marner (1975), Principles of dairy processing, wiley eastern limited, New Delhi.
3. Pillai. R. S. N and Bagavathi., 2002, Modern Marketing Principles and Practices, S.Chand& Company Ltd., New Delhi.
4. Ramasamy.D, 1999. Dairy Technologists Hand Book International Book Distributing Co, Lucknow.
5. Tuffel Ahmad 1995, Dairy Plant Engineering and Management, KitabMachal Distributers, New Delhi.

Reference book

1. David, J. 2007. Contemporary Trends in Dairy Plant Management. Gyan Books Pvt. Ltd., Delhi
2. Warner, J. N. 1976. Principles of Dairy Processing. John Wiley Publ., New York.

Website

- http://ecoursesonline.iasri.res.in/mod/page/view.php?id=5691
- https://agrimoon.com/book/

Semester IV

21DPTV0427- FOOD SAFETY AND QUALITY STANDARDS (Credits 3)

Objectives

- To provide an opportunity to learn food safety and quality in relation to dairy industry
- To gain knowledge about the national and international quality standards.

Learning outcome

- Student will understand about various safety management systems to be followed and their application in dairy industry.
- This course will provide the students regarding various organizations/agencies that impose food safety regulations.

Unit I : **Food safety:** definition – responsibilities- traditional problems – emerging pathogens. Introduction to Risk Analysis, Risk Management, Risk Assessment, and Risk Communication. By implementing robust food safety practices, a dairy plant can ensure the safety and quality of its products, comply with regulatory requirements, and maintain consumer trust. Integrating food safety into every aspect of production helps prevent foodborne illnesses and enhances overall operational excellence.

Unit II : **Quality Management Systems:** definition – terminology - Principles of quality management systems – benefits of quality management systems. SOP - Verification and validation of control measures. A robust Quality Management System in food safety is essential for safeguarding public health, complying with regulations, and ensuring the consistent delivery of high-quality food products.

Unit III : **Food laws:** definition of food standards – food legislation – general food laws – main objectives of food law – general principles of food law- main features and functions. Integrated food law. Food laws form the backbone of a country's food safety framework, ensuring the well-being of consumers, promoting ethical trade practices, and protecting public health. Laws evolve

over time, adapting to new scientific findings, technological advances, and changing consumer preferences.

Unit IV : **Regulatory systems/agencies- I:** Role of national organizations such as FSSAI and AGMARK. Significance of APEDA in dairy industry. FSSAI works with various national and international organizations, research institutes, and stakeholders to develop and implement food safety standards. AGMARK conducts training and workshops for farmers, traders, and other stakeholders involved in agricultural marketing. Promote awareness about quality standards, grading, and market practices.

Unit V : **Regulatory systems/agencies- II:** Role of International organizations such as ISO 22000-2018, HACCP, TQM and GMP in dairy industry. Achieving ISO 22000 certification improves global market access as it demonstrates a commitment to food safety and quality, which is essential in export markets. GMP helps dairy companies comply with national and international food safety regulations, thereby reducing the risk of legal issues and product recalls.

Text books:

1. Gould, W.A. and Gould, R.W. 1988. Total Quality Assurance a for the Food Industries, CTI Publications Inc, Baltimore.
2. Gupta, A., Sharma, P.C. and Verma, A.K. (2010). Application of food safety, management system (HACCP) in food industry. *Indian Food Industry*, 29 (2) 39-46.
3. Jacob Faergemand and Dort Jespersen 2005. Key elements and benefits of ISO 22000 , 18, ISO Management System.
4. Bureau of Indian Standards, Manak Bhavan , 9 Bahadur Shah Zafar Marg, New Delhi-110002.
5. Havelaar, A. H., Nauta, M. J., Jansen, J. T., 2004. Fine-tuning food safety objectives and risk assessment. International Journal of Food Microbiology, 93, 11–29.

Reference books:

1. Jessica Vapnek and Melvin Spreij. 2005. Prespectives and guidelines on food legislation with a new model food law. developement law services FAO legal Office. FAO of the UN, Rome.

2. Margret Will and Doris Guenther (Eds). 2007. Food quality and safety standards as required by the EU law and private industry, 2nd Edition.

Website :

- http://ecoursesonline.iasri.res.in/course/view.php?id=109
- www.health.gov.au/internet/wcms/Publishing.nsf/Content/health-pubs-jetacar-cnt.htm/$FILE/jetacar.pdf Accessed 27 June 2005.
- www.dti.gov.uk/quality/qms

Semester IV

21DPTV0428 - PRACTICAL - V (Credits 3)

(DAIRY PLANT MANAGEMENT)

Learning Outcomes

- Students will get practice on designing layout for construction of new dairy plant installation.
- This course will provide practical knowledge to students on operating various equipments.
- It provides practical knowledge on various quality management systems.

1. Designing a layout for pasteurized and homogenized milk processing unit
2. Designing a layout for dairy product preparation unit.
3. Designing a layout for condensed and spray drying unit.
4. Study on various machineries used in milk processing unit
    - Pasteurizer
    - Homogenizer
    - Packaging machines
    - Cream separator and clarifier
    - Butter churner
5. Setting up laboratories to support TQM system
6. Assessment of hygiene of personnel working in the plant
7. Assessment of packing materials for hygiene
8. Design a HACCP tree for milk shed area
9. Design a HACCP tree for milk processing industries
10. Visit to Tamilnadu Food Safety and Drug Administration Department

Semester IV

21DPTV0429 – IN PLANT TRAINING (Credits 6)

(QUALITY CONTROL)

Objective

- Students have to undergo In-plant training at an established dairy unit and should learn about all the following procedure.

Work Plan

1. Learn the application of computers in dairy plant.
2. Check for the safety aspects followed in dairy plant
    a) Machineries
    b) Various sources of hazards.
    c) Safety protection for employees.
    d) Check for physical safety in dairy unit.
3. Practice on internal and external audit conducted at dairy unit.
4. Plant Layout
    a) Design the layout of dairy plant layout
    b) Study the structure of layout and suggest improvements.
    c) Study on flooring, walls, ventilation, lighting and equipments
5. Study the constructional features, maintenance and operation of:
    a) Mechanical can washer
    b) Silo tank and Milk transport tank
    c) Bulk milk cooler
    d) Batch pasteurizer
    e) HTST pasteurizer
    f) Cream separator
    g) Homogenizer
    h) Sachet filling machine
    i) Roller drier
    j) Spray drier
6. Quality control
    a) Analysis for risks and management of risks

b) Find the various sources of contamination

1. At reception section
2. At processing section
3. At product manufacture section
4. At product storage section and silos
5. At packaging section

c) Study on plant environmental sources of contamination.

d) Check for the application of Food laws and Regulatory systems.

1. FSSAI
2. AGMARK
3. APEDA
4. HACCP
5. TQM and GMP

Assessment

Students who underwent the In-plant training should submit a report based on the daily routine activities that performed by them in the dairy processing and quality control unit. Also, they should submit report on the daily activities that they carried out with the details of date and timing. After the successful completion of In-plant training an examination along with a viva voce will be conducted and evaluated.

SEMESTER - V

Semester V

21DPTV0530 - DAIRY ECONOMICS, MARKETING AND ENTREPRENEURIAL SKILLS (Credits 3)

Objectives

- To provide the knowledge about economic relevant to dairy sector.
- To workout the cost of economics in an area related to dairy farm, small scale dairy units and industry.
- To expose the students about the scope for identifying and establishing enterprise in their locality.

Learning Outcomes

- Students will understand how an economic balance to be maintained in dairy sector
- Students will gain knowledge on various aspects of marketing of dairy products
- Students will understand about market and marketing theories.
- This course provides idea on starting of cottage and small scale industries.
- Students will show their enthusiasm in startup of industries and develop their Entrepreneurship skill with various training.
- This course also provides information on various regulatory laws involved in food processing.

Unit I : **Introduction to Entrepreneurship;** Definition – concept – industrial small entrepreneurship- meaning-important-signification and scope- characteristics of entrepreneur-Factors influence rural entrepreneurial development. Process of designing, launching, and running a new business, typically starting as a small venture that offers a product, service, or innovation to the market.

Unit II : **Economics of Different sizes of Dairy units and Economics of Milk Products:** Requisites of economic return from Dairy Farm – Economic traits – Farm size, location and farm soil conditions, climate of the area – Number of cows and fodder – Milk production capacity of individual cows. The cost and return of ten cow and ten buffalo dairy unit. Cost benefit analysis of different milk products – Khoa, Paneer, Dahi, Butter, Cream, Ghee, Ice cream and Flavoured milk, Premium Pricing: Specialty products, such as organic

milk, grass-fed dairy, and artisanal cheeses, often command premium prices.

Unit III : **Market and classification:** Definition of market – concepts in marketing and management – Marketing: marketing area – classification of markets – approaches to marketing problems – marketing costs and margin – SCM – process – flow – components – decision making with SCM. Successful marketing and branding are essential for maximizing the profitability of value-added products.

Unit IV : **Registration & Financing:** Identification of opportunities - choice of product - preparation of feasibility - Report- Registration and Licensing - Financial assistance Nationalized banks - DIC – KVIC. Incentives and Government support from Ministry of Agriculture – Dairy sector, GOI. Startup India program to encourage innovation in the dairy sector. Financial support, incubation centers, and mentorship for startups focusing on dairy technology, value-added products, and sustainable practices.

Unit V : **Regulatory Laws:** Central Excise – Income Tax – Sales Tax – GST –features and merits-Export and Import Regulatory Acts. GST Laws**:** Governed by the Central Goods and Services Tax Act, 2017 (CGST Act)**,** Integrated GST Act (IGST) for interstate transactions, and State GST Acts**.**

References:

Text books:

1. A.S.Kahlon, Karam Singh, 1981. Economics of Farm Business Management in India, Allied Publishers Private Limited.
2. C.P.Annathakrishnan and B.N.Padmanabhan, 1989-Dairy farming and Milk Production. Madras: Shri Lakshmi Publications,
3. R.S.N.PillaiBagavathi, 2002, Modern Marketing Principles and Practices, S.Chand& Company Ltd. New Delhi
4. Entrepreneurial Development, 2005, Khanka, S.S., published by S.Chand & Co.publications,New Delhi.

Reference Book:

1. Daniel Stanton 2017 “Supply Chain Management” 1st edition, Dammies, New Delhi.

Semester V

21DPTV0531- WASTE DISPOSAL AND EFFLUENT TREATMENT (Credits 3)

Objectives

- To disseminate the knowledge pertaining to waste water treatment in dairy food processing plants.
- To understand environmental issues and remedial measures in dairy industrial sector and to develop the skill for friendly environment management in the industrial sector.

Learning Outcome

- This course provides knowledge about the importance of environment and ways to protect the environment.
- Students will know about the quality of water supplied to farm and dairy plant.
- Students will understand about dairy waste produced in plant and their treatment and disposal process.

Unit I : Environmental hygiene- introduction – air quality control in dairy processing areas- air filtration for indoor air qualities – HNAC (Heating, Ventilating and air condition) - out door environment clean room operation. Environment protection acts: Issues concerning release of genetically engineered microorganisms in environment; environmental laws. Awareness: Increasing awareness among the public and industries about environmental laws and their benefits is essential for compliance.

Unit II : Water- Quality of farm and plant water supplied – Routine and special methods for water analysis, purification of water – Requirement of water for farm and plant. Integrated Water Resource Management (IWRM): Coordinated approach to managing water resources across different sectors and users.

Unit III : General Characteristics of dairy waste – introduction- source of dairy waste- objectives of treating dairy waste – composition of dairy waste. Sewage: types, flora of sewage. Industrial Sewage: Produced by industrial activities, including dairy processing plants. Higher levels of pollutants, chemicals, and

heavy metals depending on the industry.

Unit IV : Treatment and disposal of dairy waste water: Disposal methods – Sources of effluents and their recycling in dairy industry – Biogas formation, Panchakaviya. Zero discharge. Advanced Filtration: Uses technologies like membrane filtration (e.g., microfiltration, ultrafiltration) to remove remaining particulates and contaminants.

Unit V : Definition, standard, determination procedure of BOD and COD. Waste water discharge standards. Enforcement: Regulatory bodies enforce standards through inspections, penalties for non-compliance, and corrective actions.

References:

Text books:

1. Kumar, H.D. 1998. Environmental Pollution and Waste Management. MD Publ. Pvt. Ltd., New Delhi.
2. Maliwal, G.L. 2007. Hand book of Environmental Management. Agrotech Publ. Academy, India.
3. Kamayoprs J.S 2010 “central pollution control board” published by sri mathi mita Sharma.

Reference Book

1. Jeffer pierce 1997 “environment pollution and control” published by butterworth – Heinemann.

Website

- http://ecoursesonline.iasri.res.in/course/view.php?id=115
- https://agrimoon.com/book/

Semester V

21DPTV0532 - PACKAGING AND JUDGING OF MILK PRODUCTS (Credits 3)

Objectives

- To impart advanced knowledge about dairy product packaging to extend the shelf life of product by favorable appropriate packaging material and advanced techniques.
- To impart knowledge about the judging and grading of dairy product in the industrial level.

Learning Outcomes

- This course provides knowledge on packaging materials used in dairy industry.
- Students will learn about the various properties of packaging materials and their effects over the packed food.
- Students will get idea regarding the threshold value, sensory evaluation and its methodologies in dairy products.

Unit I	:	**Packaging materials** –Define- types of packaging materials – aluminum foils/containers, glass, LDPE, HDPE, PET, polystyrene, polypropylene, PVC, Multi-layer sheet/film -disposal packaging materials – dump filling - incineration – reuse – recycling packaging materials. Packaging – function – use of different material in milk and milk products. Edible and Plant-Based Materials: Development of new materials - biodegradable or edible to reduce waste.
Unit II	:	**Coding and Labeling:** Packaging and labeling FSSAI regulations 2011-Packaging requirements for milk and milk products-Bottling-filling-wrapping-sealing- after packaging- Labeling requirements for milk and milk products- Pre-packaged foods-Nutritional information-Declaration-Veg-Non-Veg-Food Additives- Manufacturer details-Specific requirements. Smart Packaging: Technology Integration: Incorporation of sensors, QR codes, and RFID for improved tracking, safety, and consumer interaction.
Unit III	:	**Packaging techniques**– Packaging technique like vacuum packaging,

		modified atmospheric packaging (MAP) ,oxygen absorbers/scavengers, poly clip system – zip lock method, aseptic packaging – definition and types. Compatibility and toxicity of packaging materials. Multi-Use Packaging: Design packaging for secondary uses or easy repurposing.
Unit IV	:	**Tests for Packaging material**– Types of tests for packaging materials- Odour test-width test - Thickness tests - INK test-Impact resistance test-Leak test-Drop test. Testing packaging materials - performance, safety, and regulatory requirements.
Unit V	:	**Judging and grading –** defects in milk, score card and its uses – judging and grading of milk- judging and grading of fat rich products - judging and grading of frozen dairy products - judging and grading of concentrated milk products - Judging and grading of dried milk products - judging and grading of fermented milk products- judging and grading of indigenous milk sweets. Quality and Freshness: For perishable items, grading may be based on freshness, shelf life, or bacterial content.

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Semester V

21DPTV0533 - DAIRY TECHNOLOGY – II

(FAT AND PROTEIN RICH DAIRY PRODUCTS) (Credits 3)

Objectives

- To impart knowledge regarding fat and protein rich milk products.
- To gain hands on training on production on fat and protein rich milk products.

Learning Outcomes

- Students will learn on methods of cream production, butter production and ghee manufacture.
- Students get to know about preparation of protein rich dairy products and their importance.
- Students will gain knowledge on storage, merits and demerits of fat and protein rich products.

Unit I	:	**Cream:** definition – chemical composition - types of cream – production technique- physiochemical properties – effect of fat percentage of cream on its specific gravity – defects and control measures. Neutralization of cream. High-Speed Separators: Efficiency: High-speed separators increase cream yield and reduce milk loss. Higher rotational speeds than traditional centrifuges, improving separation and reducing energy consumption.
Unit II	:	**Butter:** history - definition - standards – physicochemical characteristics – classification of butter - method of manufacture – theory of churning - over run – defects and control measures. Continuous butter making. Margarine: characteristics and types of margarine. Precision Butter Workers: Modern butter working systems use precise mechanical action to knead the butter, ensuring an even distribution of moisture and salt while preventing the formation of large air pockets.

Unit III	:	**Ghee:** definition – standards - method of manufacture – organoleptic and physiochemical properties – defects and control measures. Difference of ghee and butteroil. Importance of ghee in India. Ghee residue: definition – composition – utilization of ghee residue – nutritional benefits. Advanced ghee processing technology - improving production efficiency, quality, and sustainability.
Unit IV	:	**Cheese:** definition – standards - origin and history of cheese – milk clotting enzymes from different sources (animal and plant) - rennet – factors affecting rennin action – coagulation - method of manufacture of cheese - defects and control measures. Advanced methods are also being developed for plant-based cheeses, which use plant protein isolates (e.g., from soy, peas, or almonds) as a base. Modern fermentation techniques are employed to mimic the textures and flavors of traditional dairy-based cheeses.
Unit V	:	**Cheese varieties:** definition, composition, standards, types of cheese, production techniques and defects and control measures of cheddar cheese - cottage cheese - mozzarella cheese - processed cheese - cheese spread - pizza. Advanced cheese plants use RFID (Radio-Frequency Identification) and blockchain technology for traceability.

References:

Text books:

1. Aneja.R.P, B.N Mathur, R.C Chandra and A.K. Banerjee (2002)., Technology of Indian Milk Products, Dairy India year book 2007.
2. Eeckless C.H, W.B Combs and H.Mecy (1955), Milk and Milk Products, Tata McGraw Hill Publishing Co. Pvt.Ltd. New Delhi.
3. Ramasamy, D (1999) Dairy Technologist's Hand Book, International Book distributing Co, Lucknow.
4. Sukumar De (1980) Outlines of Dairy Technology, Oxford University Press, New Delhi.

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1. Rangappa, K.S. and Acharya, K.T. 1974. Indian Dairy Products. Asia Publishing House, New Delhi.
2. Mathur MP, Roy DD &Dinakar P.1999. Textbook of Dairy Chemistry. ICAR.
3. Anantakrishnan, C.P. and Srinivasan, M.R.1964. Milk Products of India. ICAR Publications, New Delhi.

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Semester V

21DPTV0534 - DAIRY TECHNOLOGY – III (Credits 3)

(TRADITIONAL DAIRY PRODUCTS)

Objectives

- To project the significance and status of traditional dairy products in Indian dairy industry.
- To gain and understanding of manufacturing methods of traditional dairy products

Learning Outcomes

- Students will acquire knowledge on various traditional dairy products and their methodology of preparation.
- It makes the students to prepare the tradition products on their own.
- Students will get understand about value addition and their application in dairy industry.

Unit I : **Indigenous dairy products:** definition – present status and market potential of traditional dairy products – globalization of traditional dairy products – classification of traditional milk products. Automation in Sweet Production - Improved Sugar Syrup Management.

Unit II : **Heat desiccated milk products:** Khoa – Classification- methods of manufacture – Factors affecting yield of khoa –yield and cost analysis of khoa. Confectionaries made from khoa –burfi, peda, milkcake, kalakand, gulabjamun, rabri, malai, khurchan, basundhi – composition – manufacturing practices – Nutritive value. Advanced Spray Drying Techniques - Instantizing Technologies - Automated Quality Monitoring.

Unit III : **Heat acid coagulated product:** Paneer: definition- mechanization of paneer manufacturing - paneer based products – storage and packaging and preservation methods – Nutritive value of paneer. Automated Paneer Production Systems - Continuous Paneer Machines - Enhanced Acidification Techniques. Advancements in the production of heat acid coagulated products reflect a significant shift towards increased efficiency, quality, and

sustainability.

Unit IV : **Channa based products:** Chhana – Product description, methods of manufacture, packaging and preservation. Chhana based sweets – Rasogolla, Sandesh, Rasamalai, and Chhanapodo - their manufacturing practices, compositional profile and mechanization of manufacturing process including packaging . Eco-Friendly Packaging - The use of sustainable, recyclable, or biodegradable packaging materials is encouraged to reduce the environmental impact of packaging waste.

Unit V : **Milk based pudding desserts:** Kheer and Payasam – Product description, methods of manufacture- sensory evaluation- value added dairy products – definition –types – method of manufacture – packaging processes (canning) – interaction between milk and cereal constituents- yield and cost benefit analysis. Automated Cooking and Mixing Systems - Precision Gelation and Thickening - Enzyme-Based Gelling Agents.

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Text books:

1. Aneja.R.P, B.N Mathur, R.C Chandra and A.K. Banerjee 2002,Technology of Indian Milk and Milk Products, Dairy India Publication
2. Dairy India year book 2007 & 2017, A- 25 Priyadarshinivihar, Delhi 110092, India.
3. David.J, 2009 "Technologies advanced in indigenous milk products" published by KitabMahal, 22-A, Sarojini Naidu Marg, Allahabad (2nded).
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5. Sukumar De (1980), Outlines of Dairy Technology, Oxford University Press, New Delhi.

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1. Dharam Pal and Narender Raju, P. (Eds). (2006). Developments in Traditional Dairy Products, Lecture Compendium of the 21st Short Course, CAS in Dairy Technology, NDRI, Karnal.
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Semester V

21DPTV0535 - DAIRY TECHNOLOGY - IV (Credits 3)

(CULTURED, FROZEN AND DRIED MILK PRODUCTS)

Objectives

- To impart knowledge regarding frozen, fermented, concentrated and dried milk products.
- To gain hands on training on production on frozen, fermented, concentrated and dried milk products.

Learning Outcomes

- Students will gain knowledge on various process flows for preparation of variety of frozen, fermented and condensed dairy products.
- This course provide knowledge on physiochemical properties of products including ice-cream, dairy powders and fermented dairy products
- Students will get to know about the technical problems involved in production of dairy products.

Unit I : **Fermented milk products**: Definition, specifications, and method of manufacture of dahi, yoghurt, acidophilus milk, kefir, kumiss, bulgarian butter milk, mistidahi and lassi. Chakka and shrikhand – product description and sensory evaluation. Advanced Fermentation Technologies - Probiotic and Functional Yogurts - Automation and Quality Control - Probiotic Enrichment.

Unit II : **Ice cream and Kulfi**: definition- specifications – role of the constituents in ice cream - properties of ice cream mix – action of stabilizers and emulsifiers in ice cream - production techniques of ice cream – defects and control measures. Advanced Freezing Technologies - High-Pressure Freezing (HPF) - Cryogenic Freezing - Continuous Freezing Systems.

Unit III : **Condensed milk and evaporated milk:** Definition - composition - standards – types of condensed milk - method of manufacture – pilot sterilization test - defects and control measures. Advanced Concentration Technologies - Efficient Milk Processing - Advanced Evaporation Techniques.

Unit IV : **Whole milk and skimmed milk powder:** definition – standards - types – mechanism of spray drying and roller drying – production technique - instantization- keeping quality of milk powder - defects and control measures. Advanced Drying Technologies - Processing Enhancements - Processing and Filtration - Nutritional Enhancements

Unit V : **Dried milk products:** Composition and method of production of infant milk powder - malt milk powder – ice cream mix powder - gulabjamun powder - whey powder - casein powder - milk protein concentrate powder (MPC). Advanced Filtration Technologies - Cross-Flow Filtration - Advanced Concentration and Processing – Fortification - efficiency**,** quality, sustainability.

References:

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1. Sukumar De (1980) Outlines of Dairy Technology, Oxford University Press, New Delhi.
2. Aneja.R.P, B.N Mathur, R.C Chandra and A.K. Banerjee (2002)., Technology of Indian Milk Products, Dairy India year book 2007.
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Semester V

21DPTV0536 -PRACTICAL VI (Credits 6)

(PRODUCT DEVELOPMENT – I)

1. Preparation of cream
2. Estimation of chemical composition of cream
3. Preparation of butter
4. Preparation of butteroil and ghee
5. Estimation of chemical composition of butteroil and ghee
6. Preparation of khoa and Peda
7. Preparation of Burfi
8. Preparation of Gulabjamun
9. Preparation of Channa based products: Paneer and Rasogolla
10. Sensory evaluation, Judging and packaging of following products;
    a. Milk.
    b. Cream
    c. Butter
    d. Ghee
    e. Condensed and evaporated milk
    f. Cheese and related products
    g. Frozen products
    h. Khoa and khoa based sweets
    i. Fermented dairy products
11. Detection of sugar, starch and glucose in milk
12. Detection of neutralizer in milk by Rosalic acid test and Alkalinity of ash test
13. Detection of formaldehyde in milk by Hehner / Chromotropic acid/ Leech Test
14. Detection of Ammonium Sulphate in milk
15. Detection of Vanaspati in Ghee
16. Test for Skimmed Milk Powder in Natural Milk

Semester V

21DPTV0537- PRACTICAL VII (Credits 6)

(PRODUCT DEVELOPMENT – II)

1. Preparation of ice cream
    a. Softy ice cream
    b. Honey ice cream
    c. Ginger ice cream
    d. Chocolate ice cream
    e. Fruit based ice cream
2. Estimation of chemical composition of ice cream
3. Preparation of Dahi
4. Preparation of Yoghurt
5. Estimation of chemical composition of dahi and yoghurt.
6. Preparation of acidophilus milk.
7. Preparation of Kumis.
8. Preparation of Lassi.
9. Preparation of Fermented products from whey.
10. Preparation of Beverages from whey.
11. Preparation of Basundhi.
12. Preparation of Flavored Buttermilk
13. Preparation of Probiotic dairy product

SEMESTER - VI

Semester VI

21DPTV0638 - DAIRY NOVELTIES AND MODELING (Credits 5)

Objectives

- To gain knowledge on the latest concept in area related to dairy production and technology.

Learning Outcome

- Students will get practical knowledge on development of new dairy products and value addition for dairy products.
- Students will know about the technical and non technical issues involved in development of new products.

Work Plan

The student should develop new/improved products or create latest data base or analytical procedures or low cost methods or waste utilization and value addition methods in the area related to dairy production and technology. At the completion of the project the student will submit a project report. The evaluation will be based on the project report and a viva voce examination on the project.

21DPTV0639 – IN PLANT TRAINING (Credits 25)

(OVERALL DAIRY INDUSTRY)

Objective

- Students have to undergo Inplant training at an established dairy unit and should learn about all the following procedure.

Work Plan

1. Reception
    a. Record milk inlet
        i. Record the details of milk route and cans.
        ii. Weighing and fat percentage of inlet milk.
    b. Laboratory
        i. confirm the quality of received milk
        ii. analysis of proximate composition
    c. cleaning and sanitation
        i. Preparation of cleaning solution.
        ii. Proper usage of cleaning and sanitizing solution.
2. Documentation
    a. Record all the reading at various dairy sections
        i. Reception section
        ii. Processing section
        iii. Packaging section
        iv. Waste management section
        v. Transportation and storage.
        vi. Product preparation
        vii. Ingredient section - Prepare balance sheet and maintain the record.
    b. Document all the recorded values and management of records.
3. Product section
    a. Work at various product sections and document the process.
        a) Condensed and Evaporated milk section
        b) Frozen product section.
        c) Fermented product section

d) Preparation of Condensed whey
e) Dried powder

b. Standardize the process.
c. Check for quality and proximate analysis of all products produced
d. Document the quantity and quality of produced products.

4. Planning and execution
    a. Make work plan for employees.
    b. Assign the works for workers and confirm their working schedule.
    c. Plan on production process
5. Waste management
    a. Analysis the amount of waste produced in plant.
    b. Prepare procedure for management of waste.
    c. Learn about ETP Detection of heavy metals in milk.
    d. Detection of pesticide residue in milk.
    e. Detection of antibiotics.
    f. Estimation of BOD and COD.
    g. Conventional and modern treatment methods of dairy waste.
6. Research and Development
    a. Work at Research and Development department with guidelines of senior workers and learn various aspects involved in development of new product.
7. Practice on managerial skills to run a plant

Assessment

Students who underwent the In-plant training should submit a report based on the daily routine activities that performed by them in the dairy processing unit. Also, they should submit report on the daily activities that they carried out with the details of date and timing. After the successful completion of In-plant training an examination along with a viva voce will be conducted and evaluated.

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