FACULTY OF AGRICULTURE AND ANIMAL HUSBANDRY

M.Sc.,DAIRY SCIENCE
SYLLABUS- 2015

GANDHIGRAM RURAL INSTITUTE (DEEMED UNIVERSITY)

GANDHIGRAM - 624 302

DINDIGUL DISTRICT,

TAMIL NADU.

FACULTY OF AGRICULTURE AND ANIMAL HUSBANDRY

GANDHIGRAM RURAL INSTITUTE – DEEMED UNIVERSITY
Re-Accredited by NAAC with "A" Grade
M.Sc.,DAIRY SCIENCE

M.Sc., DAIRY SCIENCE

The Faculty of Agriculture & Animal Husbandry is offering an M.Sc Dairy Science programme. The Programme is characterized by the personalized teaching approach, as well as the substantial opportunities, students have to obtain "hands-on" experience. This two year programme has been designed to furnish students with in-depth, Comprehensive study in Dairy science, Dairy production and management with greater emphasis on Dairy technology, Quality control of Milk and Milk products, Processing and Clean Milk Production. "Hands-on" training is imparted to the students in Artificial insemination, Pregnancy Diagnosis, Vaccination and treatment of common ailments.

OUTLINE OF THE COURSE

The duration of the Programme is 4 semesters which covers Animal Husbandry and Dairying in an elaborate manner. Forage crop production, Dairy Extension and Computer applications in dairy business are the additional subjects dealt in the programme. The medium of instruction is English.

OBJECTIVES

1. To train the students in modern dairy husbandry practices so that they can run a dairy farm as a commercially viable full time business.
2. To impart practical knowledge in clean milk production, processing of milk and preparation of milk products and
3. To provide knowledge in organization of Farmer's Cooperatives and Quality control of milk so as to give them an opportunity to get employment in Cooperative Milk Producers Union Limited, and in private dairy product factories.

ADMISSION ELIGIBILITY

(i) Any B.Sc., degree with Biology subjects as major or ancillary level from a recognized University **(or)** B.Sc., RDS / B.V.Sc. & AH / B.Sc., Ag. / B.Sc., Horti. / B.Sc., Animal Science / B.Sc., Home Science / B.Sc., Food & Nutrition / B.Sc Microbiology from a recognized University.

SCOPE

The individual after the completion of the programme may seek employment in private dairy farm, milk processing plants and dairy product factories. They can also start a dairy farm of their own as a self-employment programme. The students can also run an Artificial Insemination centre.

FACULTY OF AGRICULTURE AND ANIMAL HUSBANDRY			
M.Sc., Dairy Science Programme Revised syllabus with effect from July 2015			
Scheme of Examinations			
I SEMESTER			
Code No.	**Name of the Subject**	**Credit**	**Marks**
15ANHP0101	Dairy Cattle Production	3+1	150
15ANHP0102	Dairy Cattle Nutrition and Forage Crop Production	3+1	150
15ANHP0103	Dairy Chemistry	3+1	150
15ANHP0104	Market Milk	2+1	150
15ANHP0105	Principle and Applications of Laboratory Instruments	0+1	50
15AGMP0102	General Microbiology	2+1	150
Total		**13+6**	**800**
15GTPP0001	Gandhian Thought**	2+0	100
II SEMESTER			
15APRP0001	Research Methods	4+0	100
15APRP0002	Applied Statistics	4+0	100
15ANHP0206	Dairy Engineering	3+1	150
15ANHP0207	Dairy Plant Management	2+0	100
15AEXP0214	Dairy extension	3+1	150
	Non Major Elective	3+1	150
Total		**19+3**	**750**
15CSKP0201	Soft Skills**	2+0	100
III SEMESTER			
15ANHP0308	Technology of Milk Products	3+1	150
15ANHP0309	Chemistry of Milk products	2+1	150
15ANHP0310	Indigenous Dairy Products	3+2	150
15ANHP0311	Pollution Control and Environmental Safety	2+1	150
15ANHP0312	Advances in By Products Technology*	2+0	100
15ANHP0313	Major Elective	3+1	150
15VPPP0301	Village Placement Programme	2+0	100
Total		**17+6**	**950**
15ETNP0301	Field Visit/ Extension***	0+2	100
IV SEMESTER			
15ANHP0414	Dairy Microbiology	3+1	150
15ANHP0415	Packaging and Judging of Dairy Products	2+1	150
15ANHP0416	Food Safety and Quality Auditing*	2+0	100
15ANHP0417	Dissertation	4+0	100
15ANHP0418	Credit seminar	2+0	100
15ANHP0419	Inplant Training	0+5	100
Total		**13+7**	**700**
15ETNP0401	Field Visit/ Extension***	0+2	100

Note:

***** Modular courses will have no component of ESE and are to be evaluated by CFA only.

******Compulsory Non Credit Course (CNCC) to be taken by the student compulsorily but these will not be calculated of GPA & CGPA.

******* Field visit/ extension marks will not be considered for the calculation of GPA & CGPA.

Abstract

Semester	Theory	Practical	Total	Total Marks
I	13	6	19	**800**
II	19	3	22	**750**
III	17	6	23	**950**
IV	13	7	20	**700**
Total	**62**	**22**	**84**	**3150**

I SEMESTER

15ANHP0101 DAIRY CATTLE PRODUCTION (3+1)

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.

Theory

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.

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.

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..

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.

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, manager, drain etc. – Types of animal housing – conventional barn – loose housing.

Practicals

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

References

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.

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

Lecture Schedule

1. Introduction to dairying, advantages of dairying and role of dairying in Indian Economy.
2. Livestock census, milk production and availability.
3. Meaning of commonly used terms and Zoological classification of bovine.
4. Classification of breeds of cattle and distinguishing characteristics and production performance of indigenous breeds of cattle- Red Sindhi, Sahiwal, Gir and Kangayam.
5. Distinguishing characteristics and production performance of exotic breeds of cattle – Jersey, Holstein Friesian and Brown Swiss.
6. Distinguishing characteristics and production performance of buffalo breeds – Murrah – Surti - Nili-Ravi.
7. Objectives and dairy characteristics
8. Selection of individual cows and choice of breed.
9. Basic anatomy and physiology of reproductive system of bull
10. Basic anatomy and physiology of reproductive system of cow
11. Changes in female reproductive system during different phase of oestrous cycle
12. Signs of heat in cows and buffaloes
13. Concept and classification of cattle breeding systems, uses and consequences of inbreeding.
14. Various methods of out breeding and its uses.
15. Various methods used to measure the breeding efficiency of cows and bulls
16. Various steps involved in Artificial insemination – various methods of semen collection and macroscopic evaluation.
17. Microscopic and biochemical evaluation of semen, dilution and insemination
18. Frozen semen production and its advantages and disadvantages.
19. Handling of LN_2 containers and thawing of frozen semen.
20. Care of calf at birth, Meconium and Colostrum feeding.

21. System of raising calves, Milk replacer and Calf starter
22. Common ailments and their control – Scours, Pneumonia, and ringworm
23. Common ailments and their control –
24. Heifer management
25. Management of pregnant animals, signs pregnancy, diagnosis of pregnancy and feeding of pregnant cows.
26. Care of expectant cows, care at and after calving
27. Management of dry cows
28. Abortion - its causes and prevention
29. Etiology of retention of placenta, its treatment and prevention.
30. Anatomy of Mammary gland and physiology of milk secretion
31. Factors affecting milk yield and quality
32. General care of lactating animals
33. Strategies to improve fat and SNF content of milk
34. Clean milk production techniques.
35. Production of organic milk.
36. Cleaning and disinfection of dairy farm and milk room and recoed management
37. Preparation for milking – methods of hand milking.
38. Machine milking
39. Etiology, clinical signs, treatment and prevention of milk fever and mastitis.
40. Handling and restraining of dairy cow.
41. Casting, putting nose ring and string.
42. Dehorning – various methods its advantages and disadvantages
43. Castration and its advantages
44. Dentition and ageing – classification of teeth, parts of tooth, dental formula and determining the age of the cow.
45. Identification of dairy cow – tattooing, tagging and branding.
46. Selection of site for the farm buildings – planning and designing.
47. Construction details – Foundation – wall, floor, roof, manager, drain etc.
48. Types of animal housing – conventional barn and loose housing.

Learning Outcome

Unit I:

Instruction in lessons in Unit I should result in students achieving the following objectives;

1. Describe the size and contribution of dairying to Indian economy and rural livelihood
2. Describe the various breeds of dairy cattle, giving their origin and breed characteristics.
3. Identify various breeds of cattle and buffalo by viewing photographs or live animals.
4. Name the parts of dairy cattle and describe economically important traits.
5. Describe the characteristics of a good dairy cow
6. Select desirable breeding and production animals.
7. Identify the anatomical parts of the dairy animal.
8. Differentiate desirable from undesirable traits

Unit II:

Instruction in lessons in Unit II should result in students achieving the following objectives;

1. Describe the male and female reproductive organs.
2. Identify the signs of estrus and right time for insemination.
3. Able to identify suitable method of breeding for improving the productivity of herd
4. Able to determine the breeding efficiency of cows and bulls
5. Able to handle liquid nitrogen containers
6. Well versed with thawing of frozen semen straws and loading of AI guns.

Unit III:

Instruction in lessons in Unit III should result in students achieving the following objectives;

1. List the major roles of colostrum: energy, warmth, laxative, passive transfer
2. Know the correct amount and time frame for colostrum intake
3. Describe the feeding requirements of calves from birth to weaning.
4. Select suitable calf rearing systems for given requirements.

5. Prepare milk replacer in accordance with good farm practice.
6. Feed calves with liquid and solid feed in accordance with good farm practice.
7. Clean feeding equipment in accordance with good farm practice.
8. Maintain healthy and productive calves.
9. Identify good and ill health in calves.
10. Give first aid to common ailments of calves
11. Develop a better understanding of basic dairy heifer nutrition, management and healthcare.
12. Identify the external signs of pregnancy and parturition

Unit IV:

Instruction in lessons in Unit IV should result in students achieving the following objectives;

1. Prepare a milking shed for milking and clean the shed after milking.
2. Milk cows competently and efficiently
3. Demonstrate knowledge of cow mammary glands and milk bio synthesis
4. Adopt clean milk production techniques.
5. Produce organic milk.
6. Ability to maintain fat and SNF content at genetically determined level
7. Ability to handle milking machines

Unit V:

Instruction in lessons in Unit V should result in students achieving the following objectives

1. Ability to handle and restrain animals safely.
2. Acquired skill in putting nose ring, castration, dehorning tattooing, branding, tattooing and dentition and ageing of cattle.
3. Ability to prepare plans for housing of dairy cows.

I SEMESTER

15ANHP0102 DAIRY CATTLE NUTRITION AND FORAGE CROP PRODUCTION (3+1)

Objective

- The course is designed to provide a foundation in the principles of dairy cattle nutrition, dairy ration formulation and Forage Crop Production with emphasis on application of feeding programs on dairy farms.
- To impart the skills and knowledge in quality evaluation, improving forage yield and digestibility of feeds particularly the techniques that can be applied at farm level.

Theory

I. **Basic Animal Nutrition:** Nutrients of the feeding stuff – Water - Carbohydrate Protein – Fat – Vitamins and minerals – proximate principles of feed.

II. **Common feedstuffs:** Classification – Roughages – concentrates – root crops and tubers – pasture – Energy feeds – mill by products – oil cakes – urea feeding – silage making – hay making - adulterants and toxicants - improving the digestibility of roughage – chaffing - urea treatment – alkali treatment – molasses spray.

III. **Feeding:** Nutrient requirements of dairy cattle – DM, TDN and DCP requirements - Thumb rule method of feeding - Desirable characteristics of a ration - feed additives -probiotics – yeast culture - feeding of bypass proteins. Organs of digestive system – Alimentary canal - mouth - esophagus – stomach - intestine. Accessory digestive organs – salivary gland – liver – pancreas. Digestion and absorption of carbohydrates, protein and fat.

IV. **Introduction to forage crop production:** Importance of fodder production – Area, Production and Productivity in India and Tamil Nadu – Definition of Fodder

and Forage, Classification of Fodder crops – characteristics of an ideal fodder crop – Harvesting Techniques – Machineries – Pasture management – Agro-forestry - definition and benefits – Silviculture – Silvipasture - Hortipasture – Agri-Silvi- pasture.

V. **Production Technologies for fodder crops**: Agronomic packages for following crops: Fodder maize - Fodder sorghum - Cumbu-Napier - Guinea grass - Buffel grass (Cenchrus sp.) - Deenanath grass - Lucerne – Cowpea – Desmanthus – Stylo – Subabul - Sesbania and Glyricidia. Latest varieties and technologies for increasing yield of fodder grasses, legumes and trees.

Practicals

1. Estimation of moisture content of feed
2. Estimation of Ash
3. Study of parts of digestive system
4. Identification of feed ingredients
5. Urea treatment of paddy straw
6. Silage making
7. Hay making
8. Calculation of nutrient requirement
9. Visit to a feed mill
10. Identification of different fodder crops
11. Method of land preparation and sowing of fodder crops
12. Working out cost of cultivation for important fodder crops
13. Recording biometric and yield attributes of fodder crops

References

1. Banerjee, G.C., 2006. Feeds and principles of animal nutrition, second Ed. Oxford and IBH Publishing company pvt. ltd., New Delhi.
2. Ranjhan, S.K. 1993. Animal Nutrition and feeding practices, Fourth Ed., Vikas publishing house pvt. ltd., New Delhi
3. D.V.Reddy, 2001. Principles of Animal Nutrition and Feed Technology. Oxford and IBH Publishing Company, New Delhi.
4. Singh, R.V., 1982. Fodder trees of India, Oxford and IBH publishing Co.Pvt.Ltd., New Delhi..
5. Chatterjee, B.N and P.K.Das, 1989. Forage crop production – Principles and practices, Oxford and IBH, Publishing Co.Pvt.Ltd., New Delhi.

Lecture Schedule

1. Definition / meaning of terms commonly used in Animal Nutrition and importance of animal nutrition in maintaining animal health and milk production.
2. Water content of animal body and factors influencing it, functions of water and factors affecting water intake.
3. Sources and losses of water from the animal body and effects of water restriction
4. Definition, classification and functions of carbohydrates in animal body.
5. Classification and functions of amino acids and protein in animal body.
6. Classification and functions of fatty acids and lipids in animal body.
7. Functions, deficiency symptoms and sources of fat soluble vitamins.
8. Functions, deficiency symptoms and sources of water soluble vitamins.
9. Classifications and general functions of minerals in the animal body
10. Functions and deficiency symptoms of macro minerals
11. Functions and deficiency symptoms of micro minerals
12. Proximate principles of feedstuff.
13. Classification roughage – hay, straw , legume and non-legume, pasture and cultivated fodder, tree leaves, root crops and tubers.
14. Classification of concentrates, feeding value of energy rich concentrates – grains – tapioca and molasses.
15. Feeding value of mill by products.
16. Various types of oil cakes, nutritive value of groundnut, cotton seed, sesame, copra and soybean oil meal.
17. Principles of urea feeding, NPN compounds and their protein values and various methods of feeding urea
18. Factors affecting urea utilization and urea toxicity and its treatment.
19. Silage making – suitable crops, silo, methods of silage making, changes during fermentation, conditions for successful silage making and qualities of good silage.
20. Hay making - suitable crops, kinds of hay, method of hay making, various causes of nutrients loss during hay making nad qualities of good hay.
21. Toxic principles in common feedstuffs and methods to prevent their toxic effect.
22. Common adulterants in feedstuffs.

23. Improving the digestibility of roughage – chaffing, urea treatment, alkali treatment and molasses spray.
24. Calculating the DM, TDN and DCP requirements of dairy cattle for maintenance and milk production.
25. Thumb rule method of feeding and Desirable characteristics of a ration
26. Feed additives - Types of feed additives, Advantages of using feed additives, and Additives commonly used in dairy cattle feed.
27. Feeding of bypass proteins – Need for bypass proteins, Methods to increase Utilization of Crude Protein in Ruminants, Various methods of protecting protein from ruminal degradation and Benefits of bypass protein feeding**.**
28. Organs of digestive system – Alimentary canal - mouth - esophagus – stomach - intestine.
29. Accessory digestive organs – salivary gland, liver and pancreas.
30. Digestion and absorption of carbohydrates, protein and fat.
31. Introduction to and importance of fodder production
32. Area, Production and Productivity in India and Tamil Nadu
33. Definition of Fodder and Forage and Classification of Fodder crops – fodder cereals, fodder grasses – irrigated and rain fed – fodder legumes – fodder trees
34. Characteristics of an ideal fodder crop
35. Harvesting Techniques – Machineries for used for harvesting
36. Pasture management – need, importance and techniques for management of pasture.
37. Agro-forestry - definition and benefits – Agroforestry systems and advantages of Agro-forestry
38. Silviculture – Silvipasture - Hortipasture – Agri-Silvi- pasture.
39. Agronomic packages for fodder cereals - Fodder maize and Fodder sorghum
40. Agronomic packages for cultivated fodder crops - Cumbu-Napier - Guinea grass
41. Agronomic packages for rain fed fodder crops - Buffel grass and Deenanath grass
42. Agronomic packages for irrigated legume crops - Lucerne and Cowpea
43. Agronomic packages for rain fed crops– Desmanthus – Stylo
44. Agronomic packages for tree crops – Subabul, Sesbania and Glyricidia.

45. Latest varieties and technologies for increasing yield of fodder grasses and legumes – inter cropping, mixed cropping
46. Organic fodder cultivation.
47. New technologies in fodder tree production
48. New technologies in fodder preservation

Learning Outcome

Unit I:

Instruction in lessons in Unit I should result in students achieving the following objectives;

1. Be able to list key nutrients for animals
2. Be able to outline how carbohydrates, lipids and proteins can be classified
3. Be able to describe the functions of minerals and vitamins in the nutrition of animals, and list the sources as well as the clinical signs associated with deficiency symptoms of these nutrients.
4. Be able to describe how a feedstuff could be analyzed for dry matter, organic matter, lipid content, protein and fibre contents

Unit II:

Instruction in lessons in Unit II should result in students achieving the following objectives;

1. Be able to classify feeds according to their nutritive values
2. Acquire knowledge in feeding value of locally available feed
3. Acquire knowledge in the use of urea as protein supplement
4. Be able to identify feed and fodder containing toxic principles and measures to reduce their toxicity
5. Acquire knowledge to improve the digestibility of poor quality roughage

Unit III:

Instruction in lessons in Unit III should result in students achieving the following objectives;

1. Be able to demonstrate the use of feeding standards to calculate the nutrient requirements of ruminants
2. Be able to formulate rations to meet the nutrient requirements of ruminants

3. Explain the structure and function of the ruminant digestive tract.
4. Be able to describe the digestion of carbohydrates, lipids and proteins in cows
5. Design feeding strategies and systems for cattle of different physiological status

Unit IV:

Instruction in lessons in Unit IV should result in students achieving the following objectives;

1. Be able to classify forage crops according to their nutritive values
2. Acquire knowledge on fodder production and availability in India and Tamil Nadu
3. Acquire knowledge in harvesting techniques
4. Acquire hand on experience in the use of various machineries for harvesting of fodder
5. Acquire skill in pasture management
6. Acquire knowledge in various forage production systems such as Silviculture, Silvipasture, Hortipasture and Agri-Silvi- pasture.

Unit V:

Instruction in lessons in Unit V should result in students achieving the following objectives;

- Acquire knowledge and skill in the agronomic practices starting from land preparation, sowing, weeding, irrigation, application of manure and harvesting of

1. Fodder maize - Fodder sorghum and Cumbu-Napier
2. Guinea grass - Buffel grass (Cenchrus sp.) Deenanath grass
3. Lucerne,, Cowpea, Desmanthus and Stylo
4. Subabul, Sesbania and Glyricidia

I SEMESTER

15ANHP0103 DAIRY CHEMISTRY (3+1)

Objective

- To provide an understanding of the bioactive role, chemical interactions of milk constituents their components
- Their effects of nutritional quality, functional properties important to health.

Theory

I. **Milk -** definition – composition of milk – physical and chemical properties of milk -factors affecting yield and composition of milk – inter relationship between the milk constituents- effect of heat, acid and enzymes on milk- nutritive value of milk. Colostrum: composition – importance of colostrum.

II. **Carbohydrates of milk** – Chemistry of carbohydrates – lactose structure – physical forms – action of bacteria on lactose –browning reaction - physiological properties of lactose - uses of lactose.

III. **Milk fat** - structure and chemical nature of milk fat –size of fat globules – fat constants - oxidation and its control – auto oxidation.

IV. **Proteins and enzymes of milk** – Chemistry of protein including amino acids – major and minor milk proteins – physical and chemical properties of milk proteins. **Milk enzymes**: functions – influence of processing parameters and effect on storage.

V. **Minerals and vitamins of milk:** distribution of major minerals in milk- trace elements in milk- salt composition on milk – significance and factors affecting salt b alance - protein and mineral interaction. Vitamins in milk: nutrional importance and structure.

Practicals

1. Sampling of milk.
2. Determination of specific gravity of milk.
3. Estimation of fat in milk by using Gerber mehod
4. Estimation of fat in milk by using milk analyzer
5. Estimation of protein in milk
6. Estimation of lactose in milk

7. Estimation of TS and SNF content in milk.
8. Determination of acidity in milk
9. Determination of PH in milk
10. Determination of MBRT in milk
11. Detection of adulterants in milk
12. Detection of preservatives and neutralizers. in milk
13. Estimation of ash in milk.

References

1. Mathur MP, Roy DD and Dinakar P.1999. *Textbook of Dairy Chemistry*. ICAR.
2. Anantha Krishnan, C.P., (1991), Technology of milk processing, Sri Lakshmi Publications, Chennai -10.
3. Eeckles.CH.Combs, W.B and Macy.H (1955), Milk and Milk Products, Tata Mc Graw Hill Publishing Co.Pvt.Ltd., New Delhi.
4. Sukumar De (1980), Outlines of Dairy Technology, Oxford University Press, New Delhi.
5. Wong N.P, Jenness.R. Keeney.M. Marth E.H (1998); Fundamentals of Dairy Chemistry, CBB Publishers and Distributors, New Delhi.

LECTURE SCHEDULE 15ANHP0103 DAIRY CHEMISRTY (3+1)			
THEORY			
Unit	**Title of the lecture**	**Hours**	**Total Hours**
I	Milk – definition composition of milk – major components-(water, fat, protein, lactose and ash) minor components (salts, non protein substances phospholipids, vitamin, pigments and flavor)	2	10
	Physical and chemical properties of milk – acid base equlibria oxidation- reduction potential. Specific gravity, viscosity, boiling point, freezing point	2	
	Factors affecting yield and composition of milk – average composition and normal range, breed, stage of lactation effect of age of cow, seasonal variation,effect of variation in milking, effect of feed nutritional level	2	
	Inter relation between the milk constituents	1	
	Nutritive value of milk – water, carbohydrate, fat, portien, minerals and vitamins	1	
	Colostrum – definition, composition and importance of colostrum	2	

II	Carbohydrates –chemistry of carbohydrates, lactose –structure - definition molecular structure	3	10
	Physical forms – alphahydrates, anhydrous lactose anhydrous lactose glasses, beta lactose, solubility of lactose, hydrolysis lactose	2	
	Action of bacteria on lactose and browning reaction	2	
	Physical properties of lactose	2	
	Use of lactose	1	
III	Milk fat – structure-chemical change of milk fat- (chains, butyric fatty acid,oleic acid,triglycerids)	2	10
	Size of fat globules – fat contents	3	
	Oxidation and its control – (antioxidations, oxygen, heat treatment and exposure activity	4	
	Auto oxidation	1	
IV	Proteins- chemistry of protein including aminoacids	2	10
	Major and minor milk proteins - (protease, peptone, antibody protein, iron containing proteins, FGMP, lactolin glycol protein, kininogen and other proteins	4	
	Physical chemical properties of milk proteins - (casein , properties of casein)	2	
	Milk enzymes – functions – influence of processing paramenters and effect of storage	2	
V	Minerals – distributin of major minerals in milk (salt composition and milk)	1	8
	Trace elements in milk – (trace elements in milk of three species, average of some trace elements in milk	2	
	Salt composition on milk	1	
	Signification and factors affecting salt balance(the portion of mik salt)	1	
	Protein and mineral interaction	1	
	Vitamin of milk- nutritional importance and structure (food source and deficiency disease properties)	2	
		Total	**48**

LEARNING OUTCOME 15ANHP0103 DAIRY CHEMISRTY (3+1)		
Unit	**Vague outcome**	**Precious outcome**
I.	Students should know the basic knowledge about milk constituents and their composition.	1. From this content of the study, students able to know the constituents, physiochemical properties and nutritive value of milk and 2. Also know the importance of milk with colostrum.
II.	Student should able to understand the constituents of milk sugar.	1. From this content of the study, students will learn about the structure of lactose and physiochemical properties of lactose. 2. Also learn about the changes occurs during storage and manufacture of different process.
III.	Student should able to understand the constituents of milk fat.	1. From this content of the study, students learn about the size of fat globules and fat constant. 2. Also learn about the oxidation , its control and autooxidation.
IV.	Student should able to understand the constituents of milk protein and enzyme.	1. From the content of this course, student learns about the major and minor milk proteins and their chemistry and its applications. 2. Also learn about the role of enzyme in milk action of enzymes on milk protein.
V.	Students will learn about the constituents of mineral and vitamins present in milk.	1. From this content student should know about the distribution of major minerals in milk, significance of salt balance and protein mineral interactions. 2. Also learn about the vitamins present in milk.

I SEMESTER

15ANHP0104 MARKET MILK (2+1)

Objective

- To enlighten the students about the organization and functioning of milk procurement at farmer's level, private and government levels.
- To enlighten the students about the processing and marketing milk.

Theory

I. **Milk Procurement**-Principles of milk production – Selection of milk shed area –milking practices – clean milk production – importance - sources of micro organisms– Raw milk collection -Milk Collection Centres and their functions – Establishment of Dairy Cooperatives - Pricing of milk.

II. **Quality tesing of market milk:** use of bio-protective factors for preservation of raw milk: effects on physicochemical, microbial and nutritional properties of organic milk - Common adulterants, preservatives and neutralizers -present status of preservation of raw milk.

III. **Milk reception** – weighing, sampling and grading of milk - filtration-clarification. Basics involved in platform test- Chilling – Types of chilling - Preservation and transportation of milk – Location of chilling centres.

IV. **Processing**- standardization - homogenization - Heat treatment of milk: pasteurization- sterilization- UHT processing- packaging and storing.

V. **Market milk** – Market milk industry in India – milk quality standars and certificates-Sterilized milk – Flavoured milk – Vitamin fortified milk – pasteurized milk – Standardized milk – Toned milk – Double toned milk – Recombined milk – Reconstituted milk.

Practicals

1) Sensory evaluation of milk
2) Rapid platform and grading test
3) Standardization of milk
4) Chemical and microbial testing of air
5) Chemical and microbial testing of water
6) Preparation of pasteurized milk
7) Phosphatase test

8) Preparation of sterilized milk
9) Turbidity test
10) Preparation of flavoured milk.
11) Analysis of Common adulterants, preservatives and neutralizers in milk
12) Visit to Dairy Cooperative
13) Visit to Chilling Centre.

References

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LECTURE SCHEDULE **15ANHP0104 MARKET MILK (2+1)**			
THEORY			
Unit	**Title of the lecture**	**Hours**	**Total Hours**
I	Milk Procurement- Principles of milk production – Selection of milk shed area –milking practices	1	**8**
	Clean milk production – Importance - Sources of micro organisms	1	
	Raw milk collection -Milk Collection- Centres and their functions	2	
	Establishment of Dairy Cooperatives	2	
	Pricing of milk	2	
	Quality tesing of market milk - Use of bio-protective factors	2	

II	for preservation of raw milk:		**6**
	effects on physicochemical, microbial and nutritional properties of organic milk	2	
	Common adulterants, preservatives and neutralizers -present status of preservation of raw milk	2	
III	Milk reception – weighing, sampling and grading of milk	2	**6**
	Filtration- clarification	1	
	Basics involved in platform test	1	
	Chilling – Types of chilling - Preservation and transportation of milk – Location of chilling centres.	2	
IV	Processing- standardization	1	**6**
	Homogenization	1	
	Pasteurization	2	
	Sterilization- UHT processing	1	
	Packaging and storing of milk	1	
V	Market milk – Market milk industry in India – milk quality standards and certificates.	1	**6**
	Sterilized milk – Flavoured milk – Vitamin fortified milk	2	
	pasteurized milk – Standardized milk – Toned milk – Double toned milk	2	
	Recombined milk – Reconstituted milk	1	
		Total	**32**

LEARNING OUTCOME 15ANHP0104 MARKET MILK (2+1)		
Unit	**Vague outcome**	**Precious outcome**
I.	Students shall know the details of milk procurement and activities of milk cooperative societies.	1. Students should learn about the milk production and procurement. 2. Also learn about the price fixing and significance of marketing from farmers either government sector or private dairy sector.
II.	Students will learn about the organic milk production.	1. This content will teach about the preservation of raw milk and use of bio-protective factors for preservation of raw milk 2. Common adulterants, preservatives and neutralizers - present status of preservation of raw milk
III.	Student should able to understand milk reception and activities of chilling centers	1. From the unit, the students able to understand about sampling of milk and filtration process 2. Also know about various plat form tests and chilling process.
IV.	Student should know the various processes undertaken in dairy industry.	1. From the content of this course, students expertise in the technical process of standardization, homogenization, pasteurization and sterilization 2. Also know about the packaging of milk.
V.	Students should know about the market milk industry in India.	1. From the content of this course, students learn about the different types of market milk available around India. 2. Also learn about the milk quality standards and certificates.

I SEMESTER

15ANHP0105 PRINCIPLE AND APPLICATIONS OF LABORATORY INSTRUMENTS (0+1)

Objective

- 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.

Practicals

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. Verification of beer-lamberts law using spectro photo meter.
6. Practicing and handling of viscometer and flame photometer.
7. Practicing and handling of calorimeter.
8. Practicing and handling of different types of microscope and colony counter.
9. Practicing and handling of autoclave and muffle furnance.
10. Practicing and handling of laminar air flow chamber and Incubator.
11. Practicing and handling of hot air oven and micro oven.
12. Practicing and handling of Chromatogarphy techniques
13. Practicing and handling of advanced lab equipments for estimation of milk constituents in dairy products.

References

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

I SEMESTER

15AGMP102 GENERAL MICROBIOLOGY (2+1)

Objective :

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

Theory

I. Introduction to Microbiology: Microbes - Niches of Micro organisms in the living world- Evolution of Microbiology – Distribution of Micro organisms and their role in carbon, nitrogen and phosphorus cycles - microbiology a field of biology – Koch's postulate .

II. Classification of Micro Organisms: Major characteristics of Micro organisms - Prokaryote and eukaryote- aerobes and anaerobes - Microbial Taxonomy - Nomenclature and elementary classification of Bacteria - Fungi- Characters of Viruses and Mycoplasma.

III. Microbial Growth: Methods of Measurement of growth of micro organisms – Factors influencing growth of micro organisms- Principles of Serial dilution -Isolation of Micro organisms from water and soil - Streak Plate and Pour Plate Method - Spread Plate Method- Principles of simple and Differential staining.

IV. Nutrition and Culture of Micro organisms: Nutritional requirements of micro organisms -Culturing of micro organisms –Types and Preparation of culture media – Methods of growing micro organisms- Normal microbial (Bacterial) growth curve – Continuous culture- Batch culture - Methods of preservation of cultures. Controlling measures for micro organisms

V. Applied Microbiology: Application in soil and agricultural – Application in food industry – Fermentation and its products– Application in Dairy industry – Application in waste management – Application in Biotechnology.

Practicals

1) Practicing and handling of common bacteriological apparatus and equipments-I.
2) Practicing and handling of common bacteriological apparatus and equipments-II

3) Cleaning, sanitization and sterilization of apparatus and equipments.
4) Preparation of Agar media
5) Preparation of PDA media
6) Preparation of Nutrient agar
7) Estimation of micro organisms from the soil
8) Estimation of micro organisms from water
9) Estimation of micro organisms in milk
10) Preparation and use of agar plates and agar slants
11) Detection of yeast and moulds in dairy products
12) Measurement of microorganisms
13) Gram's staining techniques

References

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2. 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, Kanyakumari Dist – 629 002.
3. Pelczar.Reid and Chan, 1977 - Microbiology, Tata McGraw-Hill Publishing company Ltd., New Delhi.
4. Ramasamy, D., 1999, Dairy Technologist's Hand Book, International book distributing Co., Lucknow.
5. Yadav, J.S. (1993) A Comprehensive Dairy microbiology, Metropolitan Book Co. Pvt Ltd, 1, Netaji Subash Marg, New Delhi-11002, India.

LECTURE SCHEDULE **15AGMP102 GENERAL MICROBIOLOGY (2+1)**			
THEORY			
Unit	**Title of the lecture**	**Hours**	**Total Hours**
I	Introduction to Microbiology: Definition of microbiology- Microbes - Niches of Micro organisms in the living world- Evolution of Microbiology	3	**8**
	Distribution of Micro organisms and their role in carbon,	3	

	nitrogen and phosphorus cycles		
	Importance and microbiology – field of biology – koch'.	2	
II	Classification of Micro Organisms –. Basic and Important characteristics of Micro organisms	2	
	Groups of microorganisms-Prokaryotes and eukaryotes	1	
	Elementary classification of Bacteria	1	**6**
	Elementary classification of Fungi.	1	
	Characters of Viruses and Mycoplasma	1	
	Microbial Growth – Methods of Measurement of microbial growth	2	
III	Factors influencing growth of micro organisms	1	**6**
	Principles of Serial dilution and Isolation microorganisams .	2	
	Principles of simple and differential staining	1	
	Nutrition and Culture of Micro organisms Nutritional requirements of microorganisms	1	
	Principles of Culturing of microorganisms	1	
IV	Types and Preparation of culture media	1	**6**
	Methods of microbial growth-Continuous culture and Batch culture	1	
	Normal microbial growth curve.	1	
	Methods of preservation of microbial cultures and Controlling measures for microorganisms	1	
	Applied Microbiology: Application in soil and agricultural improvement	1	
V	Application in food industry	1	
	Application in Dairy industry	1	**6**
	Application in Biotechnology	1	
	Safe disposal of microbiological waste	1	
	Application in foods biopreservation.	1	
		Total	**32**

LEARNING OUTCOME 15AGMP102 GENERAL MICROBIOLOGY (2+1)		
Unit	**Vague out come**	**Most precious out come**
I.	Studying the basics of Microbiology	1. Understanding the principles and role played by the microorganisams in the environment 2. Understanding the importance of Microorganisams in the living world
II.	Studying the Handling procedure of Microorganisams	1. Understanding the principles of elementary microbial classification 2. Understanding the differences between -Prokaryote and eukaryote Microorganisams
III.	Studying growth of microorganisams	1. Understanding the principles of growth of microorganisams 2. Understanding the principles of isolation of microorganisams
IV.	Studying preparation of media and culturing of microorganisams	1. Understanding the principles of media preparation and cultureing of microorganisams 2. Understanding the principles of controlling of microorganisams
V.	Studying the applications of microbiology	1. Understanding the basic principles and its applications of microbiology in different industries. 2. Understand the basic principles and its application of microbiology in dairy industries.

II SEMESTER

15APRP0001 RESEARCH METHODS (4+0)

Credit: 4 Max.Marks: 100
Contact hours: 64 (ESE 60, CFA: 40)

Objectives

- To enable the students to understand the basics of research methodology, and
- To develop skill among the students to prepare professional research report

Specific Objectives of Learning: Upon completion of the course, the students will be able to:

- identify and formulate a problem for research.
- prepare suitable research design to study the research problem to be formulated
- choose appropriate methods of sampling, tools and techniques of data collection
- process the data collected in the field and analyse it using appropriate statistical methods
- prepare research report in a professional manner.

Theory

I. Scientific Research – characteristics and functions of research, scientific method, steps in research. Types of research: Pure, Applied and Action Research, Qualitative and Quantitative studies. Research Aptitude, skills and ethics.

II. Research Process – Formulation and selection of research problem, statement of the problem and definition of terms, objectives, review of literature. Variables - Hypotheses – characteristics and functions – preparation of research design.

III. Methods of Research – Exploratory, descriptive and experimental designs, surveys, content analysis, case study, participatory and interdisciplinary studies.

IV. Data Collection – Sources and types of data – Data base - conduct of Interview, participant and non-participant, observation, inquiry forms. Sociometry. Psychological test – projective techniques – types of scales, Pre test, reliability and validity.

V. Report Writing – Research Report – format - types of reports - Reference materials, bibliography, footnotes, glossary, index and appendix – dissemination of research findings.

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1) Bandarkar and Wilkinson, Methods and techniques of Social Research**,** Bombay: Himalaya Publishing Co., 2006.
2) Donald H.McBurney, Research Methods, New Delhi : Library of Congress Cataloging-in-Publication, 2003
3) Goode and Hatt, Methods in Social Research, New Delhi: McGraw Hill, 2002.
4) Kothari C.R, Research Methodology, New Delhi: Vishva Prakashan, 2001.
5) Vijayalakshmi G. & Sivapragasam C., Research Methods: Tips and Techniques, Chennai : MJP Publishers, 2009.
6) William M.K., Research Methods, New Delhi: Atomic Publishing, 2003.
7) Tim May, Social Research Issues, Methods and Process, Open University Press, Buckingham, 2001
8) Tony Brown & Liz Jones, Action Research and Postmodernism, Open University Press, Buckingam, 2001
9) John.W.Creswell, Research Design Qualitative and quantitative Approaches, Sage Publication, New Delhi, 1994.
10) Young, P.V., Scientific Social Surveys and Research, Practice Hall, New Delhi, 1994.

Lecture Schedule

Unit	Topics to be covered	Hours
I	1.1 Characteristics and functions of research	4
	1.2 Scientific method, steps in research	4
	1.3 Pure, Applied and Action Research, Qualitative and Quantitative studies, Research Aptitude, skills and ethics	4
	Total	**12**
II	2.1 Formulation and selection of research problem, statement of the problem and definition of terms, objectives	4
	2.2 Review of literature	2
	2.3 Variables - Hypotheses – characteristics and functions	3
	preparation of research design	4
	Total	**13**
III	3.1 Exploratory, descriptive and experimental designs	7
	3.2 Experimental designs	3
	3.3 Surveys, content analysis	3
	3.4 Case study, participatory and interdisciplinary studies	
	Total	**13**
IV	4.1 Sources and types of data – Data base	3
	4.2 Conduct of Interview	2
	4.3 Participant and non-participant, observation, inquiry forms	3
	4.4 Psychological test	2
	4.5 Projective techniques – types of scales, Pre test, reliability and validity, Sociometry	3
	Total	**13**
V	5.1 Research Report – format	3
	5.2 Types of reports	2
	5.3 Reference materials, bibliography, footnotes, glossary, index and appendix	5
	5.4 dissemination of research findings	3
	Total	**13**
	Total hours for Unit 1-5	**64**

SEMESTER II

15APRP0002 APPLIED STATISTICS

Credit: 4 Max.Marks: 100

Contact hours: 64 (ESE 60, CFA: 40)

Objectives

- To enable students to understand the basics and uses of statistics in their field of study
- To enable students familiar with various statistical methods that are required for the analysis of data in their field of study; and
- To develop skills among students to analyze data using appropriate statistical tools;

Specific Objectives of Learning: Upon completion of the course, the students will be able to:

- be familiar with the basic concepts and terminology of statistics;
- understand the importance and application of statistics in different disciplines
- choose appropriate sampling procedure and decide sample size.
- develop skill in reading and understanding the results from data analysis
- able to demonstrate competence in analyzing statistical data using SPSS.

Theory

I. **Statistics:** Definition, scope, functions and limitations, Statistical Organizations and Set up in India and Tamil Nadu

II. **Sources and types of data**, Coding and classification, Tabulation and presentation of data – Frequency distribution, Diagrammatic and Graphical presentation – Statistical application of Central Measures and Measures of Dispersion

III. **Sampling Techniques**: Census Vs sampling, characteristics of a good sample, sampling size and sampling error. Probability samples – simple random, stratified random, systematic cluster, multi stage sampling. Non-probability samples – accidental, purposive, judgement, convenient, volunteer, snow ball sampling. Probability and distributions – Binomial, Poisson and Normal distribution

IV. Descriptive Statistics – Central Measures, Variability measures, Skewness and Kurtosis measures, Measures of association/relationship – Coefficient of correlation, coefficient of determination, coefficient of Association and contingency, Regression analysis.

V. Inferential Analysis – Testing of hypothesis, basics and steps in hypothesis testing – Concept of sampling distribution and standard error. Parametric and non-parametric tests - Students 't' test and 'z' test, 'F' test, Chi-square test; Statistical analysis using Statistical software.

REFERENCES

1) Agarwal. Y.P. *Statistical Methods*, New Delhi: Sultan Chand & Sons, 1996.
2) Gupta, S.P., & Gupta. M.P., Business Statistics, Sultan Chand & Sons, New Delhi, 2006
3) Hawley, Warren, *Foundations of Statistics*, New York: *Saunders College Publishing*, 1996.
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5) Kothari C.R. Quantitative Techniques, New Delhi, Vikas Publishing House, 1998.
6) Vijayalakshmi G. & Sivapragasam C., Research Methods: Tips and Techniques, Chennai : MJP Publishers, 2009.
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8) Rajamanickam M., Statistical Methods in Psychological and Educational Research, New Delhi, Concept Publishing Company, 2001.
9) Siegel, Sidney, Non-Parametric Statistics for Behavioural Sciences, New Delhi, McGraw Hill, 2006.
10) Sinha B.L., Statistics in Psychology and Education, New Delhi, Anmol Publications, 2006.

Lecture Schedule

Unit	Topics to be covered	Hours
I	1.1 Definition, scope	3
	1.2 functions and limitations	3
	1.3 Statistical Organizations and Set up in India and Tamil Nadu	6
	Total	**12**
II	2.1 Characteristics of a good sample, sampling size and sampling error.	3
	2.2 Probability samples – simple random, stratified random, systematic cluster, multi stage sampling.	3
	2.3 Non-probability samples – accidental, purposive, judgement, convenient, volunteer, snow ball sampling.	3
	2.4 Probability and distributions – Binomial, Poisson and Normal distribution.	4
	Total	**13**
III	3.1 Sources and types of data	2
	3.2 Coding and classification	2
	3.3 Tabulation and presentation of data – Frequency distribution, Diagrammatic and Graphical presentation	4
	3.4 Statistical application of Central Measures and Measures of Dispersion	5
	Total	**13**
IV	4.1 Central Measures, Variability measures, Skewness and Kurtosis measures, Measures of association/relationship	5
	4.2 Coefficient of correlation, coefficient of determination, coefficient of association and contingency,	5
	4.3 Regression analysis	3
	Total	**13**
V	5.1 Testing of hypothesis: Basics and steps in hypothesis testing	3
	5.2 Concept of sampling distribution and standard error	4
	5.3 Parametric and non-parametric tests - Students 't' test and 'z' test, 'F' test, Chi-square test – simple problems. Statistical analysis – using Statistical software	6
	Total	**13**
	Total hours for unit 1-5	**64**

II SEMESTER

15ANHP0206 DAIRY ENGINEERING (3+1)

Objective

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

Theory

I. **Milk reception**- Milk received through cans, tanks – methods employed for measuring milk; construction and component details of milk transport tanks, storage tanks, silo tanks, refrigerated storage tank, process tank and aseptic tank. Cooling of milk – bulk milk coolers and in-can cooling – description and merits of the system.

II. **Heat transfer** – Mechanisms of heat transfer – Heat exchanger – Effectiveness of heat exchanger, Exchange efficiency; Tubular heat exchangers – shell and tube and concentric tubes; plate heat exchanger – merits and specifications; comparison of direct and indirect heating system.

III. **Refrigeration and Boiler** – Vapour compression refrigeration system – desirable properties of refrigerants – Compressors – Condensers – Evaporators – Types of evaporators - Refrigerant control devices – automatic expansion value, solenoid valve, pressure control and thermostat — Common troubles in refrigeration system. Boiler: Formation and properties of steam – Fuel – Types of Boiler.

IV. **Pasteurization** – definition – HTST pasteurizers – components involved, advantages and disadvantages; Vacreation - Milk sterilization – definition, purpose and major differences between pasteurizer and sterilizer; Homogenization – definition, effect of homogenization, homogenizer accessories; Centrifugation – centrifugal separator – description.

V. **Filling Operation and Drying**: Principles and working of different types of bottle fillers and capping machine, pouch filling machine and aseptic filling system. Drying –Methods of drying; Spray drying, Drum drying – Classifications, construction and capacity; properties of dried milk.

Practicals

To learn the different parts and the operation of

1) Bulk milk cooler,
2) Refrigerator
3) Boiler
4) Ice cream freezer
5) Can washer
6) Plate Heat Exchanger
7) HTST pasteurizer
8) Drum drier and spray drier
9) Milking machine
10) Ice cream making machine
11) Homogenizer
12) Cream separator
13) Calibration

References

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2. Gosta Bylund (1995), Dairy processing hand book, Tetra pak processing systems AB, Swedwn
3. Tuffel Ahmad 1995, Dairy Plant Engineering and Management, Kitab Machal Distributers, New Delhi
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5. Sukumar De 1980, Outlines of Dairy Technology. Oxford University Press, New Delhi.

LECTURE SCHEDULE 15ANHP0206 DAIRY ENGINEERING (3+1)			
THEORY			
Unit	**Topic of the lecture**	**Hour**	**Total Hours**
I.	Milk reception- Milk received through cans, tanks – methods employed for measuring milk	2	10
	construction and component details of milk transport tanks, storage tanks; silo tanks	3	
	construction and component details of Refrigerated storage tank; process tank and aseptic tank	2	
	Cooling of milk – bulk milk coolers and in-can cooling – description and merits of the system.	3	
II.	Heat transfer – mechanisms of heat transfer	2	8
	Heat exchanger – effectiveness of heat exchanger, exchange efficiency;	2	
	Merits and specifications of tubular heat exchangers – shell and tube and concentric tubes; plate heat exchanger	2	
	Comparison of direct and indirect heating system	2	
III.	Refrigeration and steam boiler – Vapour compression refrigeration system	2	10
	Compressors – Condensers – Evaporators – Types of evaporators	4	
	Common troubles in refrigeration system	2	
	Formation and properties of steam – Fuel – Types of Boiler.	2	
IV.	Pasteurization – definition – HTST pasteurizer – components involved, advantages and disadvantages	3	12
	Vacreation - milk sterilization – definition, purpose and major differences between pasteurizer and sterilizer	3	
	Homogenization – definition, effect of homogenization, homogenizer accessories;	3	
	Centrifugation – centrifugal separator – description	3	
V.	Filling Operation: Principles and working of different types of bottle fillers and capping machine, pouch filling machine and aseptic filling	3	

	system.		
	Drying – Methods of drying - classifications - construction and capacity - properties of dried milk Drum drying	3	8
	Methods of drying - classifications - construction and capacity - properties of dried milk for Spray drying	2	
		Total	**48**

LEARNING OUTCOME 15ANHP0206 DAIRY ENGINEERING (3+1)		
Unit	**Vague outcome**	**Precious outcome**
I.	From this course the students will learn about the milk reception process and accessories of bulk storage of milk.	1. From this content of the study, students will be able to know the bulk storage equipments and their accessories 2. Also know the steps and precautions of milk storage tanks during transportation as well as storage.
II.	Student should learn about mechanism of heat exchanger in dairy industry.	1. From this content of the study students can calculate the effectiveness of heat transfer and its exchange efficiency. 2. Also should know the precautions, care and maintenance of system of heat in dairy plant.
III.	Student should learn about the refrigeration system in dairy industry.	1. This content of study will explain the students, handling and maintenance of refrigeration unit dairy industry. 2. Also know the working principles steam boiler
IV.	Student should know the various processes undertaken in dairy industry.	1. From the content of this course, student learns about the handling, maintenance and the functions of pasteurizer, milk sterilizer, homogenizer and cream separator. 2. Also learns tne merits and demerits pasteurizer.
V.	Students will learn about the filling operation of milk and system of drying.	1. This content of the study will give about the working principles of milk filling operations. 2. Also learn the methods of drying in dairy industry.

II SEMESTER

15ANHP0207 DAIRY PLANT MANAGEMENT (2+0)

Objective :

- 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.

Theory

I. **Process Strategy and Forecasting:** Process strategy – Operation strategy – Product design – Process selection –layout of dairy plant and other facilities

II. **Quality and Performance Management:** Quality – Quality policy – Quality analysis – Quality Assurance – Operation performance – Human Resource Management- Lean Manufacturing – CIP

III. **Decision Analysis and Financial Management:** Approaches to Decision making – Break Even analysis –Methods of Economic analysis**.**

IV. **Store keeping and Inventory Management:** Store keeping and Inventory Management basic concepts of store keeping – Layout of store –Inventory Management – Types – Objectives – Classification of inventory.

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. Smart dairy industry.

References

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LECTURE SCHEDULE 15ANHP0207 DAIRY PLANT MANAGEMENT (2+0)			
THEORY			
Unit	**Title of the lecture**	**Hours**	**Total Hours**
I	Process Strategy and Forecasting: Process strategy – Operation strategy-types of operation strategies, response to external factors and focused operations	3	**6**
	Product design – strategies for new product introduction – new product development process	2	
	Process selection - line flow and intermittent flow - layout of dairy plant and other facilities	1	
II	Quality and Performance Management - Quality – Quality policy – total quality concept – quality cost – inspection .	2	7
	Quality analysis - acceptance sampling – process control sampling - Quality Assurance – Operation performance	3	
	Human Resource Management- Lean Manufacturing – CIP	2	
III	Decision Analysis and Financial Management: Approaches to Decision making – decision analysis – decision under certainty – decision under risk – decision under uncertainity	2	6
	Break Even analysis	2	
	Methods of Economic analysis - interest formulas – annual cost analysis – present worth analysis – internal rate of return – Net present value – cost analysis	2	
IV	Store keeping and Inventory Management - Store keeping and Inventory Management basic concepts of store keeping	3	6
	Layout of store –Inventory Management	2	
	Types – Objectives – Classification of inventory.	1	
V	Production management: Production planning & Control - forecasting –Aggregate Planning-Work motion and time study	3	7
	Plant Maintenance- Prevention & Break-down maintenance	2	
	Safety hazards -hazards prevention security for plant machinery. Smart dairy industry.	2	
Total			**32**

LEARNING OUTCOME 15ANHP0207 DAIRY PLANT MANAGEMENT (2+0)		
Unit	**Vague outcome**	**Precious outcome**
I.	Students should learn about the process strategy and forecasting.	1. From this content of the study, students can understand the system of processing strategy and operation strategy. 2. Also learn about process design, process selection and layout facilities.
II.	Students should know about the quality and performance management.	1. From this content of the study, students can able to understand the quality, quality policy, quality analysis and quality assurance. 2. Also learn the operation performance, human resource,learn manufacturing and CIP.
III.	Students should learn about the decision analysis and financial management.	1. From this content of study, students should able to know the approaches to decision making, break even analysis 2. Also learn the methods of economic analysis**.**
IV.	Students should able to learn the store keeping and inventory management.	1. From the content of this course, student able to understand the store keeping and inventory management basic concepts of store keeping and layout of store. 2. Also understand the inventory management and classification of inventory.
V.	Students should know the production management	1. From the content of this course, they understand the production planning, control, forecasting, and aggregate planning. 2. Also learn the plant maintenance, prevention, break-down maintenance safety hazards, hazards prevention security for plant machinery and Smart dairy industry.

II SEMESTER

15AEXP0214 DAIRY EXTENSION (3+1)

Objectives :

- To teach the students about the basics of extension education and to impart skill in the handling of various extension methods and audio-visual aids
- To expose the students to various dairy development programmes and institutions and their importance to rural development

Theory

I. **Education**-types. Differences between formal and extension education. Extension Education – Meaning, Scope, Principles, Philosophy and Objectives. Qualities of Extension workers. Diffusion and Adoption of innovations- Attributes of Innovation. Adoption process and ID Process. Adopter categories and their characteristics. Consequences of adoption of innovation.

II. **Extension methods**- meaning, purpose and classification. Farm & Home visit, office call, telephone call, personal letter, result demonstration and Agri-clinics. Method demonstration, General meetings, group discussion, brainstorming, seminar, workshop and field trips. Farm journalism- scope and functions. Publications- leaflet and folder, extension journals, newspaper, extension bulletins, newsletter and circular letter. Radio, television, exhibition, campaign, farmers' fairs, film shows.

III. **Audio-Visual Aids:** Audio-recording- types of recording- tape recorder, CDs, DVDs, mp3 players and public address system. Visual- Literature, symbolized-charts and graphs. Three dimensional- models, specimens and objects. Two-dimensional-non-projected- photographs, still pictures, chalk board, bulletin board. Projected- slides, MS power point presentations, LCD and OHP and Opaque projectors. Audio-visual- television, film shows, video projections, e-lessons.

IV. **Socio-economic status and causes** for poor conditions in villages and differences between rural and urban societies. Rural Development- concept, objectives and its role in Indian economy. Importance and scope of Dairying in the economic development of rural India. Birth and development of A.H. department-administration and services. Cattle Breeding and Fodder Development programme,

Intensive Dairy Development Programme and Dairy Cooperative movement. Operation Flood Phase I, II & III-National Milk Grid, Technology Mission on Dairy Development.

V. **Establishment and activities** of Indian Dairy cooperation NDRI, IVRI, IRMA, AMUL, NCDFI and TANUVAS. Emergence of private sector dairies- organization and significance. Self Help Groups- group formation, functioning, role of NGOs in linking SHGs to formal credit system and development of SHGs, credit linkage models.

Practicals

1. Practicing with Lecture, Debate, Symposium methods.
2. Steps to be followed in the conduct of result and method demonstration.
3. Preparation of poster, flash cards, still pictures, charts and graphs
4. Writing for leaflet and folder
5. Practicing the handling of different projectors
6. Practicing the techniques of photography and powerpoint presentation
7. Practicing the videography and video editing.
8. Study of tools of data collection.
9. Preparation of schedules to collect village basic data and socio-economic status.
10. Visit to nearby villages for data collection.
11. Visit to KVK at GRI to learn its activities and programmes.
12. Interacting with SHG' members about their activities and experience.
13. Visit to cooperative and private sector dairies

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2. Dahama, O.P and O.P.Bhatnagar. 1996. Education and Communication for Development, Oxford & IBH Publishing Co., Ltd., New Delhi.
3. Rogers, G.M., and F.F. Shoemaker. 1971. Communication of Innovations- A Cross cultural approach.
4. Seetharaman, Netaji. R., et.al. 1990. A Manual on Audio-visual Aids.
5. Sundaramari, M. 2006. Agriculture and Dairying- A Rural Development Perspective, NCBH, Chennai.

LECTURE SHEDULE 15AEXP0214 DAIRY EXTENSION (3+1)			
THEORY			
Unit	**Title of the lecture**	**Hours**	**Total Hours**
I	Education : Types of Education, Differences between formal and extension education	2	**10**
	Extension Education – Meaning, Scope, Principles	1	
	Philosophy and Objectives of Extension Education	1	
	Qualities of Extension workers.	1	
	Diffusion and Adoption of innovations- Attributes of Innovation.	2	
	Adoption process and ID Process.	1	
	Adopter categories and their characteristics	1	
	Consequences of adoption of innovation.	1	
II	Extension methods - Extension methods- meaning, purpose and classification.	1	10
	Individual contact methods-Farm & Home visit, office call, telephone call, personal letter.	1	
	Result demonstration, Agri-clinics and Agri-business centres.	2	
	Group contact methods-Method demonstration, General meetings	1	
	Group discussion, brainstorming, seminar, workshop and field trips.	1	
	Farm journalism- scope and functions	1	
	Publications- leaflet and folder, extension journals, newspaper, extension bulletins, newsletter and circular letter	2	
	Radio, television, exhibition, campaign, farmers' fairs, film shows.	1	
III	Audio-Visual Aids : Audio-Visual Aids: Audio-recording- types of recording- tape recorder, CDs, DVDs, mp3 players and public address system.	2	10
	Visual- Literature, symbolized- charts and graphs.	2	
	Three dimensional- models, specimens and objects.	2	
	Two-dimensional-non-projected- photographs, still pictures, chalk board, bulletin board.	1	
	Projected- slides, MS power point presentations, LCD and OHP and Opaque projectors	2	
	Audio-visual- television, film shows, video projections.	1	
IV	Socio-economic status and causes - Socio-economic status and causes for poor conditions in villages and differences between rural and urban societies	2	10
	Rural Development- concept, objectives and its role in Indian economy.	2	
	Importance and scope of Dairying in the economic development of rural India.	1	

	Birth and development of A.H. department- administration and services. Cattle Breeding and Fodder Development programme, Intensive Dairy Development Programme and Dairy Cooperative movement.	3	
	Operation Flood Phase I, II & III-National Milk Grid, Technology Mission on Dairy Development.	2	
V	Establishment and activities : . Establishment and activities of Indian Dairy cooperation NDRI, IVRI, IRMA, AMUL, NCDFI and TANUVAS.	3	8
	Emergence of private sector dairies- organization and significance	2	
	Self Help Groups- group formation, functioning, role of NGOs in linking SHGs to formal credit system and development of SHGs,	2	
	Credit linkage models.	1	
Total			**48**

LEARNING OUTCOME 15AEXP0214 DAIRY EXTENSION (3+1)		
Unit	**Vague out come**	**Most precious out come**
I.	Studying the concepts of extension education and adoption of innovations	1. Understanding philosophy and principles of extension education particularly the self help approach 2. Understanding the meaning of innovations in dairy industry and their pattern, rate and methodology of adoption
II.	Learning about the extension teaching methods and their classification	1. Understanding the various types of extension methods and their application for various communication situations 2. Acquiring the skill in the handling of various types of extension methods
III.	Learning about the audio, visual and audio-visual aids and their classification with maximum examples	1. Understanding the various types of audio-visual aids and their application for various extension communication situations 2. Learning about the combined use of audio-visual aids along with extension methods 3. Acquiring the skill in the handling of various types of audio-visual aids
IV.	Studying about the rural areas and their socio-economic settings	1. Understanding the concepts and necessity for rural development 2. Achieving rural development through various dairy development programmes
V.	Learning about the different dairy development institutions and SHGs	1. Understanding the establishment, activities and role of different dairy development institutions 2. Establishment and nurturing the SHGs and use of those groups for dairy development

II SEMESTER

NON MAJOR ELECTIVE (Credit - 4)

(A) . FOOD PRODUCT DEVELOPMENT AND MARKETING

(B) FOOD MICROBIOLOGY

II SEMESTER

COMPULSORY NON CREDIT COURSE

15CSKP0201 SOFT SKILLS (2+0)

III SEMESTER

15ANHP0308 TECHNOLOGY OF MILK PRODUCTS (3+1)

Objective

- To impart knowledge regarding various milk products composition, factors affecting their properties, packaging, storage and defects and their control measures.
- To gain handson the training on production on various milk products.

Theory

I. **Fat rich milk products** – Cream- classification – production technique- defects and control measures. Butter – standards – method of manufacture – over run – defects and control measures.

II. **Concentrated and frozen milk products** – condensed milk and evaporated milk – Definition standards – method of manufacture – defects and control. **Ice cream** – definition- classification - production techniques of ice cream – defects and control measures.

III. **Fermented milk products** – Starter culture; method of manufacture of yoghurt, acidophilus milk, Kefir, Kumiss, Bulgarian butter milk, butter milk- production technique- therapeutic benefits – Functional foods.

IV. **Protein rich milk products**– definition- composition - varities of cheese- method of manufacture of cheddar, mozzarella, processed cheese, and cheese spread - defects and control measures.

V. **Dried milk products:** Dried milk – types – standards – spray drying and roller drying – production technique- instantization- keeping quality of milk powder, defects and control measures. Cream powder – Butter power – Infant milk powder- malt milk powder - icecream mix powder – cheese powder – shrikhand powder – khoa powder- method of production.

Practicals

1. Preparation and analysis of cream
2. Preparation and analysis of butter
3. Estimation of moisture and TS condensed milk
4. Estimation of Fat in condensed milk
5. Estimation of moisture, TS, Fat, Solubility index in dried milk.

6. Preparation of different types of yoghurt.
7. Preparation of mozzarella cheese
8. Preparation re of processed cheese and cheese spread
9. Calculation and standardization of ice cream mix
10. Preparation of ice –cream
11. Field visit to cheese factory
12. Field visit to Ice-cream factory
13. Visit to curd market

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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. Sukumar De (1980) Outlines of Dairy Technology, Oxford University Press, New Delhi.
3. Mathur MP, Roy DD & Dinakar P.1999. *Textbook of Dairy Chemistry*. ICAR.
4. Eeckless C.H, W.B Combs and H.Mecy (1955), Milk and Milk Products, Tata Mc Graw Hill Publishing Co.Pvt.Ltd. New Delhi.
5. Ramasamy, D (1999) Dairy Technologist's Hand Book, International Book distributing Co, Lucknow.

LECTURE SCHEDULE **15ANHP0308 TECHNOLOGY OF MILK PRODUCTS (3+1)**			
THEORY			
Unit	**Topic of the lecture**	**Hour**	**Total Hours**
I.	Current status and production of fat rich milk products	1	10
	Cream -classification – production technique	3	
	Defects and control measures of cream	1	
	Butter – standards – method of manufacture – over run	3	
	Defects and control measures of butter	2	
II.	Condensed milk – Definition standards – method of manufacture – defects and control.	2	
	Evaporated milk – Definition standards – method of manufacture –	2	

	defects and control.		
	Ice cream – definition- classification - production techniques	2	8
	Defects and control measures of ice cream	2	
III.	Starter culture	1	
	Method of manufacture of yoghurt	2	
	Production technique of Acidophilus milk, Kefir, Kumiss, Bulgarian butter milk, Butter milk	4	10
	Therapeutic benefits of fermented milk products	1	
	Functional foods	2	
IV.	Protein rich milk products– definition- composition - varieties of cheese	2	
	Method of manufacture of cheddar, mozzarella, processed cheese, and cheese spread	4	8
	Defects and control measures of cheese	2	
V.	Production techniques of Cream powder – Butter power	2	
	Production techniques of Infant milk powder - Malted milk powder	2	
	Production techniques of Icecream mix powder – Cheese powder	2	12
	Production techniques of Shrikhand powder – Khoa powder	2	
	Dried milk – types – standards	1	
	Production technique of dried milk by roller drier	1	
	Production technique of dried milk by spray drier	1	
	Instantization- keeping quality of milk powder, defects and control measures.	1	
		Total	**48**

LEARNING OUT COME 15ANHP0308 TECHNOLOGY OF MILK PRODUCTS (3+1)		
Unit	**Vague outcome**	**Precious outcome**
I.	Students will learn about the production techniques of fat rich products.	1. From this content of the study, students will able to know the various types of manufacturing procedure of cream and butter 2. Also learns about the details of product storage, defects and their control measures.
II.	Students will learn about the production techniques of concentrated and frozen milk products.	1. From this content of the study students will able to know the production techniques of concentrated and frozen milk products. 2. Also learns about the details of product storage, defects and their control measures.
III.	Students will learn about the production techniques of fermented milk products.	1. From this content of the study will explain about the precautions of fermentation process and production techniques of yoghurt, acidophilus milk and butter milk. 2. Also learns about the details of product storage, defects and their control measures.
IV.	Students will learn about the production techniques protein rich milk product.	1. From the content of this course, student learns about the handling and manufacturing procedure of cheese 2. . Also learns about the details of product storage, defects and their control measures.
V.	Students will learn about the production details of various types of dried milk products.	1. From this content of the study will learn about the production details of dried milk, butter powder, cream powder, khoa powder, infant milk powder, malt, cheese powder, ice cream mix powder and shrikhand powder. 2. And also learn details of product storage, defects and their control measures of dried milks.

SEMESTER III

15ANHP0309 CHEMISTRY OF MILK PRODUCTS (2+1)

Objective

- To project the physico-chemical properties various of milk products.
- To impart the effects of various milk constituents of the milk products during manufacture and storage.

Theory

I. **Fat rich products** – Cream- chemical composition- physio chemical properties – effect of fat percentage of cream on its specific gravity – neutralization of cream. Butter – chemical composition - physico-chemical characteristics. effect of heat on Ghee and butter oil; Fat constants - Rancidity and auto-oxidation in ghee mechanism.

II. **Concentrated milk products**- Physico-chemical changes during manufacturing and storage of concentrated milk- crystallization – heat stability of concentrated milk – age thickening and gelation of concentrated milk. Effect of heat on dried milk – chemical quality - physico-chemical properties of dried milk.

III. **Fermented milk products** – chemical composition of Dahi, Yoghurt – physicochemical characteristics of fermented dairy foods- Changes during formation of curd- chemistry of shrikhand – chemistry of yoghurt.

IV. **Heat/ acid coagulated products:** cheese – chemical composition – milk clotting enzymes from different sources (animal and plant). Rennet – factors affecting rennin action – coagulation – physicochemical changes during ripening of cheese; chemical defects in cheese. Paneer and Chhanna– chemical composition – factors affecting the quality of paneer.

V. **Frozen milk product:** Ice cream – ISI specification – Role of the constituents in Ice cream - properties of ice cream mix – physiochemical nature of icecream- action of stabilizers and emulsifiers in ice cream.

Practicals

1. Determination of fat in cream by Gerber method
2. Determination of moisture, fat (Gerber method), curd and salt in butter;
3. Determination of diacetyl and acetyl methyl carbinol in butter/cultured products;

4. Determination of RM, Polenske value, iodine value, saponification value of ghee;
5. Determination of lactose and sucrose in condensed milk
6. Determination of lactose and sucrose in ice-cream
7. Determination of heat stability of milk and its concentrate;
8. Determination of moisture in skim milk powder/infant food by vacuum oven;
9. Compositional analysis of ice cream
10. Determination of rennet clotting time of milk.
11. Determination of amino acids in cheese;
12. Determination of free fatty acids in cheese
13. Compositional analysis of cheese

Reference

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4. Walstra P & Jenness R. 1984. *Dairy Chemistry and Physics*. John Wiley & Sons.
5. Wong NP, Jeness R, Keeney M & Elmer HM. 1988. *Fundamentals of Dairy Chemistry*. Van Nostrand Reinhold Co.

LECTURE SCHEDULE 15ANHP0309 CHEMISTRY OF MILK PRODUCTS (2+1)			
THEORY			
Unit	**Topic of the lecture**	**Hour**	**Total**
I.	Fat rich products – Cream - chemical composition- physiochemical properties	2	8
	Effect of fat percentage of cream on its specific gravity – neutralization of cream	2	
	Butter - chemical composition - physicochemical characteristics	2	
	Effect of heat on ghee and butteroil- Fat constants - Rancidity and auto-oxidation in ghee mechanism	2	
II.	Concentrated milk products- physicochemical changes during manufacturing and storage of concentrated milk – crystallization	2	6
	Heat stability of concentrated milk – age thickening and gelation of concentrated milk	2	
	Dried milk – chemical quality - physicochemical properties of dried milk	2	
III.	Chemical composition of fermented milk products (dahi & yoghurt)	1	6
	Physicochemical characteristics of fermented dairy foods	2	
	Changes during formation of curd	1	
	Chemistry of shrikhand	1	
	Chemistry of yoghurt	1	
IV.	Cheese – chemical composition – milk clotting enzymes from different sources (animal and plant)	2	6
	Rennet – factors affecting rennin action	1	
	Coagulation – physicochemical changes during ripening of cheese	1	
	Paneer and Chhanna– chemical composition – factors affecting the quality of paneer	2	
V.	Ice cream – isi specification - role the constituents in ice cream -	2	6
	Properties of ice cream mix – physiochemical nature of icecream	2	
	Action of stabilizers and emulsifiers in ice cream.	2	
	Total		**32**

LEARNING OUT COME 15ANHP0309 CHEMISTRY OF MILK PRODUCTS (2+1)		
Unit	**Vague outcome**	**Precious outcome**
I.	Students will learn about the chemical reactions during the production and storage of fat rich products.	1. From this content of the study, students able to know the chemical quality and physio chemical properties of cream and butter. 2. Also learns about the details of chemical changes occurs during the production and storage of cream and butter.
II.	Students will learn about the chemical reactions during the production and storage of concentrated milk products.	1. From this content of the study, students able to know the composition and physio chemical properties of condensed milk and milk powder. 2. Also learns about the details of chemical changes occurs during the production and storage of concentrated milk products and milk powder.
III.	Students will learn about the chemical reactions during the production and storage of fermented milk products.	1. This content of study will explain about the chemical changes during formation of curd. 2. And also physio chemical properties of dahi, yoghurt and shrikhand
IV.	Students will learn about the chemical reactions during the production and storage of acid coagulated milk products.	1. From the content of this course, students learn about the chemical reaction involved in coagulation, renneting and ripening of cheese and panner. 2. Also learns about the quality of coagulated milk products.
V.	Students will learn about the chemical reactions during the production and storage of frozen milk product.	1. From this content of the study student will learn about the physio chemical properties of icecream 2. Also role and action of stabilizer and emulsifier of ice cream.

III SEMESTER

15ANHP0310 INDIGENOUS DAIRY PRODUCTS (3+2)

Objective

- To gain an understanding of manufacturing methods and production of traditional dairy products.
- To gain an understanding of storage and preservation methods of traditional dairy products.

Theory

I. **Heat decicated milk products -** Khoa – Classification- methods of manufacture – Factors affecting yield of khoa – Physico-chemical changes – sensory evaluation- packging- storage of khoa- yield and cost analysis of khoa. Confections made from khoa –burfi, peda, milkcake, kalakand, gulabjamun, rabri, malai, khurchan, basundhi – composition - manufacturing practices – factors affecting yield – Rheological changes during manufacture.

II. **Heat acid coagulated products:** Chhana- definition- composition- methods of manufacture, Chhana based sweets - sensory evaluation- packaging and preservation methods- yield and cost analysis. Paneer: definition- mechanization of paneer manufacturing - sensory evaluation- Physico-chemical changes during manufacture- paneer based products - storage and packaging and preservation methods – Nutritive value of paneer.

III. **Fermented milk products:** Dahi - definition – composition – production procedure- misti doi **–** lassi- sensory evaluation. Chakka: – Product description - method of manufacture - Shrikhand –Product description - method of manufacture- sensory evaluation- Physico-chemical changes and quality assurance during manufacture and storage – packaging and preservation methods – yield and cost analysis.

IV. **Milk based pudding desserts:** Kheer and Payasam – Product description, methods of manufacture- sensory evaluation- value addition in manufacturing - packaging processes (canning) - interaction between milk and cereal constituents- yield and cost benefit analysis.

V. **Fat rich products :** Ghee and Butteroil – Definition – Standard method of manufacture —Organoleptic properties – Flavour and texture –Factors affecting and

prevention – Natural and synthetic anti oxidants and synergists – Adulteration in ghee and its detection.

Practicals

1) Preparation of khoa from cow, buffalo, concentrated and dried milk.
2) Preparation of khoa based sweets: Burfi and Peda
3) Preparation of Gulabjamun
4) Cost analysis of khoa and Khoa based sweets
5) Preparation of chhana from cow and buffalo milk and mixed milk.
6) Preparation of Channa based sweets: Rasogolla
7) Cost analysis of Rasogolla
8) Preparation of Channa based sweets: Pantoa, Rasmalai, Sandesh
9) Preparation of paneer from cow and buffalo milk and mixed milk.
10) Cost analysis of paneer
11) Preparation of dahi
12) Preparation of misti dahi
13) Preparation of lassi, butter milk
14) Cost analysis of fermeted milk products (dahi, misti-dahi, lassi)
15) Preparation of kheer.
16) Preparation of milk payasam
17) Preparation of Shrikhand.
18) Cost analysis of shrikhand
19) Preparation of shrikhand wadi
20) Preparation of Ghee
21) Cost analysis of Ghee
22) Visit to dairy product industries

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LECTURE SCHEDULE **15ANHP0310 INDIGENOUS DAIRY PRODUCTS (3+2)**			
THEORY			
Unit	**Title of the lecture**	**Hours**	**Total Hours**
I.	Heat decicated milk products – khoa – definition,composition-produt description – types of khoa, BIS standard for three varities of khoa size of industry	2	**12**
	Methods of manufacture –(preparation of trational and continues method)	2	
	Factors affecting the yield of khoa	2	
	Physic-chemical changes (stage, colour,milk fat, protein,lactose,milk salt,vitamin	2	
	Sensory evaluation and packaging and storage method	1	
	Cost analysis of khoa for 100 ltrs	1	
	Confection made from khoa – burfi,peda,milk cake, kalakand,gulabjamun,rabri,malai khurchan,burfi-definition composition, method of manufacture,	1	
	Rheological changes during manufacture	1	
II.	Heat acid coagulated products –channa –definition-composition – method of manufacture (traditional continuous channa making)	2	**12**
	Channa based sweets – definition composition method of manufacture	2	
	Sensory evaluation –packaging and preservation methods	1	
	Yield and cost analysis for 50 ltrs	2	
	Paneer-definition composition mechanization of panner manufacture	2	

	Physico-chemical changes during the panner manufacture	1	
	Sensory evaluation, storage and packaging and preservation methods	1	
	Nutritive value of panner	1	
III.	Fermented milk products- dahi – definition, composition,method of manufacture	1	
	Misti doi – lassi- production procedure	1	**8**
	Sensory evaluation and nutritive value of dahi	1	
	Chakka: definition,product description,method manufacture	1	
	Shrikhand-definition,composition,product description and method of manufacture	1	
	Physico-chemical changes and quality assurance during manufacture and storage	1	
	Packaging and preservation methods	1	
	Yield and cost analysis for 50 ltrs	1	
IV.	Milk based pudding deserts- kheer and payasam defition composition method of manufacture	2	
	Sensory evaluation	1	**8**
	Value addition in manufacturing products	2	
	Packaging process – inter between milk and ceral constituents	2	
	Yield and cost benefit of kheer and payasam	1	
V.	Fat rich products:Ghee and Butter oil – definition standard(legal standards for ghee,quality standard for ghee) method of manufacture(desi method,direct cream method,pre-stratifiation method,continous mehod)	2	**8**
	Organoleptic properties-flavour and texture	1	
	Factors affecting and prevention	1	
	Natural and synthetic anti oxidation and synergists	2	
	Adulteration in ghee and its detection	2	
		Total	**48**

LEARNING OUTCOME 15ANHP0310 INDIGENOUS DAIRY PRODUCTS (3+2)		
Unit	**Vague outcome**	**Precious outcome**
I.	From this unit the students will learn the preparation method of khoa and khoa based products	1. From this content of the unit students able to know the method of manufacture of khoa, physico chemical changes, sensory evaluation, cost analysis and improve the keeping quality of khoa. 2. Also they should learn about the estimation of cost of the developed product.
II.	Student will learn about the heat acid coagulated products	1. From this content of the study. Students able to know the method of manufacture of channa and channa based products, also learn about the various types of paneer production, packaging and preservation method. 2. Also they should learn about the estimation of cost of the developed product.
III.	Student will learn about the fermented milk products	1. This content of the course students able to know the preparation of Dahi , mistidoi and lassi, also will learn the composition and nutritive value of the fermented dairy products. And the students should able to know the method of manufacture of chakka based products (shrikhand) and its testing procedure. 2. Also they should learn about the estimation of cost of the developed product.
IV.	This unit students will learn to the millk based pudding and desserts	1. From this content of the study. Students able to know the product description manufacture of value addition product detail about the interaction between milk and cereal constituents. 2. Also they should learn about the estimation of cost of the developed product.
V.	The end of this unit students will learn about the fat rich products	1. From this content of the unit the students would know about the changes occurs during the production and storage of ghee and butter oil. And should aware adulteration in ghee and its detection method. 2. Also they should learn about the estimation of cost of the developed product.

III SEMESTER

15ANHP0311 POLLUTION CONTROL AND ENVIRONMENTAL SAFETY

(2+1)

Objective

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

Theory

I. **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.

II. **Importance of cleaning and sanitization in dairy industry** – Current trends in cleaning and sanitization of dairy equipment: detergents; Automation; Ultrasonic techniques in cleaning; bio-detergents, development of sanitizers-heat; chemical; radiation, mechanism of fouling and soil removal; Bio-films, assessing the effectiveness of cleaning and sanitization of dairy products.

III. **General Characteristics of dairy waste** – Types of sewage - Disposal methods – Flora of sewage – factors influencing dairy waste – Sources of effluents and their recycling in dairy industry – Biogas formation .

IV. **Environment protection acts**: Issues concerning release of genetically engineered microorganisms in environment; environmental laws

V. **Determination of BOD – COD** – Waste water discharge standards – Mode of entry and occurrence of antibiotics, pesticide residues and heavy metals in milk and milk products and their preventive measures.

Practicals

1. Detection of heavy metals in milk.
2. Detection of pesticide residue in milk.
3. Detection of antibiotics.
4. Estimation of BOD.
5. Estimation of COD.

6. Conventional and modern treatment methods of dairy waste.
7. MPN Test.
8. Assessment of efficiency of detergents / sanitizers
9. Preparation of sanitizing solution and estimation of available chlorine content.
10. Method of cleaning and sanitizing equipments.
11. Evaluation of dairy plant sanitation.

References

1) Anantha Krishnan, C.P., (1991), Technology of milk processing, Sri Lakshmi Publications, Chennai -10.
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LECTURE SCHEDULE **15ANHP0311 POLLUTION CONTROL ENVIRONMENT SAFETY (2+1)**			
THEORY			
Unit	**Title of the lecture**	**Hours**	**Total Hours**
I	Water – quality of farm and plant water supplied	2	6
	Routine and special methods for water analysis	2	
	Purification of water	1	
	Requirement of water for farm and plant	1	
II	Importance of cleaning and sanitization in dairy industry:- current trends in cleaning and sanitization of dairy equipment – definition,soil milk stone importance	2	8
	Detergent-deseirable properties,classified	1	
	Automation-ultrasonic techniques in cleaning	1	
	Bio detergents – development of sanitizers – heat,chemical,radiation,mechanism of fouling and soil removal	2	

	Bio-films,assessing the effectiveness of cleaning and sanitization of dairy products	2	
III	General characteristics of dairy waste :types of sewage – disposal methods	2	6
	Flora sewage – factors influencing dairy waste	2	
	Sources of effluents and their recycling in dairy industry – biogas formation	2	
IV	Environmental protection acts : issues concerning relase of gendtically engineered	3	6
	Environment laws – introduction,water -prevention and control of pollution(act 1974),air – prevention and control of pollution(act1981),environment protection act-1986,procedure for obtaining consent.	3	
V	Determination of BOD –COD –definition ,merits and demerits procedure - waste water discharge standards	2	6
	Mode of entry and occurrence of antibiotics	1	
	Pesticide residues- definition,pesticide reasidues in milk,sources of pesticide residues in milk,toxological aspects, preventive measures,other potent contaminants in milk(residues of antimicrobial agents in milk,contaminants n milk)	2	
	Heavy metals in milk and milk products and their preventive measures – definition –biological contamination of heavy metals in milk – pathways of heavy metals – health effects of heavy metals.	1	
		Total	**32**

LEARNING OUT COME 15ANHP0311 POLLUTION CONTROL ENVIRONMENT SAFETY (2+1)		
Unit	**Vague outcome**	**Precious outcome**
I.	By this unit student will learn about the water	1. From this content of chapter students able to know the quality of water from plant and farm 2. Also learnt in detail about the routine and special method for water analysis purification method and requirement of water for farm and plant
II.	Student will learn about the importance of cleaning and sanitization of Dairy industry	1. From this content of the course students able to know the current trends in cleaning and sanitization of dairy equipment, classification of detergents, such as ultra sonic techniques in cleaning. 2. Also learn the development of sanitizers' heat, radiation. Understanding for the mechanism of fouling and soil removal Bio-films, assessing the effectiveness of cleaning and sanitization of dairy products
III.	From this unit students will learn about the General characteristics of dairy waste	1. From this content of the course students able to know understanding for the types of sewage describe the factors influencing dairy waste 2. And also various source of effluent and their recycling in dairy industry and biogas formation
IV.	Students will learn about the environment protection acts	1. From this content of the course students should able to understand the various environment protection acts from state and central government for the issues 2. And also concerning release of genetically engineered microorganisms in environment, environment laws
V.	The end of the unit student will to learn about the determination of BOD and COD	1. From this content of the course student able to know the analysis for the BOD and COD describe for the waste water discharge standard 2. Also learn the mode of entry and occurrence and heavy metals in milk and milk products.

III SEMESTER

MODULAR COURSE

15ANHP0312 ADVANCES IN BY PRODUCTS TECHNOLOGY (2+0)

Objective

- To provide in-depth knowledge, facts and principles of dairy by products.
- To provide in-depth knowledge about the waste utilization in dairy industries.

Theory

I. Status, availability and utilization of dairy by-products in india and Abroad. Membrane technology for effective utilization of dairy by products. Nanotechnology process – Microencapsulation process - Carbonation process - extending the shelf life of dairy products.

II. Casein – definition - types – specifications - coprecipitates - principles - manufacturing processes - physicochemical and functional properties and food applications - Industrial and edible uses of caseins- Nutritional importance.

III. Whey - composition - types – specification - manufacturing techniques - Fermented products from whey - Beverages from whey - Deproteinized and demineralized whey - Condensed whey – WPC- Nutritional importance.

IV. Lactose – definition – types - methods for the industrial production of lactose - refining of lactose - uses of lactose and hydrolysis of lactose - Nutritional importance.

V. Buttermilk processing - Condensed butter milk - Dried butter milk - Utilization of buttermilk products- Nutritional importance. Ghee residue- Composition- processing and utilization- Nutritional importance.

References

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 Mc Graw 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.
5. Walstra P & Jenness R. 1984. *Dairy Chemistry and Physics*. John Wiley & Sons.

LECTURE SCHEDULE 15ANHP0312 ADVANCES IN BY PRODUCTS TECHNOLOGY (2+0)			
THEORY			
Unit	**Topic of the lecture**	**Hour**	**Total Hours**
I.	Status, availability and utilization of dairy by-products in india and abroad.	2	8
	Membrane technology for effective utilization of dairy by products	2	
	Nanotechnology process - microencapsulation process	2	
	Carbonation process - extending the shelf life of dairy products	2	
II.	Casein – definition - types – specifications – co-precipitates - principles - manufacturing processes	2	6
	Physicochemical and functional properties and food applications	2	
	Industrial and edible uses of caseins- nutritional importance	2	
III.	Whey - composition - types – specification - manufacturing techniques	2	6
	Fermented products from whey - Beverages from whey - Deproteinized and demineralized whey	2	
	Condensed whey – WPC- Nutritional importance	2	
IV.	Lactose – definition – types - methods for the industrial production of lactose	2	6
	Refining of lactose - uses of lactose and hydrolysis of lactose	2	
	Nutritional importance of lactose	2	
V.	Butter milk processing - Condensed butter milk - Dried butter milk	2	6
	Utilization of butter milk products- Nutritional importance	2	
	Ghee residue- Composition- processing and utilization- Nutritional importance	2	
		Total	**32**

LEARNING OUTCOME 15ANHP0312 ADVANCES IN BY PRODUCTS TECHNOLOGY (2+0)		
Unit	**Vague outcome**	**Precious outcome**
I.	Students should learn about the status, availability and utilization of dairy by products	1. From this content of the study, students can understand the production details of dairy by products. 2. And also learn about the effective utilization of by products from membrane process.
II.	Students shouldknow about the advanced technical process for extending shelf life of dairy products	1. From this content of the study, students understand the various process of nanotechnology, microencapsulation technology 2. And also carbonation process for extending shelf life of dairy products
III.	Students should learn about the utilization of skimmed milk and its by-products their uses and applications.	1. This content of study, students should able to know the manufacturing details of casein derived from skimmilk. 2. Also learns about the functional properties of casein.
IV.	Students should learn about the utilization and production details of whey and its based products	1. From the content of this course, student able to know the manufacturing details of whey. 2. Also learns about the techniques of various whey based products.
V.	Students should know the production techniques of lactose	1. From the content of this course, they should understand the production details of lactose 2. And also their application of dairy industry.

III SEMESTER

MAJOR ELECTIVE

15ANHP0313(A) COMMERCIAL CHICKEN PRODUCTION (3+1)

Objectives

- To impart the skills and knowledge needed for chicken production, and how these can be applied in practice.
- To develop skills and knowledge of management of broiler and layer chicken in different systems of production

Theory

I. **Introduction**: Meaning of commonly used terms – advantages of poultry farming – egg and chicken meat production and availability – role of egg and chicken meat in human nutrition -Economic importance – Development of poultry industry in India – Zoological classification of chicken - Common breeds of poultry - Plymouth rock - RIR - New Hampshire - Brahman - Cochin - Lagshan - Leghorn - Minorca - Aseel - Kadakanath – Commercial strains of broilers and layers. Reproduction in fowl - female reproductive system - formation of egg - Factors affecting egg size. Male reproductive system - culling.

II. **Hatching of Eggs**: Selection and care of hatching eggs - Factors affecting hatchability - Natural hatching of eggs - Artificial incubation – Types of incubators – Principles of incubation – steps involved in commercial hatchery operation – Hatchery Design and management – Hatchery operation - Sexing of chicks - fumigation and incubators.

III. **Poultry Management**: Chick management - Grower management - Layer management - Broiler management – Layer And Broiler production indices - Housing management - Essentials of good housing - Location of poultry house - Types of poultry housing - Systems of Poultry housing House construction - Deep litter versus cage system - Factors affecting profitability of a poultry farm - Common diseases and control - Vaccination schedule - Poultry waste management.

IV. **Poultry Nutrition**: Nutrients of the feeding stuff - Digestive system in fowl - Feed ingredients - Energy sources - Protein sources - Use of unconventional

feeds– Feed Additives - Nutrient requirement - Computation of ration – FCR- Feeders and water.

V. **Processing**: Preservation and marketing of egg and poultry meat: Structure of egg - Chemical composition and nutritive value - Effect of consumption of raw and cooked eggs - Processing of eggs - Preservation of shell, eggs and liquid eggs - Egg marketing - Slaughtering of poultry - Projects for poultry unit.

Practicals

1. Identification of different breeds of poultry.
2. Reproductive system of hen
3. Candling of eggs.
4. Grading of eggs.
5. Identification of feed ingredients.

6&7. Computation of chick, grower, layer and broiler ration.

8. Visit to feed units.
9. Visit to poultry farms - study of different poultry houses, Vaccination and Debeaking.
10. Slaughtering of poultry.
11. Poultry farm lay out and housing design
12. Visit to a hatchery.
13. Preparation of projects for poultry unit (Layers and Broilers)

References

1. ICAR, 2013. Hand book of Animal Husbandry, 4th Ed.ICAR Publication, Pusa, New Delhi.
2. Banerjee, G.C., 1993. Poultry 2 Ed. Oxford and IBH Publishing Company Ltd., New Delhi.
3. Sastry, N.S.R., C.K.Thomas and R.A.Singh, 1994. Livestock Production Management, 3 Ed.Kalyani Publishers, New Delhi.
4. Panda, B., and S.C.Mohapatra, 1989. Poultry Production, ICAR Publications, New Delhi.
5. Gopalakrishnan, C.A., C.M.M. Lal, 1989. Livestock & Poultry Enterprises for Rural development, Vikas Publishing House Pvt. Ltd., Ghaziabad, U.P.

Lecture Schedule

1. Meaning of commonly used terms, advantages of poultry farming, egg and chicken meat production and availability
2. Role of egg and chicken meat in human nutrition, economic importance of poultry farming and Development of poultry industry in India
3. Zoological classification of chicken and classification chicken breeds based on origin and utility
4. Common breeds of poultry - Plymouth rock, RIR, New Hampshire,Brahman, Cochin - Lagshan - Leghorn - Minorca - Aseel – Kadakanath. Commercial strains of broilers and layers.
5. Anatomy of reproductive system of hen
6. Formation of egg – formation of yolk, ovulation, sexual maturity, clutch, egg formation time, ovulation time,
7. Formation of albumin, shell membrane and shell and factors influencing shell quality.
8. Abnormal eggs and male reproductive system
9. Culling – objectives, culling on the basis of external appearance, pigmentation and moulting
10. Selection and care of hatching eggs
11. Factors affecting hatchability
12. Natural hatching of eggs - Selection of hatching hen, Best time to set hen, the nest, care of sitting hen hatching egg.
13. Artificial incubation – Types of incubators and Principles of incubation
14. Steps involved in commercial hatchery operation
15. Hatchery design and management
16. Hatchery operation
17. Sexing of chicks and fumigationof incubators.
18. Chick management
19. Grower management
20. Layer management
21. Broiler management
22. Layer and Broiler production indices

23. Housing management - Essentials of good housing - Location and lay out of poultry house
24. Types of poultry housing and Systems of Poultry housing
25. Construction details deep litter houses - the built up litter, Litter management, Recycling of nutrients in deep-litter system and Qualities of good litter material advantages and disadvantages
26. Details of poultry cages – types of cages and its advantages and disadvantages.
27. Lighting in poultry production
28. Factors affecting profitability of a poultry farm
29. Common diseases and control
30. Vaccination schedule
31. Poultry waste management – Manure management , utility of poultry manure, disposal of dead birds.
32. Nutrients of the feeding stuff – Water, Carbohydrate, Protein, Fat, Vitamins, Minerals
33. Digestive system of fowl
34. Feed ingredients – Energy, Protein, Mineral and Vitamin sources
35. Use of unconventional feeds
36. Feed Additives
37. Nutrient requirement and Computation of ration – FCR- Feeders and waterers.
38. Factors influencing the nutrient requirements
39. Structure of egg, its chemical composition and nutritive value.
40. Effect of consumption of raw and cooked eggs
41. Preservation of shell eggs – thermal processing, immersion in liquids, oil coating, cold storage and pickling
42. Preservation of liquid eggs – whole egg, albumin and yolk powder
43. Marketing of egg in India and developed countries – marketing channels
44. Slaughtering of poultry
45. Projects for poultry unit.

Learning Outcome

Unit I:

Instruction in lessons in Unit I should result in students achieving the following objectives;

1. Growth and development of Poultry Industry in India
2. Statistics on Poultry population and Per-capita availability in India
3. Be able to identify different types of chicken and describe common breeds of each type.
4. Steps involved in the process of Egg formation
5. Hormonal control of Ovulation and Oviposition
5. Parts of the male reproductive system
6. Acquire skill in culling of unproductive birds
7. Acquire knowledge on various factors affecting egg size.

Unit II:

Instruction in lessons in Unit II should result in students achieving the following objectives;

1. Acquire knowledge on selection and care of hatching eggs.
2. Acquire knowledge on Factors affecting hatchability
3. How to know that the hen is broody.
4. Using the broody hen to incubate chicken and duck eggs.
5. Care of the broody hen.
6. Acquire knowledge on types of incubators
7. Design and layout of hatchery
8. How to operate hatchery?
9. Acquire skill sexing of chicks
10. Acquire skill in disinfection by fumigation.

Unit III:

Instruction in lessons in Unit III should result in students achieving the following objectives;

1. How to keep chicks in a brooder.
2. Purpose of Brooding
3. Types of Brooding Equipment
4. Acquire skill in the management of grower and layer chicken
5. Acquire knowledge in broiler chickenproduction
6. Acquire knowledge in essentials of good housing
7. Acquire knowledge in design and layout of poultry hosse
8. Acquire knowledge in different systems of poultry housing.
9. Acquire knowledge in factors affecting profitability of a poultry farm
10. Common diseases of viral and bacterial, protozoan chickenand their control
11. Vaccination schedule for layers and broilers
12. Acquire knowledge in chicken waste management.

Unit IV:

Instruction in lessons in Unit IV should result in students achieving the following objectives;

1. Acquire knowledge in nutrients of the feeding stuff.
2. Acquire knowledge in feed ingredients and additives
3. Acquire knowledge in nutrient requirement for different classes of chicken
4. Acquire knowledge in anatomy and physiology digestive system of chicken
5. Acquire skill in low cost feed formulation
6. Acquire knowledge in the types of food and water troughs to use

Unit V:

Instruction in lessons in Unit V should result in students achieving the following objectives;

1. Acquire knowledge in Structure, chemical composition and nutritive value of egg
2. Acquire knowledge in effect of consumption of raw and cooked eggs.
3. Acquire knowledge in home preservation of shell eggs and liquid eggs
4. Acquire knowledge in commercial preservation of shell eggs
5. Acquire knowledge in commercial preservation liquid eggs and manufacture of egg powder
6. Acquire knowledge in Egg marketing channels

7. Acquire skill in Slaughtering of chicken
8. Acquire skill in preparation of bankable projects for poultry unit.

MAJOR ELECTIVE

15ANHP0313(B) SHEEP AND GOAT PRODUCTION (3+1)

Theory

I. Sheep breeds: Introduction - Zoological classification. Advantages of sheep. Breeds classification - indigenous breeds - Hissardale chokla - Nali - Malpura - Nellore - Mandya - Breeds of Tamilnadu - Mecheri - Madras Red - Ramnad white - Trichy black - Kilakarsal - Vembur Exotic breeds- Merino - Rambouillet - Dorest - Suffolk south down.

II. Sheep Breeding and feeding: Selection of breeding stocks- Reproduction in sheep - Breeding system. Breeding policy for improving mutton and wool production. Feeding - nutrient requirements - Feed resources - Pasture management flushing - Feeding of pregnant and lactating ewes - Care of pregnant ewes.

III. Housing and Health Care: Housing of sheep common disease - Sheep pox - Blue tongue - Haemorrhagic septicemia - Anthrax - Foot Rot - Pregnancy toxemia.

IV. Goat breeds and breeding: Introduction - Meaning of commonly used terms - Advantages of goat farming. Breeds - Indigenous breeds Jamunapari - Tellicherry - Barbari. Exotic breeds - Saanen - Toggenberg - Nubian breeding - Selection of breeding animal - Reproduction - Mating system.

V. Feeding, Housing and health care: Feeding habits of goat - Nutrient requirements - Water requirement - Dry matter requirement - Feeding different classes of goat - Stall fed system and goat rearing - Control of ecto and endoparasites - Coccidiosis - HCN poisoning - Ruminal acidosis.

Practical:-

1. Preparation of project for a sheep unit.
2. Identification of breeds of sheep.
3. Preparation of project for a goat unit.
4. Identification of breeds of goat.
5. Preparation of plans for housing of sheep.
6. Preparation of plans for housing of goat.

7. Visit to commercial sheep and goat farm.
8. Vaccination and deworming.
9. Dentition and ageing.
10. Calculation of nutrient requirements of sheep.
11. Calculation of nutrient requirement of goat.

References:-

1. ICAR, 1990. Hand book of Animal Husbandry, 2 Ed.ICAR Publication, Pusa, New Delhi.
2. Banerjee, G.C., 1993. Poultry 2 Ed. Oxford and IBH Publishing Company Ltd., New Delhi.
3. Sastry, N.S.R., C.K.Thomas and R.A.Singh, 1994. Livestock Production Management, 3 Ed.Kalyani Publishers, New Delhi.
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III SEMESTER

15VPPP0301 VILLAGE PLACEMENT PROGRAMME (2+0)

III SEMESTER

COMPULSORY NON CREDIT COURSE

15ETNP0301 FIELD VISIT / EXTENSION (0+2)

Objective

To provide practical exposure in dairy sectors.

Scope

Students have to undergo training in dairy industry so that they become aware of the practical applications of theoretical concepts studied in the class rooms.

Assessment

The students will be placed in dairy sectors such as dairy plant, dairy farm and dairy cooperatives societies of their choice but with the approval of the department. The students have to observe and involve themselves with daily routine activities of the dairy farm and dairy cooperatives like clean milk production, sampling of milk, quality control of milk and milk products, processing, preparation of milk products and marketing. At the end of the training student will submit a report as per the prescribed format to the department.

IV SEMESTER

15ANHP0414 DAIRY MICROBIOLOGY (3+1)

Objective

- To impart current knowledge on basic and applied microbiological aspect of fluid milk and dairy products for improved quality and food safety.
- To facilitate the students to analysis the microbial examination of various dairy products.

Theory

I. **Importance of dairy microbiology** – Types of microbes in milk and their morphology – Milk borne diseases – Microbiology of raw milk – Bacteriological grading of raw milk – Microbiology of heat processed milk – Bacteriological problems associated with pasteurization sterilization - bactofugation processes – Bacteriological standards for processed milks - mycotoxins in milk – Anti-microbial system in raw milk - Inhibitors in milk – microbiology of milk at farm level.

II. **Bacteriology of starter cultures**-Types-Function- Propagation – Preservation methods – Factors affecting activity of starter cultures – role of starter in dairy fermentation Characteristics of good starter culture – Bacteriophage action in starter cultures and its control measures.

III. **Microbiology of fermented milk products and cheese–**fermented milk and food borne diseases - Microbial spoilage of fermented milk and their control measures – microbial analysis of fermented milk. Microbiology of cheese – cheese and food borne disease – production of biogenic amines in cheese – spoilage of cheese – microbiological examination of cheese.

IV. **Microbiology of cream and cream based products** – spoilage of cream and cream based products – microbiological analysis of cream – microbiology of butter – spoilage of butter – microbiological analysis of butter – microbiology of ice cream – ice cream and food borne disease – bacteriological standards of ice cream – microbial analysis of ice cream.

V. **Microbiology of concentrated and dried milk products –** concentrated and dried milk product and food borne disease – spoilage microflora of concentrated milks – microflora of dried milk powder – microbial analysis of concentrated

and dried milk products – Microbial control of new Non thermal methods – controlling microbial quality of food and food standards.

Practicals

1. Sampling techniques of milk and milk products
2. MBR Test
3. Testing the activity of starter cultures
4. Microbial analysis of raw and pasteurized milk
5. Microbial analysis of cream and butter
6. Microbial analysis of cream
7. Microbial analysis of ice-cream
8. Microbial analysis of Propagation and maintenance of starter culture
9. Microbial analysis of dahi and yoghurt
10. Microbial analysis of condensed milk
11. Microbial analysis of evaporated milk
12. Microbial analysis of dried milk
13. Microbial analysis of cheese

References

1. Foster E.M (1957) Dairy Microbiology, Prentice Hall Inc, USA.
2. Pelczar, Chan (1997), Microbiology, Tata MC Graw, Hill Publishing Co. Ltd., New Delhi.
3. Ramasamy (1999) Dairy Technologist's Hand Book, International Book Distributing Co, Lucknow
4. Srivastava.L. (2002)., Hand Book of Milk Microbiology, Daya Publishing House, Delhi.
5. Yadav, J.S Sunita Grover and V.K. Batish (1993), A Comprehensive Dairy Microbiology, Metropolitan Book Co. Pvt. Ltd., New Delhi.

LECTURE SCHEDULE 15ANHP0414 DAIRY MICROBIOLOGY (3+1)			
THEORY			
Unit	**Title of the lecture**	**Hours**	**Total Hours**
I	Importance of dairy microbiology- Types of microbes in milk and their morphology – Milk borne diseases – Microbiology of raw milk – Bacteriological grading of raw milk	**4**	**10**
	Bacteriological grading of raw milk – Microbiology of heat processed milk – Bacteriological problems associated with pasteurization sterilization - bactofugation processes – Bacteriological standards for processed milks	4	
	Mycotoxins in milk – Anti-microbial system in raw milk - Inhibitors in milk –microbilogy of milk at farm level.	2	
II	Bacteriology of starter cultures Types-Function- Propagation – Preservation methods – Factors affecting activity of starter cultures – role of starter in dairy fermentation	4	8
	Role of starter in dairy fermentation	1	
	Characteristics of good starter culture –	1	
	Bacteriophage action in starter cultures and its control measures.	2	
III	Microbiology of fermented milk products and cheese–fermented milk and food borne diseases - Microbial spoilage of fermented milk and their control measures– microbial analysis of fermented milk.	4	10
	Microbiology of cheese – cheese and food borne disease – production of biogenic amines in cheese	4	
	Spoilage of cheese – microbiological examination of cheese.	2	
IV	Microbiology of cream and cream based products – spoilage of cream and cream based products – microbiological analysis of cream	4	10
	Microbiology of butter – spoilage of butter – microbilogical analysis of butter	3	
	Microbiology of ice cream – ice cream and food borne disease	2	

	Bacteriological standards of ice cream – microbial analysis of ice cream.	1	
V	Microbiology of concentrated and dried milk products – concentrated and dried milk product and food borne disease – spoilage microflora of concentrated milks	4	10
	Microflora of dried milk powder – microbial analysis of concentrated and dried milk products	3	
	Microbial control of new Non thermal methods – controlling microbial quality of food and food standards	3	
	Total		48

LEARNING OUTCOME **15ANHP0414 DAIRY MICROBIOLOGY (3+1)**		
Unit	**Vague outcome**	**Precious outcome**
I	Students should learn about the different types microbes in milk and their morphology, Milk borne diseases, Bacteriological standards for processed milks and Inhibitors in milk.	1. From this content of study, students will able to know the different types of microbes in milk, their morphology and milk borne diseases. 2. Also to evaluate the bacteriological grading of raw milk and to estimate the Bacteriological problems associated with pasteurization, sterilization, bactofugation processes.
II	Students should able to identify the good starter cultures, Factors affecting activity of starter cultures and its control measures	1. From this content of the study, students can able to understand the starter culture types, function, and propagation and preservation method. 2. Also recognize the factors affecting activity of starter cultures and prevent the Bacteriophage action.
III	Students should learn about the microbiology of fermented milk and cheese	1. From this content of the study, students can able to know the microflora of fermented milk, food borne diseases, recognize the microbial spoilage

		of fermented milk and their control measures. 2. Also to know the microbiology of cheese, food borne disease. And to evaluate the production of biogenic amines in cheese spoilage of cheese
IV	Students should learn about the microbiology cream and cream based products. Bacteriological standards of ice cream and microbial analysis of ice cream.	1. From this content of the study, Students to recognize the spoilage of cream and cream based products and evaluate the microial analysis of cream and butter. 2. Also learn the microbial analysis of ice cream, their food borne disease and its bacteriological standards of ice cream
V	Students should learn about thethe microbiology of concentrated and dried milk product and their food borne disease. Microbial control of new Non thermal methods. Controlling microbial quality of food and food standards.	1. From this content of the study, Students to know microflora of concentrated and dried milk product and their food borne disease, identify the spoilage microflora of concentrated milks and microflora of dried milk powder and evaluate the microbial analysis of concentrated and dried milk products, 2. Also know the microbial control of new Non thermal methods and implement the controlling microbial quality of food and food standards.

IV SEMESTER

15ANHP0415 PACKAGING AND JUDGING OF DAIRY PRODUCTS (2+1)

Objective

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

Theory

I.Packaging materials - types of packaging materials – aluminium foils/containers, glass, LDPE, HDPE, PET, Polstyrene, polypropylene, PVC, Multi-layer sheet/film and BOPP - range of packing materials - disposal packaging materials – dump filling - incineration – reuse – recycling packaging materials – recommended packaging and storage condition.

II.Packaging- packaging – function – use of different material in milk and milk products-packaging of heat and acid coagulated products- packaging of cultured/fermented milk – packaging of milk based pudding/desserts – packaging machinery - standardization in packaging - ecofriendly - edible packaging – biodegradable packaging.

III.Packaging techniques– Packaging technique like vacuum packaging, Modified Atmospheric Packaging (MAP) ,Oxygen absorbers/scavengers, poly clip system, aseptic packaging and computer-aided designning – Procurement of packaging machine - Compatibility and toxicity of packaging materials.

IV.Fundamental rules for scoring and grading of milk and milk products– Types of tests – Different test, paired comparison, doutrio, triangle, ranking, scoring, hedonic scale and descriptive tests-Threshold test. Panel selection, screening and training judges, requirement of sensory evaluation, sampling procedures sensory characteristic of food – taste interaction- sensory aspects of UHT milk.

V.Judging and grading – defects in milk, score card and its uses – judging and grading of milk- judging and grading of khoa - judging and grading of fat rich products like cream, butter and ghee - judging and grading of ice cream - judging and grading of

concentrated milk products like condensed and evaporated milk products - Judging and grading of dried milk products - Judging and grading of Dahi.

Practicals

1. Determination of threshold value for basic taste.
2. Selection of judging the panels
3. Training of judges for recognition of flavour and texture.

Sensory evaluation, Judging and packaging of following products;

1. milk.
2. Cream
3. Butter
4. Ghee
5. Condensed and evaporated milk
6. Dried milk
7. Cheese and related products
8. Frozen products
9. Khoa and khoa based sweets
10. Dahi and fermented dairy products

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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.
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5. Sukumar, DE., 1980, Outlines of Dairy Technology, Oxford University Press, New Delhi.

LECTURE SCHEDULE 15ANHP0415 PACKAGING AND JUDGING OF DAIRY PRODUCTS (2+1)			
THEORY			
Unit	**Title of the lecture**	**Hours**	**Total Hours**
I	Packaging materials - types of packaging materials – aluminium foils/containers, glass, LDPE, HDPE, petpolstyrene, polypropylene, PVC, Multi-layer sheet/film and BOPP	**3**	**6**
	Disposal packaging materials – dump filling - incineration - reuse – recycling packaging materials	2	
	Recommended packaging and storage condition.	1	
II	Packaging-– packaging – function – use of different material in milk and milk products	1	6
	Packaging of heat an acid coagulated products - treatments for extending the shelf life	1	
	Packaging of cultured/fermented milk - packaging of milk based pudding/desserts	1	
	Packaging machinery – Form Fill and Seal (FFS) - standardization in packaging	2	
	Ecofriendly - edible packaging – biodegradable packaging.	1	
III	Packaging technique - vacuum packaging, Modified Atmospheric Packaging (MAP),Oxygen absorbers/scavengers, poly clip system, aseptic packaging and computer-aided designing	4	6
	Procurement of packaging machine	1	
	Compatibility and toxicity of packaging materials	1	
IV	Fundamental rules for scoring and grading of milk and milk products - Types of tests – Different test, paired comparison, doutrio, triangle, ranking, scoring, hedonic scale and descriptive tests- Threshold test.	4	8

	Panel selection, screening and training judges, requirement of sensory evaluation, sampling procedures	2	
	Sensory characteristic of food – taste interaction	1	
	Sensory aspects of UHT milk	1	
V	Judging and grading – defects in milk, score card and its uses – judging and grading of milk	1	6
	Judging and grading of khoa - score card -procedure of examination	1	
	Judging and grading of fat rich products like cream, butter and ghee	1	
	Judging and grading of ice cream score card - procedure of examination	1	
	Judging and grading of concentrated milk products like condensed and evaporated milk products	1	
	Judging and grading of dried milk products and Judging and grading of Dahi	1	
		Total	**32**

LEARNING OUTCOME **15ANHP0415 PACKAGING AND JUDGING OF DAIRY PRODUCTS (2+1)**		
Unit	**Vague outcome**	**Precious outcome**
I.	Students should learn about the different types of packaging materials and recommended packaging and storage condition.	1. From this content of study, students will able to know the different types of packaging materials like aluminum foils/containers, glass, LDPE, HDPE, PET, Polystyrene, polypropylene, PVC, Multi-layer sheet/film and BOPP. 2. Also disposal of packaging materials like dump filling, incineration and recycling packaging materials. To know the recommended packaging and storage

		condition.
II.	Students should learn about the packaging functions and their packaging machinery also eco friendly packaging.	1. From this content of study, students will able to know the packaging function, their use of different material in milk and milk products. 2. Also explain packaging machinery and standardization in packaging. To implement the eco friendly packaging like edible and biodegradable packaging.
III.	Students should gain the knowledge about packaging technique, compatibility and toxicity of packaging materials.	1. From this content of study, students will able to know the Packaging technique like vacuum packaging, Modified Atmospheric Packaging (MAP),Oxygen absorbers/scavengers, poly clip system, aseptic packaging and computer-aided designing. 2. And also their Compatibility and toxicity of packaging materials.
IV.	Students should learn about the Fundamental rules for scoring and grading of milk and milk products. The process of panel selection and recognize the characteristic of food.	1. From this content of study, students will able to assess the milk products by using the different types scoring test like different test, paired comparison, dou-trio, triangle, ranking, scoring, hedonic scale, descriptive tests and also threshold test. 2. Also to know the process of panel selection, screening and training judges. Also sensory characteristic of food like taste interaction and sensory aspects of UHT milk.
V.	Students should learn about the techniques of Judging and grading of milk products.	1. From this content of study, students will able to assess the defects in milk, score card and its uses. 2. Also to evaluate the sensory characteristic of khoa, fat rich products like cream, butter and ghee. Also concentrated milk products like condensed and evaporated milk products.

IV SEMESTER

MODULAR COURSE

15ANHP0416 FOOD SAFETY AND QUALITY AUDITING (2+0)

Objective

- To provide an opportunity to learn food safety and quality auditing programme
- To gain knowledge about the international food law and quality standards.

Theory

I. **General principles for food safety and Hygiene-** Principles of food safety and quality –Food Safety System - Quality attributes- Total Quality Management. Introduction to Risk Analysis, Risk Management, Risk Assessment, Risk Communication.

II. **Implementation, Documentation and Record Keeping-**Identification of hazards in food industry -Identifying the Key Focus Areas for GHP & GMP- Developing HACCP for any food production -Verification and Validation of Control Measures- Implementation of occupational health & safety specification.

III. **Audit Checklist -** Preparation of audit checklist including salient features of ISO 9001 and FSMS 22000.

IV. **Conducting Audit -** Conducting open meeting and close meeting in auditing - Preparation of auditing report for different departments-Mock Audit Exercise.

V. **Certification-** Application of ISO 9001 Model/ Food Safety Management System.

References

1. Neal D. Fortin. 2009. Food regulation, Publisher Wiley
2. Naomi Rees. David Watson. 2000. International standards for food safety, An Aspen Publications.

LECTURE SCHDULE 15ANHP0416 FOOD SAFETY AND QUALITY AUDITING (2+0)			
THEORY			
Unit	**Topic of the lecture**	**Hour**	**Total Hours**
I.	General principles for food safety and hygiene- principles of food safety and quality	2	8
	Food Safety System - quality attributes	2	
	Total quality management	2	
	Introduction to risk analysis, risk management, risk assessment, risk communication	2	
II.	Implementation, documentation and record keeping-identification of hazards in food industry -identifying the key focus areas for GHP & GMP	2	6
	Developing HACCP for any food production -verification and validation of control measures	2	
	Implementation of occupational health & safety specification	2	
III.	Audit checklist- preparation of audit checklist	2	6
	Salient features of ISO 9001	2	
	Salient features of FSMS 22000	2	
IV.	Conducting audit - conducting open meeting and close meeting in auditing	2	6
	Preparation of auditing report for different departments	2	
	Mock audit exercise	2	
V.	Certification- need and importance	2	6
	Application of ISO 9001 model	2	
	Application of Food Safety Management System	2	
		Total	**32**

LEARNING OUT COME 15ANHP0416 FOOD SAFETY AND QUALITY AUDITING (2+0)		
Unit	**Vague outcome**	**Precious outcome**
I.	Students should learn about the general principles for food safety and hygiene.	1. From this content of the study, students can understand the system of food safety. 2. Also learn about the risk analysis, risk management, risk assessment and risk communication.
II.	Students should know about the implementation, documentation and record keeping.	1. From this content of the study, students can able toidentified the hazards in food industry 2. Also apply the HACCP for food production.
III.	Students should learn about the food safety audit check list.	1. This content of study, students should able to prepare the audit checklist 2. Also including salient features of ISO 9001 and FSMS 2200.
IV.	Students should able to conduct the food safety and quality audit.	1. From the content of this course, student able to conduct the meeting and preparation of auditing report for different departments 2. Also learn the mock audit exercise.
V.	Students should know to get the food safety certificate.	1. From the content of this course, they understand to get the food safety 2. And also understand the quality auditing certificates.

IV SEMESTER

15ANHP0417 DISSERTATION (4+0)

Objective

- To identify the research area relavent to the program of study.
- To undertake research in an area related to the program of study.

Scope

The student shall be capable of identifying a problem related to the program of study and carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society.

Assessment

M.Sc projects should be socially relevant and research oriented ones. Each student is expected to do an individual project. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project.

The dissertation work will be evaluated by the research supervisor (Guide) and External Examiner.

IV SEMESTER

15ANHP0418 CREDIT SEMINAR (2+0)

Objective

- To train the students in preparing and presenting technical topics.
- To assess and improve capability of the students in presenting their topics of research.

Scope

- The student shall be capable of identifying topics of interest related to the program of study and prepare and make presentation before an enlightened audience.

The students are expected to give presentation on their topic of interest which will be assessed by a committee constituted for this purpose. This course is mandatory and a student has to pass the course to become eligible for the award of degree. The presentation will be evaluated through CFA by the Chairman and two internal examiners.

IV SEMESTER

15ANHP0419 INPLANT TRAINING (0+5)

Objective:

- To provide practical exposure in dairy sectors.
- To equip the students with various operating procedures in dairy industry.

Scope :

Students have to undergo one month hands on training in dairy industry so that they become aware of the practical applications of theoretical concepts studied in the class rooms.

Assessment

The students will be placed in dairy sectors such as dairy plant, dairy farm and dairy cooperatives societies of their choice but with the approval of the department. The students have to observe and involve themselves with daily routine activities of the dairy farm and Dairy Cooperatives like clean milk production, sampling of milk, quality control of milk and milk products, processing, preparation of milk products and marketing. At the end of the training student will submit a report as per the prescribed format to the department.

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