

## ABOUT THE COURSE

Agriculture is one of the fields which can absorb a considerable number of unemployed educated youth of the the country. In India agriculture employs about 50% of the total work force. While income from crop production is seasonal, stable income from dairying provides an important economic incentive for the small farmers to take to dairying.

Animal husbandry and Dairying play an important role in the national economy and in the socio- economic development of country. These sectors also play a significant role in supplementing family incomes and generating gainful employment. The dairy industry with large number of Dairy entrepreneurs in rural areas as made a tremendous impact on agrarian economy of country with present production level of 98 million tons of milk per annum, India ranks first in the world .

Vocationalization in the field of Dairying will definitely change the pace of rural employment. The course 'Dairy Technology' is designed to train the youth so that there will be improvement in the present scenario of effective and efficient management of dairy enterprise. Now the course "Dairy Technology' has been revised with latest scientific technologies developed and improved management practices. The course curriculum is designed and presented to mould the students suitable for self employment as well as seek employment with state departments, private/public firms, co-operatives, educational institutes etc.

This course consists of 4 modules, more importance has been given to practicals and On the Job Training, which develop vocational skills in the field.

## JOB ROLES (CAREER PATH)

<b>Government/ co-operative sector</b>	<b>Private sector</b>	<b>Self Employment</b>
<ul style="list-style-type: none"> <li>• Laboratory Technical Assistant/Laboratory Assistant in Dairy industry or educational institutions with dairy courses</li> <li>• Food Analyst/Laboratory Assistant in Food industry/ departments</li> <li>• Dairy Farm Instructor</li> <li>• Fodder Promoter</li> <li>• Secretary in dairy co-operative societies.</li> <li>• Milk Tester in dairy co-operative societies.</li> <li>• Livestock assistant/ Artificial Insemination Assistant</li> <li>• Dairy plant Assistant/ Dairy plant operator</li> <li>• Milk and milk products sales promotion assistant.</li> <li>• Dairy Farm supervisor</li> <li>• Dairy Extension Assistant</li> <li>• Vocational Instructor</li> </ul>	<ul style="list-style-type: none"> <li>• Laboratory Assistant in Quality Control labs of Private dairy plants.</li> <li>• Assistant food analyst in food industry.</li> <li>• Dairy Extension Assistant</li> <li>• Fodder production Assistant</li> <li>• Salesman for               <ul style="list-style-type: none"> <li>- Feeds and suppliers</li> <li>- Purchase and sale of cattle</li> <li>- Sale of dairy equipments/Farm implements.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Dairy farm owner</li> <li>• Owner of milk processing and marketing unit (Fluid milk plant)</li> <li>• Owner of milk products/ sweet manufacturing unit</li> <li>• Fodder Producer</li> <li>• Technical staff for research organizations and consultancy services</li> <li>• Marketing of milk and milk products</li> </ul>

## SUBJECT APPROACH

### DAIRY TECHNOLOGY

#### Introduction

Vocational education enables students to acquire skills which are traditionally non-academic and totally related to specific trade, occupation or vocation. Vocational courses are primarily designed in such a way that they impart a thorough application based study wherein theoretical concepts of a field are not studied independently but are subordinated to the understanding of techno-operational aspects of specific job.

In India Dairying is recognized as an instrument for social and economic development. Ample labour and a small land base encourage farmers to practice dairying as an occupation subsidiary agriculture. India is the highest milk producer in the entire globe. India is well known as the 'Oyster' of the global dairy industry, with opportunities galore for the entrepreneurs globally. The main Objective of Indian Dairy Industry is to manage the national resources in a manner to enhance milk production and upgrade milk processing using innovative technologies.

The Indian Dairy Industry which is in the developing stage provides gainful employment to a vast majority of rural house holds. It employs about 8.47 million people on yearly basis out which 71% are women. Jobs in Indian Dairy Industry are mainly in the fields of production and processing of dairy products.

#### Objectives of the course

1. To train students to scientifically undertake all operations of animal husbandry and dairy technology and to create employment potential and man power for dairy development
2. To create entrepreneur in dairying and dairy associated activities.
3. To develop organizational capabilities among our youth in dairy industry
4. To develop skill, instill confidence by enhancing life skills
5. To increase nutritional status and income of community through dairy farming.

#### LEARNING APPROACH

A learner centered and activity based learning approach is to be adopted. The many sided intelligence of the students should be explored to gain in depth knowledge. The teacher has to create an atmosphere that encourages the learner to discover ideas and facts

on his own. For example, the teacher can assign the student to identify the characteristics of different breeds. This gives an opportunity for the

learner to observe different breeds in their surroundings or they can collect information from different sources like internet and print media. Their observation can be consolidated in to the product. Peer learning is also relevant in this era of inclusive education as the learners learn by helping each other. In collaborative learning students contributes their part to a common goal. Teacher can direct the students to collect different varieties of feeding materials of animals and study their characteristics. Their observations can be consolidated and presented in the class. .

The following are the domains livestock management course should lay emphasis on,

- Knowledge domain: students are expected to know scientific principles and available scientific facts. Knowledge can be created through observations, discussions, debates, projects, activities, reference books etc.
- Process domain: process is a chain of procedures for achieving a particular aim. Process skills enable students to identify concepts, analyze and draw conclusions. The important process skills are observing, classifying, preparing charts, engaging in experiments, collecting and recording data, inferring, interpreting data, identifying solutions/problems, decision taking, handling instruments etc.
- Creativity domain: All science education should enable the student to deviate from the conventional path and think differently. Livestock management is also not an exception to this fact. Some skills pertaining to this domain are, visualizing, formulating and identifying alternative uses of technology/objects, finding solutions for problems, designing instruments and machine. For eg., the traditional ways of identifying animals are by classical methods like branding, tattooing, tagging etc. but each of these methods has many limitations. With the advent of technology, micro chips/transducers were introduced which revolutionized the field of animal identification especially in case of wild animals. So students should be able to dream and come up with new technologies and thereby contribute to the field of livestock management.
- Application domain: the concepts, processes and values should be applied in daily life or anywhere possible and then only the education is complete. A livestock management student can apply what all studied in the course under real field. The student will be able to evaluate the events or developments happening in animal husbandry sector.

## LEARNING STRATEGIES

In the modern era of globalization the introduction of new technologies ensure only the survival of the fittest. So it becomes a necessity to equip

the leanness to face the growing challenges in the competitive world. Hence the traditional approach to learning is

no more relevant in the present context. The teacher should use instructional techniques that motivate the students to construct his own knowledge. Instructional strategies should be viewed as a social skill which is part of educational environment and not as a technique to be mastered. They are considered to be as important components of teacher-student interaction and not as teacher activities alone. The important instructional strategies which can be employed for livestock management course are described below.

### **ASSIGNMENT**

Assignment is some specific work assigned to the students as a part of their academic enrichment. There are learning activities undertaken as a continuation of class room activities to realize the curriculum objectives to a broader extent. They should be completed in time bound manner. They help to lead learner to higher level of learning from the present status. Challenging assignment can motivate the students to involve in group dynamics and achieve fruitful results. The teachers may act as a guide. Assignment may be given on individuals or group basis. Assignment includes preparation of notes, preparation of charts, models, collection of materials from institutions etc. Assignments develop skills of reference, observation, enquire reporting etc. It ensures the effective utilization of leisure time of the students.

### **SEMINAR**

Seminar is a learning strategy involving an in-depth analysis of specific topic, preparation of a paper and presentation. The paper is presented by either one student or a group of students. After the presentation, there will be a discussion/ interaction in which all the students can participate. The students get an opportunity to clear their doubts and make clarification. Seminar helps to develop communication skill and overcome stage fright.

### **PROJECT**

Project is a self-learning strategy which can exert great influence on the overall development of the learner. Project as learning strategy is to be selected where a problem arises in any part of the curriculum. The students may be divided into groups and assigned different aspects of the problem. Each group works independently. Specific aspects of the problem such as data collection, classification, analysis, report preparation and presentation is to be undertaken by each of the members. Even though the work is divided among the members, it must be ensured that the execution of each and every activity is done with the active participation of all. After analyzing data collected from different sources, the learner arrives at a conclusion that can help to solve

the problem. Thereby learner learns the topic through his own activity. The other advantage of these learning activities is that it helps the learner to scientifically handle any problematic situation. It helps in the development of scientific thinking and thereby builds up the students' aptitude for the subject.

### **DEBATE**

Debate is a hot and interesting learning activity. A debate can be organized only on a topic on which there is difference of opinion. Therefore a topic suitable for debate has to be chosen. Debate can be on relevant topic that is different and interesting to the students and relevant to society. Students with different opinions have to be identified for discussion. Those who have similar opinion should join together to form a side. Those who hold the opposite view with form the other side. It would be ideal to write down the topic of the debate and displayed in advance. There should also a person to control debate. Students should be given opportunity to absorb the ideas obtained from discussion and debate, develop the idea through reading and study, and to express them through writing or other means

### **CASE STUDY**

A case may be a person, institution or a community case study is an in-depth analysis of an actual event or situation. It presents real pictures of situation with facts, objective information or data. Learners analyze the case to interpret, predict and resolve issues associated with it. The case study provides the learner an opportunity to analyze and apply concepts, data and theory taught from the class. Learners can work individually or in groups. By studying realistic cases in the classroom, students develop new insights into the solution of specific on - the - job problem and also acquire knowledge of the latest concepts and principles used in problem solving. Case may be presented by the teachers or may be provided in print form. A simple case study may have the following steps

### **BRAIN STORMING**

This is the best method for solving creative problems. It facilitates generation of ideas quickly. Rules for conducting Brain storming include (1) No response is wrong (2) Welcome as many responses as possible (3) No criticism is allowed (4) Allow working on others idea.

### **DISCUSSION**

Discussion is essential for the student to share new finding, idea and conclusion at each stage of learning with fellow students and teachers. In general discussion the teachers should guide the discussion through questioning and summarizing. The teacher introduces some lead points and follows up the interaction and summarizing.

## GROUP DISCUSSION

Group discussion is an ideal method to develop co-operation, democratic attitude, friendliness and compromising attitude which are the ultimate aims of education. During group discussion the teacher may observe each group and it needed help them to channel the discussion towards the common objectives. All students may be given opportunity to take part and express their ideas within a time limit. The conclusion reached may be entered by each student. A group representative must present this during consolidation in which the teacher may correct or add information to ensure that all the relevant ideas have been covered.

## COLLECTION

Collection is a continuous learning activity, which ensures complete participation of students. The collected item may be specimens, pictures, charts, ideas, data etc. Collection provides direct experience to learn. An exhibition of collected materials will help to strengthen the concept.

## PRACTICAL WORKS

Experimentation contains the process skill in an integrated way. The objective of doing an experiment is to explore new ideas through investigation only. Its main purpose is to verify some principles associated with theory. In the case of 'Vocational Practical', the ultimate goal is to generate skill through continuous practice along with investigation and invention. Continuous practice transforms the unskilled to the skilled. This is the significance and importance of practical in the Vocational stream. Hence it is very crucial that Vocational teachers as well as instructors should understand the importance of vocational practical and act accordingly.

## QUIZ

Quiz programmes can be used as an interesting class room tool for transaction of curriculum objectives as well as to evaluate the effectiveness of transaction and achievement of students. For conducting a quiz programme a topic should be selected based on the above objective. The students are asked to prepare questions based on the topic individually. The next day / next hour the students are grouped into 3-4 groups randomly. A question is raised by a particular team and the other teams to answer them if they can answer the question they get points for that if all other teams fail to answer the question raised by the 1st team. The 1st team answer the question and explain the background if necessary. All the teams get equal number of chances to ask the question. Time limit is also prescribed for the conduction of the programme. The team who scores maximum points wins. All the

participants can make notes on the questions asked, answers and their explanations which help them in learning.

## MODELS

Models are used in learning process. It enhances the learning experience. This is based on the 'seeing is believing'. It helps the learner a chance to see feel the model presented. Still models and working models help the students to understand the structure, working principles, actual operation etc.

## SURVEY

This strategy involves collection of data from the group under study (book, person, materials etc.). It develops the social interaction and communication ability of the learner. It also provides a scope for discovery learning. Steps involved in survey

- Objective of survey
- Selection of area for? survey/sampling frame
- Selection of survey method
  - Direct method
  - With help of questionnaire/schedule
- Tabulation and analysis
- Consolidation and Presentation?

## EXHIBITION

It is a learning strategy by which the learner can get a chance to show the skill developed. It provides the intrinsic motivation and exposure. Exhibition item can be conducted either individually or as a group task. It can be conducted at school / Regional/State/National level. Necessary publicity and other arrangements can be provided. Presentation, documentation, participation and innovative skills of the learner can be evaluated.

In vocational higher secondary education, production cum-training centre (PTC) provides various avenues for showcasing the skills of students and products prepared by the students. In addition it also gives students opportunities' to provide their services to public and create awareness on various aspects of vocational courses. PTC not only enriches the skill of students, but improves their entrepreneurship abilities and instills confidence to venture into a successful business after their school tenure.

## OUT DOOR LEARNING

Field/farm/hospita /dairy plant visit: field visit is an inevitable vocational tool to be implemented in Vocational Higher Secondary Education. This helps the students to familiarize with the modern technologies and new situation in a different atmosphere. It provides



learning through viewing. It is based on the principle that seeing is better than having. It enables the learning to retain the learned information longer and to make the subject more interesting. The facilitator should identify suitable center/ institution/site. Get prior permission from the authorities before conducting the field visit. Give instructions to the learners for collection data/information/materials/specimens. Teacher may assign different duties to learners by working them in different groups. Each learner should take utmost care and interest during the visit. He/she should observe and interact at the center/ institution where the field visit is conducted. After the visit, learner should acquire the ability to apply the ideas/concepts in his future carrier. Each learner should submit a detailed report about the field visit. Field visit is of utmost interest in the case of Dairy Technology, as many of the practical cannot be transacted fully at school conditions.

On-the-job training (OJT) is a unique programme of VHSE where students get industrial exposure in their respective fields. In case of Dairy Technology, students get training in various livestock farms, veterinary hospitals and dairy plants, Dairy Training Centers of Dairy Development Department, where they will get abreast with modern technologies and advances happening in the sector. Students can interact with farmers and get awareness of the problems faced in the sector. In addition, it also improves the soft skills of the student, a necessary pre-requisite in the industrial field.

## DEMONSTRATION

Though demonstration we can present an item/product and emphasize its features very effectively.

Eg: - To identify the body parts of a cow

1. Live animal
2. Demonstration
3. Venue - open area around school/field
4. Additional requirements - necessary personnel for handling the animal

### Demonstration Process

1. Introduction about approaching the animal and purpose of identification
2. Procedure - facilitator first demonstrates the body parts of cattle
3. Practice - students practice under the monitoring of facilitator
4. Evaluation - based on the performance during demonstration

## CHART DISPLAY

It is also one of the important teaching aids. It can be used in every activities of a learning process. Chart display is a written or pictorial representation of idea or concept. It is cheap, brief and clear. The learner

can retain the ideas in his mind for longer periods and a complicated idea can be simplified through a chart.

### **DAIRY CLUB**

Dairy clubs can be implemented in schools in association with Dairy Development Department. Dairy Development Department conducts various seminars on Dairying, conducts field visits, milk products exhibition, cattle shows. Students participate in these activities with very interest. Students and their family will develop an interest in dairy farming and milk products manufacturing. Such ventures will enhance the interest of the community as such.

### **ICT ENABLED EDUCATION**

With the development of modern technology, ICT enabled education serves a pivotal role in efficient transaction of concepts to students. Concepts will get imprinted in students' minds if the ICT aids like videos, simulations and power-point presentations were employed. Computer simulations are particularly useful for those topics which cannot be demonstrated on live animals like artificial insemination methods, painful procedures like branding. It can be also used in viewing lengthy manufacturing procedures like cheese production, which cannot be demonstrated in our labs. Power point presentations can be prepared for almost all topics especially for topics like breeds of animals, fodder grasses, and packaging materials. Various milk products can be prepared with the help of videos.

### **INCLUSIVE EDUCATION**

Dairy Technology course has very much importance in inclusive education system. ICT enabled education can help a lot in proper transaction of concepts and increase the interest of students in the course. Dairy Farming and milk products manufacturing will help to improve the living standards of the students from poor backgrounds. Dairy Technology course is suitable for all sections of students in terms of skill, knowledge, mental, physical, social and financial development.

### **APPRENTICESHIP TRAINING**

After the completion of Dairy Technology course, students get the opportunity for undergoing apprenticeship training in suitable institutions/schools as per Central Government norms which will polish their already learnt skills and knowledge besides getting some remuneration. This will also enable students for getting permanent jobs in the same institutions if they perform satisfactorily.

## SYLLABUS

**Module 1 : DAIRY FARM MANAGEMENT**

**Unit 1 : Introduction to Dairying**

- Role of livestock in Indian economy:
- Advantages and disadvantages of dairy farming:
- Body parts of cattle:
- Judging of dairy cattle.
- Common breeds of cattle, buffalo and goat
- Technical terms related to dairy farming

**Unit 2 : Design and Construction of Cattle shed**

**Selection of Site for a Dairy farm:**

- systems of rearing – Advantages and disadvantages of:
- Conventional housing system-head-to-head and tail-to-tail.
- Loose housing system
- Free range system.
- Plan and design of cattle shed:
- Floor space requirements of manger, feeding passage, standing space, dung channel, central passage.
- Different types of sheds required in a farm.
- Waste disposal in farms:

**Unit 3 : Dairy Cattle Physiology**

**Digestive system**

- Structure of ruminant stomach
- Functions
- Reproductive system
- Structure of male and female reproductive system
- Functions of important organs
- Oestrus cycle
- Heat detection
- Artificial insemination-importance and methods(Speculum method and Recto Vaginal method)

**Unit 4 : Dairy Cattle Management**

**Handling of animals :**

- Restraining Equipments.
- Identification methods:
- Different identification methods-Tattooing, Ear tagging and Branding.
- Calf Management:

- Handling of new born calf
- Weaning of calf.
- Colostrum feeding.
- De-horning.
- De-worming.
- Castration.
- Breeding Systems:
- Methods of breeding.
- In breeding.
- Cross breeding
- Grading -up.
- Signs of good health:
- Normal values of temperature, pulse rate and respiration rate.
- Common diseases- Mastitis, FMD, Anthrax, Milk fever and Ketosis.
- Farm records:

**Unit 5 : Feeds and Feedings**

**Introduction:**

- Concentrates and roughages.
- Classification:
- Feed stuffs.
- Fodder-Hybrid Napier, Guinea grass, Congo signal, Para grass.
- Fodder Preservation techniques:  
Hay and Straw, Silage/ Haylage
- Ration:
- Basic idea of important nutrients.
- Computation of balanced ration.
- Equipments- Introduction to knowledge about, Tractor, Tillers, Harvester, Chaff cutter, Grinder

**Module 2 : MILK PRODUCTION, PROCESSING AND QUALITY CONTROL**

**Unit 1 : Lactation**

- Physiology of milk production:
- Structure of udder.
- Let down of milk.
- Influence of hormones.
- Milking:
- Hand milking
- Machine milking
- Milking parlor

**Unit 1 : Milk**

- Milk:
- Definition.
- Composition of milk.
- Factors influencing the composition of milk.
- Estimation of fat and SNF% in milk.
- Properties of milk:
- Introduction to physical and chemical properties of milk.
- Estimation of acidity, specific gravity and boiling point of milk.
- Factors influencing the physico-chemical properties of milk.
- Common adulterants in milk.
- Neutralizers in milk.
- Preservatives in milk.
- Platform tests.
- Microbiology of milk:
- Basic awareness.
- Common microorganisms present in milk.
- Microbial standard of raw and pasteurized milk
- Effects of microbial action in milk/microbial spoilage of milk
- Clean Milk Production.

**UNIT 3 FLUID MILK PROCESSING****Standards:**

- PFA standards of cow milk, buffalo milk and goat milk.
- Pasteurization of milk:
- Definition of pasteurization of milk.
- Objectives.
- Methods of pasteurization.

**HTST pasteurization:**

- Schematic diagram.
- Process detailing.
- Milk standardization.
- Cream Separation of milk.
- Homogenization of milk

**Cleaning and Sanitization**

- Detergents and sanitizers-desirable characters
- Common detergents and sanitizers used in dairy plant
- Cleaning and sanitization methods-CIP systems

**Sterilization:**

- Definition
- Methods- In-bottle sterilization, UHT sterilization.

## LEARNING OUTCOMES

On completion of the course the learners are competent to;

- 1.1.1 Compare the cattle, buffalo and goat population strength Kerala and India.
- 1.1.2 Identify the pros and cons of dairy farming and its implementation in farming situations.
- 1.1.3 Score card rating of dairy cattle.
- 1.1.4 Apply score card method and purchase a good dairy cattle.
- 1.1.5 Identify different breeds of cattle, buffalo and goat.
- 1.1.6 Identify and select cattle breed suitable to the existing climatic conditions and needs of the farmer.
- 1.1.7 Identify and categorize cattle as heifers, bull and bullock.
- 1.1.8 Identify and aware of various stages of cattle like lactation, gestation, dry period.
- 1.2.1 Identify an apt place for starting a dairy farm
- 1.2.2 Analyze and design apt rearing system for dairy cattle depending on the land availability of the farmer
- 1.2.3 Evaluate and recommend the structural requirements of a dairy farm and construction of cattle shed.
- 1.2.4 Identify and apply waste disposal technique in dairy farms and farm houses.
- 1.3.1 Understand general animal physiology like digestion, reproduction in cattle.
- 1.3.2 Decide the correct time of insemination in farm animals and acquire general awareness about various Artificial Insemination techniques.
- 1.4.1 Apply restraining equipments on farm animals.
- 1.4.2 Choose and apply right identification method on farm animals
- 1.4.3 Apply calf management practices like weaning, Colostrum feeding, de-horning, de-worming and castration on farm animals.
- 1.4.4 Identify and adopt correct breeding technique for producing superior quality new generation
- 1.4.5 Evaluate signs of good health in cattle in a farm.
- 1.4.6 Identify disease conditions in farm animals like mastitis, FMD, Anthrax, milk fever and ketosis and recommend remedial measures.
- 1.4.7 Compile the various types of records in a dairy farm-Calf register, Breeding record, Milk record, Health record.

- 1.4.7.1 Identify and classify feeds as concentrates and roughages.
- 1.5.1 Identify the feed stuff and fodder variety
- 1.5.2 Adopt fodder preservation techniques like hay, straw and silage
- 1.5.3 Describe importance of nutrients in animal diet.
- 1.5.4 Computation of balanced ration for cattle.
- 1.5.5 Categorize various types of farm equipments.
- 2.1.1 Identify and observe the theoretical aspects of the process of milk let down
- 2.1.2 Apply suitable milking technique in a farm.
- 2.1.3 Identify milking disorders in a cattle and recommend remedial measures
- 2.2.1 Analyze the fat and SNF of various market samples of milk for quality assessment.
- 2.2.2 Compare and analyze the factors influencing the compositional variation in milk constituents.
- 2.2.3 Evaluate the physical and chemical properties of market milk samples for quality assessment.
- 2.2.4 Analyze and infer adulteration of market milk samples with water, starch and sugar.
- 2.2.5 Analyze and infer adulteration of market milk samples with preservatives and neutralisers.
- 2.2.6 Evaluate the quality of raw milk received at the reception dock in a dairy plant by various platform tests.
- 2.2.7 Aware and categorize different microorganisms in milk and changes due to microbial action in milk
- 2.2.8 Aware of microbiological standards of milk.
- 2.2.9 Apply Clean milk production practices in dairy farms and improve the quality of milk.
- 2.2.10 Understand and categorize different microorganisms in milk.
- 2.2.11 Apply Clean milk production practices in dairy farms and improve the quality of milk.
- 2.3.1 Apply fluid milk pasteurization technique.
- 2.3.2 Identify the parts of a cream separator, homogenizer and HTST unit Apply fluid milk pasteurization technique.
- 2.3.3 Operate the fluid milk pasteurizing unit.
- 2.3.4 Categorize and select different detergents and sanitizers according to the need.
- 2.3.5 Operate CIP systems in dairy plants.
- 2.36 Identify and apply various milk sterilization techniques in dairy plants.

## SCHEME OF WORK (MODULE 1 AND 2)

<b>Month</b>	<b>Module</b>	<b>Unit</b>	<b>Period</b>
June	1	Introduction to Dairying	50
June July	1	Design and construction of cattle shed	50
July August	1	Dairy cattle Physiology	60
August September October	1	Dairy cattle Management	120
October	1	Feeds and Feeding	60
November	2	Lactation	60
November December January	2	Milk	110
January February	2	Fluid Milk Processing	100
March	2	OJT	70



## COURSE STRUCTURE OF DAIRY TECHNOLOGY (DT)

This course will consists of four modules :

- Module 1 : **Dairy Farm Management**  
 Module 2 : **Milk Production, Processing and quality control**  
 Module 3 : **Milk Products and Quality assurance**  
 Module 4 : **Dairy Business Management**

This will be taught as per the designated time schedule. Practical assessment will be conducted at the end of each module.

### Unit wise Distribution of Modules

#### Module 1

##### DAIRY FARM MANAGEMENT

Unit No.	Name of units	Periods
1.1	Introduction to dairying	50
1.2	Design and construction of cattle shed	50
1.3	Dairy Cattle Physiology	60
1.4	Dairy cattle management	120
1.5	Feeds and Feeding	60
	<b>Total periods</b>	<b>340</b>

30% periods for theory section and 70%periods for practical activities

### Unit wise Distribution of Modules

#### Module 2

##### MILK PRODUCTION, PROCESSING AND QUALITY CONTROL

Unit No.	Name of units	Periods
2.1	Lactation	60
2.2	Milk	110
2.3	Fluid Milk Processing	100
2.4	OJT	70
	<b>Total periods</b>	<b>340</b>

30% periods for theory section and 70%periods for practical activities

## Module 3

### MILK PRODUCTS AND QUALITY ASSURANCE

Unit No.	Name of units	Periods
3.1	Special Milks	25
3.2	Fermented Milks	30
3.2	Fat Rich Dairy Products	30
3.3	Condensed and Dried Milk	20
3.4	Cheese	40
3.5	Frozen Dairy Products	45
3.6	Indigeneous Milk Products/ Sweets	90
3.7	Dairy By-products	30
3.8	Quality Assurance	30
	<b>Total periods</b>	<b>340</b>

30% periods for theory section and 70%periods for practical activities.

## Module 4

### DAIRY BUSINESS MANAGEMENT

Unit No.	Name of units	Periods
1	Introduction to Dairy Extension	65
2	Dairy Co-operative Management	80
3	Packaging of milk and milk products	50
4	Marketing of milk and milk products	70
5.	Dairy Economics	75
	<b>Total periods</b>	<b>340</b>

30% periods for theory section and 70%periods for practical activities.

## Detailed Elements

### Module 1. Dairy Farm Management

**PERIODS: 340**

#### VOCATIONAL SKILLS:

1. Identify, categorize ,judge and select a good cattle breed.
2. Select a suitable place for starting a dairy farm.(plan and design)
3. Evaluate and recommend the structural requirements of a dairy farm and construction of cattle shed.
4. Utilize farm waste for biogas production or as manure.
5. Apply identification and restraining equipments on farm animals.
6. Do various calf management practices -care of new born calf, weaning, colostrum feeding, dehorning, de worming etc.
7. Evaluate signs of good health in cattle .

8. Identify common diseases and take preventive measures
9. Diagnose the correct time of insemination in farm animals and acquire general awareness about various Artificial Insemination techniques.
10. Maintaining of records and registers in a farm.
11. Analyze and classify various feed stuffs and fodder varieties.
12. Production of fodder crops
13. Computation of balanced ration for cattle.
14. Do various fodder preservation techniques-hay,straw,silage making
15. Categorize various types of farm equipments and use according to situational need.

## INTRODUCTION TO DAIRYING

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Role of livestock in Indian economy:</b></p> <ul style="list-style-type: none"> <li>• Present status of dairy farming in India and Kerala.</li> <li>• Cattle, buffalo and goat population.</li> <li>• Contribution to national income.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Comparison skill</li> <li>• Listening skill</li> </ul>	<p><i>The learner will be able to:</i></p> <ul style="list-style-type: none"> <li>• Compare the cattle, buffalo and goat population strength Kerala and India.</li> </ul>	<ul style="list-style-type: none"> <li>• Survey reports via census journals/ internet / Instructional audio/video, market survey, instructional lectures, chart.</li> </ul>	<ul style="list-style-type: none"> <li>• Seminar</li> <li>• Group discussion</li> <li>• Test, chart/graph preparation, record</li> </ul>
<p><b>Advantages and disadvantages of dairy farming:</b></p> <ul style="list-style-type: none"> <li>• Economic use of land and labour.</li> <li>• Nutritional quality of milk.</li> <li>• Perishability of milk.</li> <li>• Marketability of milk.</li> <li>• Risks involved in dairy farming.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Decision skill</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the pros and cons of dairy farming and its implementation in farming situations.</li> </ul>	<ul style="list-style-type: none"> <li>• Group discussion</li> <li>• Market survey</li> <li>• Farm visit/ visit to individual farmers</li> <li>• Instructional lectures, chart.</li> </ul>	<ul style="list-style-type: none"> <li>• Survey report</li> <li>• Seminar</li> <li>• Group discussion</li> <li>• Tests, record, presentation.</li> </ul>
<p><b>Body parts of cattle:</b></p> <ul style="list-style-type: none"> <li>• Introduction to the different body parts of cattle.</li> <li>• Judging of dairy cattle.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Observation skill</li> <li>• Analysing skill</li> <li>• Comparison skill</li> <li>• Judging skill</li> </ul>	<ul style="list-style-type: none"> <li>• Score card rating of dairy cattle.</li> <li>• Apply score card method and purchase good dairy cattle.</li> </ul>	<ul style="list-style-type: none"> <li>• Visit to farm and judging different animals.</li> <li>• Score card tabulation, lectures, demonstration</li> </ul>	<ul style="list-style-type: none"> <li>• Live animal demonstration evaluation.</li> <li>• Judging of cattle in a cattle show/fair.</li> <li>• Spot questions</li> <li>• Tests/ quiz.</li> <li>• Record</li> </ul>

**INTRODUCTION TO DAIRYING**

<b>Ideas/Concepts/Skill</b>	<b>Learning Outcomes</b>	<b>Suggested Activities</b>	<b>Assessment</b>
<p><b>Common breeds of cattle, buffalo and goat</b></p> <ul style="list-style-type: none"> <li>• Origin</li> <li>• Body characters.</li> <li>• Milk yield</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Observation skill</li> <li>• Analysing skill</li> <li>• Comparison skill</li> <li>• Data collection skill</li> <li>• Evaluation skill</li> </ul>	<p><i>The learner will be able to:</i></p> <ul style="list-style-type: none"> <li>• Identify different breeds of cattle, buffalo and goat.</li> <li>• Identify and select cattle breed suitable to the existing climatic conditions and needs of the farmer.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration using pictures/charts.</li> <li>• Collection of pictures/chart of cattle/buffalo/goat breeds.</li> <li>• Lectures, videos</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of the breed of the presented animal/ picture.</li> <li>• Tests/quiz</li> <li>• Records/ album, chart</li> </ul>
<p><b>Technical terms related to dairy farming:</b></p> <ul style="list-style-type: none"> <li>• Calf.</li> <li>• Heifer.</li> <li>• Bull</li> <li>• Bullock</li> <li>• Lactation</li> <li>• Gestation</li> <li>• Dry period</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Observation skill</li> <li>• Understanding skill</li> <li>• Comparison skill</li> </ul>	<ul style="list-style-type: none"> <li>• Identify and categorize cattle as heifers, bull, bullock.</li> <li>• Identify and aware of various stages of cattle like lactation, gestation, dry period.</li> </ul>	<ul style="list-style-type: none"> <li>• Visit to farm and identify cattle as calf, heifer, bull and bullock.</li> <li>• Farm visit and evaluate animals in lactation, gestation and dry period,</li> <li>• Instructional videos, lectures</li> </ul>	<ul style="list-style-type: none"> <li>• Group discussion</li> <li>• Seminar.</li> <li>• Tests</li> <li>• Quiz</li> <li>• Records</li> </ul>

## Unit 2 : DESIGN AND CONSTRUCTION OF CATTLE SHED

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Selection of Site for a Dairy farm:</b></p> <ul style="list-style-type: none"> <li>• Climate</li> <li>• Water availability</li> <li>• Electricity availability.</li> <li>• Land availability.</li> <li>• Transportation facility</li> <li>• Marketability</li> <li>• Waste disposability</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Understanding skill</li> </ul>	<p><i>The learner will be able to:</i></p> <ul style="list-style-type: none"> <li>• Identify an apt place for starting a dairy farm</li> </ul>	<ul style="list-style-type: none"> <li>• Locate and observe locally available farm sites, Farm visit/ field visit</li> </ul>	<ul style="list-style-type: none"> <li>• Quiz/exam</li> <li>• Visit report</li> <li>• Seminar</li> <li>• Record</li> </ul>
<p><b>Systems of rearing - Advantages and disadvantages of:</b></p> <ul style="list-style-type: none"> <li>• Conventional housing system-head-to-head and tail-to-tail.</li> <li>• Loose housing system</li> <li>• Free range system.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Understanding skill</li> </ul>	<ul style="list-style-type: none"> <li>• Analyze and design apt rearing system for dairy cattle depending on the land availability of the farmer.</li> </ul>	<ul style="list-style-type: none"> <li>• Interactive lectures, instructional videos, drawing the plan outlay</li> <li>• Visit to farms and study the method adopted.</li> </ul>	<ul style="list-style-type: none"> <li>• Situational analysis,</li> <li>• Record,</li> <li>• Test/quiz,</li> <li>• Suitable Sketch evaluation</li> </ul>

**Unit 2 : DESIGN AND CONSTRUCTION OF CATTLE SHED**

<b>Ideas/Concepts/Skill</b>	<b>Learning Outcomes</b>	<b>Suggested Activities</b>	<b>Assessment</b>
<p><b>Plan and design of cattle shed:</b></p> <ul style="list-style-type: none"> <li>• Floor space requirements of manger, feeding passage, standing space, dung/urine channel, central passage.</li> <li>• Different types of sheds required in a farm.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> </ul>	<p><i>The learner will be able to:</i></p> <ul style="list-style-type: none"> <li>• Evaluate and recommend the structural requirements of a dairy farm and construction of cattle shed.</li> </ul>	<ul style="list-style-type: none"> <li>• Visit a dairy farm and measure the various sections/ parts in a shed, Instructional lectures, videos, Diagrams, sketches</li> </ul>	<ul style="list-style-type: none"> <li>• Situational analysis</li> <li>• Evaluation of plan and design of cattle shed in the record / chart</li> <li>• Test/ quiz</li> </ul>

**Unit 3 : DIARY CATTLE PHYSIOLOGY**

<p><b>Digestive System:</b></p> <ul style="list-style-type: none"> <li>• Structure of ruminant stomach.</li> <li>• Functions.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Observation skill</li> <li>• Understanding skill</li> <li>• Learning skill</li> </ul>	<ul style="list-style-type: none"> <li>• Understand general animal physiology of digestion in cattle</li> </ul>	<ul style="list-style-type: none"> <li>• Instructional lectures, visual media, Visit to a veterinary hospital /farm to study the digestion in cattle</li> <li>• Picture/diagram</li> <li>• Chart</li> <li>• Group discussion</li> </ul>	<ul style="list-style-type: none"> <li>• Seminar</li> <li>• Group discussion</li> <li>• Test, record preparation</li> </ul>
<p><b>Reproductive system:</b></p> <ul style="list-style-type: none"> <li>• Structure of male and female reproductive system.</li> <li>• Functions of important organs.</li> <li>• Oestrous cycle.</li> <li>• Heat detection.</li> <li>• Artificial Insemination- importance and methods (Speculum method and Recto-Vaginal method).</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> </ul>	<ul style="list-style-type: none"> <li>• Understand general animal physiology of reproduction in cattle</li> <li>• Decide the correct time of insemination in farm animals and acquire general awareness about various Artificial Insemination techniques.</li> </ul>	<ul style="list-style-type: none"> <li>• Instructional lectures, visual media, Visit to a veterinary hospital /farm to study the reproduction aspects in cattle</li> <li>• Picture/diagram</li> <li>• Chart</li> <li>• Group discussion</li> </ul>	<ul style="list-style-type: none"> <li>• Seminar</li> <li>• Group discussion</li> <li>• Test, record preparation</li> </ul>

Unit 4 : DAIRY CATTLE MANAGEMENT

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Handling of animals :</b></p> <ul style="list-style-type: none"> <li>• Restraining Equipments.</li> <li>• Identification and sketches of restraining equipments.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Implementation/Activity skill</li> </ul>	<p><i>The learner will be able to:</i></p> <ul style="list-style-type: none"> <li>• Apply restraining equipments on farm animals.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration on the use of restraining equipments and self practicing.</li> <li>• Interactive lectures,</li> <li>• Instructional videos, pictures, charts.</li> </ul>	<ul style="list-style-type: none"> <li>• Handling of restraining equipments, Diagrams,</li> <li>• Equipment identification in a spot test,</li> <li>• Methodology demonstration.</li> </ul>
<p><b>Identification methods:</b></p> <ul style="list-style-type: none"> <li>• Different identification methods- Tattooing, Ear tagging and Branding.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Implementation/Activity skill</li> </ul>	<ul style="list-style-type: none"> <li>• Choose and apply right identification method on farm animals</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration on the use of identification techniques and self practicing.</li> <li>• Interactive lectures,</li> <li>• Instructional videos, pictures, charts.</li> </ul>	<ul style="list-style-type: none"> <li>• Equipment handling,</li> <li>• Diagrams,</li> <li>• Equipment identification in a spot test,</li> <li>• Methodology demonstration</li> </ul>
<p><b>Calf Management:</b></p> <ul style="list-style-type: none"> <li>• Handling of new born calf</li> <li>• Weaning of calf.</li> <li>• Colostrum feeding.</li> <li>• De-horning.</li> <li>• De-worming.</li> <li>• Castration.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Learning skill</li> <li>• Understanding skill</li> </ul>	<ul style="list-style-type: none"> <li>• Apply calf management practices like weaning, colostrum feeding, de-horning, de-worming and castration on farm animals.</li> </ul>	<ul style="list-style-type: none"> <li>• Instructional lectures, visual media, Live demonstration</li> </ul>	<ul style="list-style-type: none"> <li>• Seminar presentation</li> <li>• Group discussion</li> <li>• Spotting</li> <li>• Tests/quiz</li> </ul>



Unit 4 : DAIRY CATTLE MANAGEMENT

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Breeding Systems:</b></p> <ul style="list-style-type: none"> <li>• Methods of breeding.</li> <li>• In breeding.</li> <li>• Cross breeding</li> <li>• Grading -up.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> </ul>	<p><i>The learner will be able to:</i></p> <ul style="list-style-type: none"> <li>• Identify and adopt correct breeding technique for producing superior quality new generation.</li> </ul>	<ul style="list-style-type: none"> <li>• Instructional lectures, visual media, Farm visit to evaluate the cattle breeds based on milk production and health aspects.</li> </ul>	<ul style="list-style-type: none"> <li>• Seminar presentation</li> <li>• Group discussion</li> <li>• Spotting</li> <li>• Tests/quiz</li> </ul>
<p><b>Signs of good health:</b></p> <ul style="list-style-type: none"> <li>• Normal values of temperature, pulse rate and respiration rate.</li> <li>• Common diseases- Mastitis, FMD, Anthrax, Milk fever and Ketosis.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> </ul>	<ul style="list-style-type: none"> <li>• Analyse normal values of temperature, pulse rate and respiration rate in cattle.</li> <li>• Identify disease conditions in farm animals like mastitis, FMD, Anthrax, milk fever and ketosis.</li> </ul>	<ul style="list-style-type: none"> <li>• Measurement of normal values in live animals, Chart</li> <li>• Pictures and videos</li> <li>• Visit to a farm and study the symptoms of disease conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Chart evaluation</li> <li>• Seminar presentation</li> <li>• Group discussion</li> <li>• Record</li> <li>• Tests/quiz</li> </ul>
<p><b>Farm records:</b></p> <ul style="list-style-type: none"> <li>• Enlist various types of record kept on an ideal dairy farm.</li> <li>• State the utility of each type of record.</li> <li>• Prepare formats of records.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Compiling skill</li> </ul>	<ul style="list-style-type: none"> <li>• Compile the various types of records in a dairy farm-Calif register, Breeding record, Milk record, Health record.</li> </ul>	<ul style="list-style-type: none"> <li>• Visit a dairy farm and study the records.</li> <li>• Preparation of personal records.</li> </ul>	<ul style="list-style-type: none"> <li>• Seminar</li> <li>• Group discussion</li> <li>• Test, record preparation</li> </ul>

## Unit 5 : FEEDS AND FEEDING

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Introduction:</b></p> <ul style="list-style-type: none"> <li>• Concentrates and roughages.</li> <li>• Examples.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> </ul>	<p><i>The learner will be able to:</i></p> <ul style="list-style-type: none"> <li>• Identify and classify feeds as concentrates and roughages.</li> </ul>	<ul style="list-style-type: none"> <li>• Visit a fodder production unit and learn the varieties.</li> <li>• Records/ Pictures</li> <li>• Videos</li> </ul>	<ul style="list-style-type: none"> <li>• Feed identification</li> <li>• Tests/quiz</li> <li>• Records</li> <li>• Pictures</li> </ul>
<p><b>Classification:</b></p> <ul style="list-style-type: none"> <li>• Feed stuffs.</li> <li>• Fodder-Hybrid Napier, Guinea grass, Congo signal, Para grass.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analysing skill</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the feed stuff and fodder variety.</li> </ul>	<ul style="list-style-type: none"> <li>• Visit a fodder production unit and learn the varieties.</li> <li>• Records/ Pictures</li> <li>• Videos</li> </ul>	<ul style="list-style-type: none"> <li>• Feed identification</li> <li>• Tests/quiz</li> <li>• Records</li> <li>• Pictures</li> </ul>
<p><b>Fodder Preservation techniques:</b></p> <ul style="list-style-type: none"> <li>• Hay and Straw.</li> <li>• Silage/ Haylage</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analysing skill.</li> </ul>	<ul style="list-style-type: none"> <li>• Adopt fodder preservation techniques like hay, straw and silage.</li> </ul>	<ul style="list-style-type: none"> <li>• Visit a fodder preservation unit where hay, straw and silage are produced.</li> <li>• videos</li> <li>• lectures</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of the feed</li> <li>• Seminar</li> <li>• Record</li> </ul>
<p><b>Ration:</b></p> <ul style="list-style-type: none"> <li>• Basic idea of important nutrients.</li> <li>• Computation of balanced ration.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analysing skill.</li> </ul>	<ul style="list-style-type: none"> <li>• Describe importance of nutrients in animal diet.</li> <li>• Computation of balanced ration for cattle.</li> </ul>	<ul style="list-style-type: none"> <li>• Visit to farm for practical awareness</li> <li>• lectures</li> <li>• Computation of ration based on the body weight of the animal</li> </ul>	<ul style="list-style-type: none"> <li>• Calculation of balanced ration based on body weight</li> <li>• Records</li> <li>• Problem solving</li> <li>• Tests/quiz</li> </ul>

**Unit 5 : FEEDS AND FEEDING**

<b>Ideas/Concepts/Skill</b>	<b>Learning Outcomes</b>	<b>Suggested Activities</b>	<b>Assessment</b>
<p><b>Equipments- Introduction to knowledge about,</b></p> <ul style="list-style-type: none"> <li>• Tractor</li> <li>• Tillers</li> <li>• Harvester</li> <li>• Chaff cutter</li> <li>• Grinder</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analysing skill.</li> </ul>	<p><i>The learner will be able to:</i></p> <ul style="list-style-type: none"> <li>• Categorize various types of farm equipments.</li> </ul>	<ul style="list-style-type: none"> <li>• Farm visit and operate the equipments.</li> <li>• Pictures</li> <li>• Videos</li> <li>• Charts</li> </ul>	<ul style="list-style-type: none"> <li>• Picture identification</li> <li>• Purpose/working description</li> </ul>

## LIST OF PRACTICALS

### Module 1

- Identification of different parts of body of cattle
- Judging of Dairy cattle
- Identification of different breeds of cattle, buffaloes and goats ( Sahiwal, Gir, Red Sindhi, Jersey, Holstein-Friesian, Brown Swiss, Murrah, Surti, Malabari, Jamnapari )
- Plan and Design of cattle sheds.
- AI methods.
- Measurement of temperature, respiration and pulse of cattle.
- Identification of animals-Tattooing , Tagging, and Branding.
- Dehorning of cattle.
- Maintenance of records in farm.
- Identification of common feed stuffs.
- Identification of grasses.
- Visit to Dairy Farms, and Veterinary Hospitals.

## DETAILED ELEMENTS

### Module 2 : Milk Production, Processing and Control

**PERIODS: 340**

#### Vocational Skills:

1. Apply suitable milking technique in a farm.
2. Identify milking disorders in a cattle and recommend remedial measures
3. Analyze the fat and SNF of various market samples of milk for quality assessment.
4. Compare and analyze the factors influencing the compositional variation in milk constituents.
5. Evaluate the physical and chemical properties of market milk samples for quality assessment.
6. Analyse and infer adulteration of market milk samples with water, starch and sugar.
7. Analyse and infer adulteration of market milk samples with preservatives and neutralisers.
8. Evaluate the quality of raw milk received at the reception dock in a dairy plant by various platform tests.
9. Understand and categorize different microorganisms in milk.
10. Apply Clean milk production practices in dairy farms and improve the quality of milk.
11. Operate the fluid milk pasteurizing unit.
12. Identify and apply various milk sterilization techniques in dairy plants.

Unit 1 : LACTATION

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Physiology of milk production:</b></p> <ul style="list-style-type: none"> <li>• Physiology of milk production:</li> <li>• Structure of udder.</li> <li>• Let down of milk.</li> <li>• Influence of hormones.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Listening skill</li> <li>• Responding skill</li> </ul>	<p><i>The learner will be able to:</i></p> <ul style="list-style-type: none"> <li>• Identify and observe the theoretical aspects of the process of milk let down</li> </ul>	<ul style="list-style-type: none"> <li>• Diagram, journals, chart, interactive lectures</li> </ul>	<ul style="list-style-type: none"> <li>• Records</li> <li>• Tests</li> <li>• Chart</li> </ul>
<p><b>Milking:</b></p> <ul style="list-style-type: none"> <li>• Hand milking</li> <li>• Machine milking</li> <li>• Milking parlor</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> </ul>	<ul style="list-style-type: none"> <li>• Apply suitable milking technique in a farm.</li> </ul>	<ul style="list-style-type: none"> <li>• Instructional videos, Live demonstration in farm animals</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluation of milking method, chart, record, Seminar/Presentation</li> </ul>
<ul style="list-style-type: none"> <li>• Listening skill</li> <li>• Responding skill</li> </ul> <p><b>Milking Disorders:</b></p> <ul style="list-style-type: none"> <li>• Supernumerary teat.</li> <li>• Fistulated teat.</li> <li>• Bore teat.</li> <li>• Teat crack.</li> <li>• Leaky teat.</li> <li>• Hard milker.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill, • Analyzing skill</li> <li>• Listening skill • Responding skill</li> </ul>	<ul style="list-style-type: none"> <li>• Identify milking disorders in a cattle and recommend remedial measures</li> </ul>	<ul style="list-style-type: none"> <li>• Visit to farm and study the disease conditions and remedial actions taken.</li> </ul>	<ul style="list-style-type: none"> <li>• Seminar</li> <li>• Group discussion</li> <li>• Test, record preparation</li> </ul>

## Unit 2 : MILK

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Milk</b></p> <ul style="list-style-type: none"> <li>• Definition.</li> <li>• Composition of milk.</li> <li>• Factors influencing the composition of milk.</li> <li>• Estimation of fat and SNF% in milk.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill.</li> <li>• Observation skill.</li> <li>• Analyzing skill.</li> <li>• Differentiating skill.</li> <li>• Responding skill.</li> </ul>	<p><i>The learner will be able to:</i></p> <ul style="list-style-type: none"> <li>• Analyze the fat and SNF of various market samples of milk for quality assessment.</li> <li>• Compare and analyze the factors influencing the compositional variation in milk constituents.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration, Chart preparation, Instructional lectures, Seminar, instructional videos</li> </ul>	<ul style="list-style-type: none"> <li>• Diagrams, Spot tests,</li> <li>• Demonstration, Practical exam, Records, Seminar</li> </ul>
<p><b>Properties of milk:</b></p> <ul style="list-style-type: none"> <li>• Introduction to physical and chemical properties of milk.</li> <li>• Estimation of acidity, specific gravity and boiling point of milk.</li> <li>• Factors influencing the physico-chemical properties of milk.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Recording skill</li> <li>• Responding skill</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate the physical and chemical properties of market milk samples for quality assessment.</li> </ul>	<ul style="list-style-type: none"> <li>• Interactive lectures, instructional videos, Charts, Method demonstration, Sample analysis.</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluation of testing methodology, Result, Record, Seminar, Practical tests.</li> </ul>

Unit 2 : MILK

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Analysis of Milk</b></p> <ul style="list-style-type: none"> <li>• Common adulterants in milk.</li> <li>• Neutralizers in milk.</li> <li>• Preservatives in milk.</li> <li>• Platform tests.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Responding skill</li> <li>• Equipment handling skill</li> <li>• Process skill</li> </ul>	<p><i>The learner will be able to:</i></p> <ul style="list-style-type: none"> <li>• Analyze and infer adulteration of market milk samples with water, starch and sugar.</li> <li>• Analyze and infer adulteration of market milk samples with preservatives and neutralizers.</li> <li>• Evaluate the quality of raw milk received at the reception dock in a dairy plant by various platform tests.</li> </ul>	<ul style="list-style-type: none"> <li>• Chart, Practical Tests, Method Demonstration, Practical examination, Instructional lecturers</li> </ul>	<ul style="list-style-type: none"> <li>• Seminar, Chart presentation</li> <li>• Group discussion</li> <li>• Spotting, Practical tests, Records.</li> </ul>
<p><b>Microbiology of milk:</b></p> <ul style="list-style-type: none"> <li>• Basic awareness.</li> <li>• Common microorganisms present in milk.</li> <li>• Microbial standard of raw and pasteurized milk</li> <li>• Effects of microbial action in milk/microbial spoilage of milk</li> <li>• Clean Milk Production.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Differentiating skill</li> <li>• Extension work skill</li> </ul>	<ul style="list-style-type: none"> <li>• Aware and categorize different microorganisms in milk and changes due to microbial action in milk</li> <li>• Aware of microbiological standards of milk.</li> <li>• Apply Clean milk production practices in dairy farms and improve the quality of milk.</li> </ul>	<ul style="list-style-type: none"> <li>• Method demonstration, Practical tests, Chart, Farm visit, Practical examination of samples,</li> </ul>	<ul style="list-style-type: none"> <li>• Spotting, Evaluation of chart, Practical test, Seminar, Record</li> </ul>

Unit 4 : FLUID MILK PROCESSING

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Standard</b></p> <ul style="list-style-type: none"> <li>• PFA standards of cow milk, buffalo milk and goat milk.</li> </ul> <p><b>Pasteurization of milk:</b></p> <ul style="list-style-type: none"> <li>• Definition of pasteurization of milk.</li> <li>• Objectives.</li> <li>• Methods of pasteurization.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Responding skill</li> <li>• Equipment handling skill.</li> <li>• Process skill.</li> </ul>	<p><i>The learner will be able to:</i></p> <ul style="list-style-type: none"> <li>• Apply fluid milk pasteurization technique.</li> <li>• Identify the parts of a cream separator, homogenizer and HTST unit</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration, Instructional videos, lecturers, practical knowhow.</li> <li>• Flow diagram</li> </ul>	<ul style="list-style-type: none"> <li>• Practical tests, Seminar, Record, Presentation, Quiz, Spot questions.</li> </ul>
<p><b>HTST pasteurization:</b></p> <ul style="list-style-type: none"> <li>• Schematic diagram.</li> <li>• Process detailing.</li> <li>• Milk standardization.</li> <li>• Cream Separation of milk.</li> <li>• Homogenization of milk.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Responding skill</li> <li>• Equipment handling skill.</li> <li>• Process skill.</li> </ul>	<ul style="list-style-type: none"> <li>• Operate the fluid milk pasteurizing unit.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration, Instructional videos, lecturers, practical knowhow.</li> <li>• Flow diagram</li> </ul>	<ul style="list-style-type: none"> <li>• Practical tests, Seminar, Record, Presentation, Quiz, Spot questions.</li> </ul>



Unit 4 : FLUID MILK PROCESSING

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Cleaning and Sanitization</b></p> <ul style="list-style-type: none"> <li>• Detergents and sanitizers-desirable characters</li> <li>• Common detergents and sanitizers used in dairy plant</li> <li>• Cleaning and sanitization methods-CIP systems</li> </ul> <p><b>SKILLS</b></p> <ul style="list-style-type: none"> <li>• Categorizing skill</li> </ul>	<p><i>The learner will be able to:</i></p> <ul style="list-style-type: none"> <li>• Categorize and select different detergents and sanitizers according to the need.</li> <li>• Operate CIP systems in dairy plants.</li> </ul>	<ul style="list-style-type: none"> <li>• Interactive lectures, charts, vedios, plant visit</li> </ul>	<ul style="list-style-type: none"> <li>• Charts ,visit report</li> </ul>
<p><b>Sterilization:</b></p> <ul style="list-style-type: none"> <li>• Definition.</li> <li>• Methods- In-bottle sterilization, UHT sterilization.</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Data collection skill</li> <li>• Observation skill</li> <li>• Analyzing skill</li> <li>• Responding skill</li> <li>• Equipment handling skill.</li> <li>• Process skill.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify and apply various milk sterilization techniques in dairy plants.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration, Instructional videos, lecturers, practical knowhow.</li> <li>• Flow diagram</li> </ul>	<ul style="list-style-type: none"> <li>• Practical tests, Seminar, Record, Presentation, Quiz, Spot questions.</li> </ul>

## LIST OF PRACTICALS

### Module 2

- Milking Methods (Hand milking and Machine milking).
- Sampling of milk (for physical and chemical examination and microbiological analysis).
- Estimation of fat in milk by Gerber's method.
- Estimation of specific gravity by lactometer.
- Estimation of specific gravity by specific gravity bottle.
- Estimation of TS and SNF by (Formula method).
- Estimation of TS (gravimetric method)
- Determination of acidity of milk
- Detection of adulterants in milk
- Detection of preservatives in milk.
- Platform Tests.
- Methylene Blue reduction Test
- Standard plate count
- Direct microscopic count
- Alkaline Phosphatase Test
- Cleaning and Sanitization of Dairy equipments
- Visit to Dairy Plant and study operation of HTST Pasteurizer.
- Visit to Dairy Farms, Dairy plants and Veterinary Hospitals.

### ON THE JOB TRAINING

On the Job training occurs whenever more experienced employee or supervisor teaches less experienced person on how to do one or more tasks of a job. It is a form of training taking place in a normal working situation. The training utilizes actual equipments and materials.

OJT of the course will be 30 days duration. OJT consist of Farm training and dairy plant training and training in Dairy Department. 10 days OJT has to be conducted at the end of first module, which can be further divided as 7 days training at Dairy farm management and 3 days training in feeds and Fodders .

20 days OJT has to be conducted at the end of second module which should include milk products training in Dairy development department training centers and inplant training in dairy plants (processing, quality control and marketing)

vocational higher secondary schools are at liberty to conduct the entire on the job training according to their local feasibility of institutions and industries. Flexibility in the duration can also be provided accordingly, but the vocational teacher has to ensure student gets OJT in all important

skills like farm management, fodder cultivation, feed computation, Processing and quality assurance of milk and milk products, dairy business management ( marketing and co-operative management ).

### CERTIFICATION

After completion of each module , Department of Vocational Higher secondary will give certification for acquiring and verifying competencies developed by the candidate .After completion of each module the certificates will be given as mentioned below.

<b>Module</b>	<b>Certificate</b>
Module 1	Dairy Farm Management
Module 2	Milk production, Processing and Quality control
Module 3	Milk products and Quality Assurance
Module 4	Dairy Business Management

### UNIT DETAILING

#### **Name of Module 1 : Dairy Farm Management**

#### **Unit : Introduction to Dairying**

Animal husbandry and dairying plays an important role in the development of India's economy. Animal husbandry and dairying play an important role in the National economy and in the socio-economic development of the Nation. These sectors also play a significant role in supplementing family incomes and generating gainful employment. Dairy sector not only provides essential proteins and nutritious human diet through milk but also plays an important role in utilisation of non-edible agricultural by-products.

This unit deals with role of livestock in Indian economy, present status of dairy farming in India and Kerala, advantages and disadvantages of dairy farming, familiarization with the body parts of cattle, judging of dairy cattle, common breeds of cattle, buffalo and goat and technical terms related to dairy farming.

Learner becomes aware of different breeds of cattle and their characters. Learner will be able to judge and select good cattle.

## LEARNING OUTCOME

1.1.1 Compare the population of different species & compare major livestock products and their contribution to national economy.

### CONCEPT

Role of livestock in Indian economy, Present status of dairy farming in India and Kerala

### Suggested activities

Updation of knowledge from survey reports by internet /journals

Ask the students to collect data about present population status of different species of livestock and contribution of livestock sector to Indian economy from journals ,internets

### Points to be discussed

- Livestock farming
- Cattle population
- Buffalo population
- Goat population
- Major livestock products and their contribution to Indian economy

### CONSOLIDATION

The learner gets an idea about cattle , buffalo & goat population and contribution of each species to the milk production of India. Learner came to know that India stands first in milk production in the world.

Prepared notes

## LEARNING OUTCOME

1.1.2 Analyse various aspects in dairy farming

### CONCEPT

Advantages and disadvantages of dairy farming

### Suggested activities

Group discussion - Learners may be divided into two groups .The topic should be given in advance to each group.Then the group representatives are asked to present their arguments.After presentation arrange a discussion followed by the consolidation by moderator.

### Points to be discussed

- Employment opportunities.
- Income
- Nutritional status
- Capital investment

- Utilization agricultural by-products
- Risk factors

### **CONSOLIDATION**

Merits of dairy farming

- stable Income
- Nutritional Status
- Employment opportunities
- Utilization agricultural by-products

Demerits of dairy farming

- Perishable
- Risk
- High capital of Dairy farming

### **Other suggested activities**

Survey and interaction with farmers

Prepare questionnaire and interact with farmers and learner can come to conclusion what are the actual problems faced by farmers and advantages of dairy farming.

### **LEARNING OUTCOME**

1.1.3 identify the body parts of cattle

#### **Concept:**

Familiarization with body parts of cattle.

#### **Suggested activities**

#### **Demonstration with live animal**

Ask the students identify the body parts known to them. Then the teacher demonstrates other body parts. Then teacher should ask learners to draw diagram of cattle and label body parts of cattle.

#### **Points for discussion**

Important body parts of the cattle

### **CONSOLIDATION**

The learner will be able to identify different body parts of cattle

Other suggested activities

Instructional videos

### **LEARNING OUTCOME**

1.1.4 Judge and select a good dairy cattle in cattle show or for purchasing a new dairy cattle

**CONCEPT**

Judging of dairy cattle

**Suggested activities**

Discussion, Demonstration /Farm visit

Discussion : The topic is introduced by asking the question: how you will select a good dairy cattle?.ther by making them aware of the purpose of judging. Then discuss ratings in score card.

Demonstration.

Teacher demonstrates judgment of a cow in neighbouring house, with active involment of students

**Farm visit**

During farm visit learners are divided into five groups. They are asked to judge each animal based on the score card. Teacher assist them in judging.

Points to be discussed

- Purpose of judging
- Score card rating of cattle:
- General Appearance
- Body Capacity
- Dairy character
- Mammary System

**Suggested activities**

Farm visit

During farm visit learners are divided into five groups.They are asked to judge each animal based on the score card .teacher assist them in judging.

**CONSOLIDATION**

The learner get aware that how a good dairy cattle has to be judged and selected.

**LEARNING OUTCOME**

1.1.5 Identify and categorize different breeds of cattle,buffalo and goat

1.1.6 Selection of breed suitable to the existing climatic conditions and needs

**Concept**

Common Breeds of cattle,Buffalo and Goat.

### Suggested activities

Collection of photographs, preparation of charts, Demonstration Using Pictures, Farm visit, and Seminar.

Divide students into groups, they may be asked to collect photographs of cattle breeds from journals, news papers, magazines, internet etc.

Based on photographs they may be asked to define the characters of each breed and categorize them based on their origin and utility and represent them in the form of a chart.

The above gained knowledge may be consolidated by a Farm visit and live demonstration. After a discussion section categorize the animals.

Based on the knowledge gained from the above activities, conduct a seminar. Students may be divided into six groups

### Seminar topics

1. Indegenious milch breeds
2. Exotic milch breeds
3. Draught purpose breeds
4. Dual purpose breeds.
5. Breeds of buffalo
6. Breeds of goat

### Points for discussion

- Origin, Salient Features and production/utility of following
  1. Indian milch breeds-Red Sindhi, Gir, Sahiwal
  2. Draught purpose breeds: Kangayam, Amritmahal
  3. Dual Purpose Breeds: Kankrej, Hariana
  4. Exotic milch breeds: Jersey, HF, Brown Swiss
  5. Buffalo Breeds: Murrah, Surti
  6. Goat Breeds: Jamnapari, Malabari
    - Information about local breeds like Vechur cattle

### LEARNING OUTCOME

1.1.7. Identify and categorize cattle at different stages

### Concept:

Technical terms related to dairy Farming

### Suggested Activities:

Reference and discussion using internet and journals, instructional videos

Learners are introduced to the terms related to dairying like calf, heifer, bull, lactation period, Dry period, Gestation period etc. and asked to collect data from internets, then discussed in the class and consolidated.

**STANDARD LIST**  
**NAME OF THE COURSE - DAIRY TECHNOLOGY**  
**NON CONSUMABLE**

Sl. No	Name of Article	Quantity Required	Remarks
1.	Gerber centrifuge machine with electrically operated automatically 24 sockets.	One set	
2.	Gerber' s butyrometers For milk 0-10% scale with 0.1% mark.	30 Nos	
3.	Hot water bath	Two sets	
4.	10ml automatic tilt measure for acid with bottle	3 nos	
5.	1ml automatic tilt measure for amyl alcohol with bottle	3 nos	
6.	10.75 ml milk pipettes	6 nos	
7.	Butyrometer stoppers	100 nos	
8.	Butyrometer stand with lock 24 holes	3 nos	
9.	Lock stoppers	12 nos	
10.	Cotton wool	1 roll	
11.	Milk pipette stand	2 nos	
12.	Test tube medium size	3 dozen	
13.	Test tube stands	2 nos	
14.	Thermometer 0 C	6 nos	
15.	Thermometer 0 F	2 nos	
16.	Lactometer zeal type	12 nos	
17.	Lactometer Quevenne's type	6 nos	
18.	Glass cylinder 150 ml	6 nos	
19.	Glass cylinder 250 ml	4 nos	
20.	Porceline disc bottom flat 100ml	6 nos	
21.	Stirring glass rod	6 nos	
22.	Burette 50 ml with control valve	12 nos	
23.	Burette stand	12 nos	
24.	Aluminium alloy cylinder 150ml	6 nos	
25.	Enameled tray 1 ½ feet X1 feet	4 nos	
26.	Enameled tray 2 feet X1 1/2feet	4 nos	
27.	Polythene tray 2 feet X 1 ½ feet	4 nos	
28.	Spirit lamp glass with cover large	2 nos	
29.	Milk sample bottle 100 ml polythene	100 nos	
30.	Milk sample dipper 50 ml S.S	2 nos	
31.	Muslin cloth	5 meters	
32.	Plunger	2 nos	
33.	Beaker 150 ml	4 nos	
34.	Beaker 250ml	4 nos	
35.	Beaker 500ml	2 nos	
36.	Conical flask 250 ml	6nos	
37.	Polythene cup (150 ml)(disposable)	2 00 nos	
38.	Paper plate	100nos	
39.	Spoons(Disposable)	200 nos	
40.	Plain glass(lessi making)	10 nos	
41.	Sip- up rolls	1	



42.	Sambharam packets	1 roll	
43.	Chocolate wrapping paper/butter paper		
44.	S steel mug 1 litre	One	
45.	Litre set 1ml, 500ml, 200ml,100ml,50ml	One set	
46.	Avery weighing balance 5 kg capacity	One set	
47.	S.S bucket 10 litre cap	1	
48.	Litmus paper	5 set	
49.	Analytical balance with weight box	1nos	
50.	Shallow bottom S.S dish 7-8 cm dia 2.5 cm deep provided with easily removable lid	5 nos	
51.	Hot air oven -small size	1	
52.	Desiccators small size	1	
53.	10ml milk pipettes for acidity test	10 nos	
54.	15ml,2ml,1ml pipettes for protein test etc.	10 each	
55.	Cream butyrometer with key & stopper	5 nos	
56.	Sp. Gravity bottle	6 nos	
57.	Rubber cork for test tube	50 nos	
58.	S.S forceps 9"	5 nos	
59.	Plaster of paris mould of a cow height 1 feet	One	
60.	Colour photographic chart of different breeds ie. Hallikar, Kangayan, sahiwal, Gir, Sindhi, jersy, H.F, Brownswiss, Murrah, Surti, Malabari, jamnapari in single frame	One each	
61.	Chart of cattle shed with pain and front elevation (Tail to tail system & head to head system)	One	
62.	Tattooing machine with set	One	
63.	Tagging set	One	
64.	Branding set	One	
65.	Electric dehorner	One	
66.	Burdizzo Castrator	One	
67.	Bull nose ring	One	
68.	Bull holder	One	
69.	Clinical thermometer	One	
70.	Glass funnel	2nos	
71.	AI Gun	One	
72.	Artificial Vagina	One	
73.	Vaginal Speculum	One	
74.	Pipette .01ml breeds pipette	5 nos	
75.	Slides	1 box	
76.	Laminar air flow system		
77.	Pipette 1ml	5 each	
78.	Incubator		
79.	Oil immersion microscope	2 nos	
80.	Petridishes	10 nos	
81.	Autoclave	1	
82.	Colony counter	1	
83.	Standard flask 1litre,100ml	8 each	
84.	Digital electronic weighing balance2g-5Kg	one	
85.	Precision balance .01 to 300g	one	

### LIST OF CONSUMABLES

Sl. No	Name of Item	Quantity	Cost
1.	Toned milk	150 litre	
2.	Sugar	15 Kg	
3.	Ghee	5kg	
4.	Butter	2 kg	
5.	Milk cream	10 kg	
6.	Skimmed milk powder	5 kg	
7.	Condensed milk	3 kg	
8.	Rava	25 kg	
9.	Maida	25 kg	
10.	Baking powder	500 gm	
11.	Essence	300 ml	
12.	Colour	300 ml	
13.	Emulsifier	500 ml	
14.	Coconut oil	3 kg	
15.	Cocoa powder	500 gm	
16.	Salt	500 gm	
17.	Cashew nut	1 kg	
18.	Cardamom	1 kg	
19.	Cherry, Raisins	250 g Each	
20.	Vegetables as per demand limited to Rs.200/year		

### LIST OF UTENSILS

Sl. No	Name of Item	Quantity	Cost
1.	LPG gas stove with two cylinders	2 nos	
2.	Single burner LPG gas stove (Large)	1 nos	
3.	Anodized Pan /Vessel 3kg	one	
4.	Anodized Pan/Vessel 4kg	one	
5.	Metal pan 5 kg(ordinary size)	one	
6.	Metal 8 kg (small size)	one	
7.	Stainless steel stirrer long & short	Two each	
8.	Stainless steel strainer	one	
9.	Stainless steel ladle	two	
10.	Stainless steel knife long & short	One each	
11.	Glass Trays	3 nos	
12.	Glass bowls	6 nos	
13.	Glass plates (small)	6 nos	
14.	Vegetable cutting slab ½ feetx1feet	one	
15.	peda mould	One	
16.	Chocolate mould	One	
17.	Steel Spoon	10 nos	
18.	Tray (Steel)	5 nos	
19.	Vessels (5L) Steel	5 nos	
20.	Vessels (3L) Steel	5 nos	
21.	Vessels (2L) Steel	5 nos	

## MACHINES

Sl. No	Name of Item	Quantity	Cost
1.	Cream separator electrically operated	One	
2.	Stainless steel bowls capacity smallest one	One set	
3.	Ice cream mixing machine (small size)	One set	
4.	Stainless steel butter churner (small size)	one	
5.	Cheese vat, cheese knives, curd mill, paraffin tank, drying & curing rooms	One each	
6.	Incubator for culture making	one	
7.	Double jacketed stainless steel ghee vat	one	
8.	Milko Tester	one	
9.	Deep Freezer	One	
10.	Fridge 165 litre capacity	one	
11.	Mixer grinder	one	
12.	Semi automatic Form Filling Packing Machine (small)	One	
13.	Sealing Machine	One	

## LABORATORY CHEMICALS

Sl. No	Name of Item	Quantity	Cost
1.	Gerber sulphuric acid. concentration of 90 to 91 % by weight,	3 litre	
2.	Amyl alcohol 95% of clear colourless with density of 0.805 g/ml	500 ml bottle	
3.	N/10 sodium hydroxide solution	500 ml x 2 bottle	
4.	0.5% phenolphthalein indicator	500 ml x 1 bottle	
5.	Ethyl alcohol 68% or 75% by volume	500 ml	
6.	Conc. hydrochloric acid	500 ml	
7.	Resorcinol powder	450 gm	
8.	Spirit-laboratory type	1 litre bottle	
9.	Iodine solution 1%	1 litre	
10.	Methylene blue thiocyanate solution	1 bottle	
11.	Gelatin	500 gm	
12.	Sodium alginate	500 ml	
13.	Citric acid	1 litre x 2 bottle	
14.	Soluted potassium oxalate solution	250 ml	
15.	Neutral formalin	500 ml	
16.	Potassium chromate aqueous 10 %	250 ml	
17.	Ag no <sub>3</sub> (1 normal)	100 gm	
18.	Rennet for cheese preparation	500 ml	
19.	Anhydrous AR sodium carbonate		
20.	AR sodium bicarbonate		
21.	Para-nitro phenyl-disodium ortho phosphate		
22.	Newman's lampert stain		
23.	Methylene blue		
24.	Ethyl alcohol		
25.	Tetra chloride ethylene		
26.	Glacial acetic acid		
27.	Nutrient agar		
28.	Tryptone glucose yeast extract agar		