

contain the description of his observations about (1) Products/Work (2) Tools and Equipment's Used. He will be evaluated at the institution level In III Sem. for 30 marks for the report presented. See Annexure -I

### THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
3.1	*Energy Conservation	3	-	2	3	20	10	30	50	2 ½	20	3	70	100	
3.2	Steam Engineering and Heat Engines	6	-	4	5	20	30	50	50	2 ½	50	3	100	150	
3.3	Dairy Engineering-I	6	-	4	5	20	30	50	50	2 ½	50	3	100	150	
3.4	Dairy Microbiology	6	-	4	5	20	30	50	50	2 ½	50	3	100	150	
3.5	Dairy Chemistry	6	-	4	5	20	30	50	50	2 ½	50	3	100	150	
3.6	Field Exposure	-	-	-	2	-	30	30	-	-	-	-	-	30	
#Student Centred Activities (SCA)		-	-	3	1	-	30	30	-	-	-	-	-	30	
Total		27	-	21	26	100	190	290	250		220	15	470	760	

\* Common with other diploma programmes

# Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

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### **3.1 ENERGY CONSERVATION**

**L T P**  
**3 - 2**

#### **RATIONALE**

The requirement of energy has increased manifold in last two decades due to rapid urbanization and growth in industrial/service sector. It has become a challenging task to meet ever increasing energy demands with limited conventional fuels and natural resources. Due to fast depletion of fossil fuels and a tremendous gap between supply and demand of energy, it is essential to adopt energy conservation techniques in almost every field like industries, commercial and residential sectors etc. Energy conservation has attained priority as it is regarded as an additional energy resource. Energy saved is energy produced. This course covers the concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in general industry and details out energy audit methodology and energy audit instruments.

#### **LEARNING OUTCOMES**

After undergoing this subject, the students will be able to:

- define principles and objectives of energy management and energy audit.
- understand Energy Conservation Act 2001 and its features.
- understand various forms & elements of energy.
- identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipments.
- identify areas of energy conservation and adopt conservation methods in various systems.
- evaluate the techno economic feasibility of the energy conservation technique adopted.

#### **DETAILED CONTENTS**

##### **1. Basics of Energy**

- 1.1 Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators.
- 1.2 Global fuel reserve
- 1.3 Energy scenario in India and state of U.P. Sector-wise energy consumption (domestic, industrial, agricultural and other sectors)
- 1.4 Impact of energy usage on climate

##### **2. Energy Conservation and EC Act 2001**

- 2.1 Introduction to energy management, energy conservation, energy efficiency and its need

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- 2.2 Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation.
  - 2.3 Standards and Labeling: Concept of star rating and its importance, Types of product available for star rating
3. Electrical Supply System and Motors
  - 3.1 Types of electrical supply system
  - 3.2 Single line diagram
  - 3.3 Losses in electrical power distribution system
  - 3.4 Understanding Electricity Bill: Transformers Tariff structure, Components of power (kW, kVA and kVAR) and power factor, improvement of power factor, Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)
  - 3.5 Transformers: Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers
  - 3.6 Electric Motors  
Types of motors, Losses in induction motors Features and characteristics of energy efficient motors, Estimation of motor loading, Variation in efficiency and power factor with loading, Tips for energy savings in motors
- 4 Energy Efficiency in Electrical Utilities
  - 4.1 Pumps: Introduction to pump and its applications, Efficient pumping system operation, Energy efficiency in agriculture pumps, Tips for energy saving in pumps
  - 4.2 Compressed Air System: Types of air compressor and its applications, Leakage test, Energy saving opportunities in compressors.
  - 4.3 Energy Conservation in HVAC and Refrigeration System: Introduction, Concept of Energy Efficiency Ratio (EER), Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.
- 5 Lighting and DG Systems
  - 5.1 Lighting Systems: Basic definitions- Lux, lumen and efficacy, Types of different lamps and their features, Energy efficient practices in lighting
  - 5.2 DG Systems: Introduction, Energy efficiency opportunities in DG systems, Loading estimation
- 6 Energy Efficiency in Thermal Utilities
  - 6.1 Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE)
  - 6.2 Energy Conservation in boilers and furnaces : Introduction and types of boilers, Energy performance assessment of boilers, Concept of stoichiometric air and excess air for

- combustion, Energy conservation in boilers and furnaces, Do's and Don'ts for efficient use of boilers and furnaces
- 6.2 Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers
- 6.3 Efficient Steam Utilization
- 7. Energy Conservation Building Code (ECBC)
  - 7.1 ECBC and its salient features
  - 7.2 Tips for energy savings in buildings: New Buildings, Existing Buildings
- 8 Waste Heat Recovery and Co-Generation
  - 8.1 Concept, classification and benefits of waste heat recovery
  - 8.2 Concept and types of co-generation system
- 9 General Energy Saving Tips
  - Energy saving tips in:
    - 9.1 Lighting
    - 9.2 Room Air Conditioner
    - 9.3 Refrigerator
    - 9.4 Water Heater
    - 9.5 Computer
    - 9.6 Fan, Heater, Blower and Washing Machine
    - 9.7 Colour Television
    - 9.8 Water Pump
    - 9.9 Cooking
    - 9.10 Transport
- 10 Energy Audit
  - 10.1 Types and methodology
  - 10.2 Energy audit instruments
  - 10.3 Energy auditing reporting format

## **PRACTICAL EXERCISES**

1. To conduct load survey and power consumption calculations of small building.
2. To check efficacy of different lamps by measuring power consumption and lumens using lux meter.
3. To measure energy efficiency ratio (EER) of an air conditioner.

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4. To measure effect of valve throttling and variable frequency drive (VFD ) on energy consumption by centrifugal pump.
5. To measure and calculate energy saving by arresting air leakages in compressor.
6. To measure the effect of blower speed on energy consumed by it.

## **STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY**

- Presentations of Case Studies
- Debate competitions
- Poster competitions
- Industrial visits
- Visual Aids

## **INSTRUCTIONAL STRATEGY**

Teachers are expected to lay considerable stress on understanding the basic concepts in energy conservation, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject must be supplemented by demonstrations and practical work in the laboratory. Visits to industries must be carried out. Expert from industry must be invited to deliver talks on energy conservation to students and faculty.

## **RECOMMENDED BOOKS**

1. Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015
2. Guide book on Energy Efficiency in Electrical Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
3. Guide book on Energy Efficiency in Thermal Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
4. Handbook on Energy Audit & Environmental Management by Y P Abbi & Shashank Jain published by TERI. Latest Edition

### **Important Links:**

- (i) Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India. [www.beeindia.gov.in](http://www.beeindia.gov.in).
- (ii) Ministry of New and Renewable Energy (MNRE), Government of India. [www.mnre.gov.in](http://www.mnre.gov.in).

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- (iii)Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh.  
[www.upneda.org.in](http://www.upneda.org.in).
- (iv)**Central Pollution Control Board (CPCB)**, Ministry of Environment, Forest and Climate Change, Government of India. [www.cpcb.nic.in](http://www.cpcb.nic.in).
- (v) **Energy Efficiency Services Limited (EESL)**. [www.eeslindia.org](http://www.eeslindia.org).
- (vi)Electrical India, Magazine on power and electrical products industry. [www.electricalindia.in](http://www.electricalindia.in).

## 3.2 STEAM ENGINEERING & HEAT ENGINES

L T P  
6 - 4

### RATIONALE

The heat energy is still a major means of power in the world. Knowledge of Steam Engg. and Heat Engines is very important for Dairy Engineers. The paper presents an introduction to sources of heat and its application.

### LEARNING OUTCOMES

After undergoing this subject, the student will be able to;

- Learn various types of boilers, their construction and working.
- Learn draught phenomenon in steam generators.
- Understand the detailed study of steam generation processes and performance parameters.
- Understand the phenomenon of heat exchange in mechanical systems.
- Learn the concepts and working of internal combustion engines.

### DETAILED CONTENTS

#### **STEAM ENGINEERING**

##### **1. STEAM GENERATORS: (14 Periods)**

Classification of Boilers, Difference between fire tube and water tube boilers. Names of different types of boilers used in dairy plants, their merits and demerits. Principle of working of economic boilers, electric steam boilers. Function and working of different boiler mountings and accessories (simple line diagrams.)

##### **2. BOILER DRAUGHT: (10 Periods)**

Purpose of draught, Concept of different types of draught such as natural, induced and forced draught.

##### **3. BOILER PERFORMANCE: (10 Periods)**

Boiler trial, equivalent evaporation rating of boiler, thermal efficiency. sources of energy and simple numerical problems on boiler trials, boiler management and maintenance, selection of boilers, importance of boiler testing. Boiler safety problems in boiler operation, their identification, remedies and repair and maintenance.

##### **4. CONDENSERS: (10 Periods)**

Types of condensers. Importance of condenser in a steam power plant. Principle of working of a surface and jet condenser with simple line diagrams. (details not required.) Simple calculations related to condensers.

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## **HEAT ENGINES**

### **5. HEAT TRANSFER : (15 Periods)**

Conduction and convection, Concept of heat transfer through combined effect, Heat transfer through fins, Mean temperature difference for parallel and counter flow. Effectiveness of heat exchangers. Simple numerical problems for heat transfer (Heating and Cooling).

### **6. RECIPROCATING STEAM ENGINE : (10 Periods)**

Working principle. A brief concept of engine details.

### **7. I.C. ENGINES: (15 Periods)**

Introduction and classification of IC Engine, working principle of 2-stroke and 4-stroke I.C. Engines (petrol and Diesel). General idea of mixture formation. Purpose and use of fuel equipment. Ignition, Importance of cooling and lubrication.

## **HEAT ENGINE LAB**

### **LIST OF EXPERIMENTS**

1. To study and sketch a boiler installed in the laboratory.
2. To study and sketch fire tube boiler i.e. a Lancashire boiler.
3. To study the construction and working of various mountings.
  - (a) Feed check valve.
  - (b) Safety valve, (dead weight safety valve, lever safety valve and rams bottom safety valve).
  - (c) Stop valve.
4. To study the construction and working of various accessories of boiler.
  - (a) Air-preheater.
  - (b) Green's Economizer.
  - (c) Superheater.
5. To study and sketch a two-stroke petrol engine.
6. To study and sketch four stroke I.C. Engine:
  - (a) Petrol Engine.
  - (b) Diesel Engine.

7. To study and sketch Cooling system of a 4-stroke petrol Engine.

8. To study and sketch Lubrication system of a 4 stroke I.C. Engine.

9. To study and sketch steam condenser.

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- (a) Surface condenser.
- (b) Jet condenser.

10. To study and sketch the fuel supply system of 4 stroke Diesel Engine.

11. To measure the BHP of an I.C. engine.

**INSTRUCTIONAL STRATEGY:** Teacher should mainly focus on the detailed study of boilers, heat engines and internal combustion engines. Some aids / animations should also be demonstrated.

**MEANS OF ASSESSMENT:**

- Theory classes.
- Practical /Viva voce
- Assignments/ quizzes.

**RECOMMENDED BOOKS :**

1. Heat engines volume-1 by Dr.N.C.Pandey
2. Thermal engineering by R.K.Hegde
3. Thermal engineering by M.M.L.Patel.
4. Power generation by kapil goyal.

**ONLINE RESOURCES:**

- [www.swayam.in](http://www.swayam.in)
- [www.urise.up.gov.in](http://www.urise.up.gov.in)
- [www.nptel.ac.in](http://www.nptel.ac.in)

**SUGGESTED DISTRIBUTION OF MARKS**

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	14	20
2	10	12
3	10	12
4	10	12
5	15	16
6	10	12
7	15	16
Total	84	100

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### 3.3 DAIRY ENGINEERING - I

**L T P**  
**6 - 4**

#### **RATIONALE**

Milk is an important ingredient for health and therefore it is universally utilized by human being of all age groups. The supply terminals are normally situated at distant places from the processing units. Therefore, effective methods of milk collection and storage are required to avoid microbiological contamination of milk. The students are required to be trained in handling of milk at preprocessing stage.

#### **LEARNING OUTCOMES**

After undergoing this subject, the student will be able to;

- 1-Milk storage system and Storage equipments used in the dairy plant.
- 2-All heat exchanging equipments used in milk processing in a dairy plant
- 3- Pasteurization and sterilization of Milk and Milk products.
- 4-Different type of conveyors used in Dairy Plant
- 5 different types of filling and packaging methods and equipments used for packaging the fluid milk and Milk products in Dairy plant

#### **DETAILED CONTENTS**

##### **1. STORAGE EQUIPMENT: (20 Periods)**

Insulated storage tank. refrigerated storage tanks specification for the storage tanks. Milk transport tank. Milk processing equipments, filters, clarifiers. Bactofuge separators-warm milk separators, cold milk separators, Triprocess and self desludging centrifugal. Bottle washers, purpose and types, operation, maintenance and trouble shooting.

##### **2. HEAT EXCHANGING EQUIPMENT: (24 Periods)**

Pasteurizing plants, purpose and special requirement. High temperature short time pasteurizer, utilities, regeneration, holding time. Metering pump and drive F.D.V. UHT (Ultra High Temperature) Pasteurizers. Flavour treating systems. Vaceator. Electric conduction pasteurization. direct steam heater. Milk sterilization. Indirect heating system, comparison between them.

### 3. **INSTALLATION OF INFLOOR AND ONFLOOR CONVEYOR:** (20 Periods)

Different types of conveyors used in dairy industry, their drives, take up units. conveyor components, Case stackers and unstacks, Plastic Milk Crates, handling of dispenser milk containers, handling of ice cream.

### 4. **FILLING AND PACKAGING EQUIPMENTS :** (20 Periods)

Different types of filling and packaging materials, their composition and uses Bottle filler, Flexible packaging, Gravity fillers, Asceptic fillers, Sachet machines, Care and maintenance of fillers, Asceptic canning.

### **LIST OF EXPERIMENT**

1. Study of constructional details, dismantling, assembling, adjustment, and maintenance, commissioning of clarifiers and separators.
2. Study of constructional details, dismantling, assembling adjustment operation, control and maintenance of:-
  - (a) H.T.S.T. pasteurizer
  - (b) Batch pasteurizer
  - (c) Sterilizer
3. Study the working, operation, maintenance, adjustments of bottle washing machine.
4. Study of constructional details, dismantling, assembling adjustment, operation, control, maintenance of bottle filling and capping machine.
5. Study of constructional details, dismantling, assembling, adjustment, operation control and maintenance of fluid milk packaging machine.
6. Study of constructional details, disassembling, assembling, adjustment, operation and control of different types of bulk milk cooler and storage tanks.
7. Study the batch type sterilizer for bottled milk.

### **INSTRUCTIONAL STATREGY**

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon.

### **MEANS OF ASSESSMENT**

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Actual Lab & Practical Work,

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- Viva Voce

### RECOMMENDED BOOKS

- 1-Dairy Plant Engineering And Management : By Tufail Ahmad Publisher- Kitab
- 2- Dairy Engineering : Advanced Technologies and Their Application: By Murlidhar Meghwal, Megh R. Goyal, Rupesh S. Chavan Publisher- CRC Press
- 3-Dudh Udyog ; By-Dr. Anil Kumar Kulkarni : Publisher:Continental Publication
- 4-Dairy Products manufacturing Technologies By-Jagdish Prasad : Publisher: Kalayani Publisher
- 5- Dairy Science and Technology Hand Book ; By Y .H. Hui Publisher; John Wiley
- 6-Dairy Engg Practical Book ; By-Seema Tanwar , V.D Mudgal, S K Jain ; Publisher- Satish Serial Publishing House.
- 7- Dairy Process Engg (Practical Book) ; By VD Mudgal , KK Meena ; Publisher- Satish Serial Publishing House
- 8- Dairy Engineering : Advanced Technologies and Their Applications; By- Murlidhar Meghwal, Megh R. Goyal, Rupesh S. Chavan Publisher-Apple Academic Press
- 9- Novel Dairy Processing Technologies ; Techniques, Management and Energy Conservation; By- Megh R. Goyal, Anit Kumar, Anil K.Gupta Publisher: CRC Press

### Online Resources

1. <https://agrimoon.com/>
2. [Swayam.gov.in](https://swayam.gov.in)
3. <https://www.researchgate.net/>
4. <https://www.perlego.com/>

### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	20	24
2	24	28
3	20	24
4	20	24
<b>Total</b>	84	100

### 3.4 DAIRY MICROBIOLOGY

L T P  
6 - 4

#### RATIONALE

The chemical changes in the milk are caused due to micro-organism. The study of different type of micro-organism is essential for maintaining the nutritive value and taste of milk products. Disintegration of milk may result the unhygienic effect on the human body and various types of deceases may be caused. Therefore, micro-biological pollution should be controlled.

#### LEARNING OUTCOMES

After undergoing this subject, the student will be able to;

- 1-Microorganism types, structure, growth in the milk and different products during processing.
- 2-M measurement of bacterial growth nutrition milk
- 3-Hygenic Milk production
- 4 Microbiological test of milk and Milk products.
- 5- Waste management for Dairy Plant

#### DETAILED CONTENTS

##### 1. INTRODUCTION TO MICROBIOLOGY: (20 Periods)

General concept regarding classification and nomenclature of micro organisms. Principles of staining, morphology and structure of bacteria, yeast and moulds Growth, reproduction and spore formation in micro organisms. Bacteriological techniques for enumeration, isolation and identification of bacteria. Measurement of bacterial growth . Nutrition and metabolism of Bactria. Effect of physical and chemical factors on growth and death of micro organisms.

##### 2. PRINCIPLE OF HYGENIC MILK PRODUCTION: (24 Periods)

Sources of contamination of milk, relative importance and methods of their control. Growth of different types of micro-organisms in milk and their role in spoilage. Farm and dairy sanitation, cleaning and sanitization of dairy equipment's, different methods of controlling bacterial growth in milk, effect of cooling pasteurization, sterilization and ultra-high temperature on Bactria in milk, milk borne diseases. Quality control tests for milk, psychrophilic, mesophilic, thermoduric and thermophilic Bactria. Starter culture and their use in preparation of curd, butter, cheese, yogurt & acidophilus milk. microbial spoilage of evaporated and condensed milk, processed cheese ice-cream and other milk products.

##### 3. DAIRY WASTE MANAGEMENT : (20 Periods)

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Characterization of the dairy waste (solids, liquids & gases) and its treatment through chemical, physical & biological methods and their utilization.

4. **MICROBIOLOGICAL TEST :**

**(20 Periods)**

Standard plate count, Total plate count, Coliform test, Yeast And mould test, Phosphatase test, Methylene blue reduction test, ETP water test, BOD and COD, SWAB test, Pathogens tests.

**List of Experiment**

1. Familiarity with equipments used in Microbiological work and common bacteriological techniques.
2. Motility of bacteria, yeast and molds.
3. Preparation of smears, simple staining, gram staining and study of morphology of bacteria, yeast and molds.
4. Direct microscopic count.
5. Standard plate count technique.
6. To conduct Dye-Reduction and presumptive and utensils.
7. Examination of sterility of dairy equipment coliform tests.
8. Micro-organisms in air.
9. Examination of various milk products with respect of the
  - (a) Total plate count.
  - (b) Total coliform count.
  - (c) Total yeast and Mold counts.

**INSTRUCTIONAL STATREGY**

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students.

**MEANS OF ASSESSMENT**

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Actual Lab & Practical Work,
- Viva Voce

**RECOMMENDED BOOKS**

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- 1- Dairy Microbiology Handbook; The Microbiology of Milk and Milk Products; By-R K Robinsion; Publisher-
- 2-Applied Dairy Microbiology; By-Elmer H Marth, James Steele ; Publisher; Taylor & Francis
- 3-Dairy Microbiology; A practical approach ; By- Photis Papademas ; Publisher-CRC Press
- 4-Dairy Microbiology; By- Pradeep Parihar :Publisher- Student Edition,2008
- 5- Fundamental of Micobiology; By-I Edward Alcamo; Jones and Bartlett
- 6- A comprehensive Dairy Microbiology; By-JS Yadav , Sunita Grover and V K Batish
- 7- Food and Dairy Microbiology; By- Dr M K Rao ; Publisher- Mangalam publishers & Distributors
- 8- Dairy Microbiology, KC Mahanta

#### WEBSITES FOR REFERENCE:

- [www.swayam.in](http://www.swayam.in)
- [www.urise.up.gov.in](http://www.urise.up.gov.in)
- [www.nptel.ac.in](http://www.nptel.ac.in)

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	20	24
2	24	28
3	20	24
4	20	24
<b>Total</b>	84	100

### 3.5 DAIRY CHEMISTRY

**L T P**  
**6 - 4**

#### **RATIONALE**

Several milk products are manufactured from milk. The quality and variety of finished products require a qualitative and quantitative study of composition of milk. The student having knowledge about the initial essential constituents of milk like proteins, lactose, enzymes, etc., will be very useful for milk processing plants.

#### **LEARNING OUTCOMES**

After undergoing this subject, the student will be able to;

- 1-Milk composition of buffalo, cow, sheep, goat etc. and composition .
- 2-Physical and chemical properties of milk and its measurement.
- 3-Details of Milk Fat, Proteins, Lactose, Enzymes.
- 4- Vitamins and pigments present in milk
- 5- different factors affecting the composition of milk

#### **DETAILED CONTENTS**

##### 1. COMPOSITION OF MILK: (08 Periods)

Average gross composition of colostrum and milk of cow, buffalo, sheep and goat. Detailed composition of cow milk; factor affecting the composition of milk; basic differences between cow and buffalo milks.

##### 2. PHYSICAL PROPERTIES OF MILK: (08 Periods)

Colour, specific gravity, index of refraction, surface tension, viscosity, specific heat and its significance in dairy industry, boiling point and freezing point ; acidity, pH and buffering capacity. Electrical conductivity, Osmotic pressure of milk.

##### 3. MILK FAT: (06 Periods)

Composition of milk fat; factors affecting composition of milk fat quality; physico-chemical constants of butter fat; hydrolysis; oxidation rancidity; saponification and hydrogenation.

##### 4. MILK PROTIENS: (06 Periods)

General properties and classification of milk proteins; casein, lactalbumin and lactoglobulin and their general properties.

##### 5. LACTOSE: (04 Periods)

General physical and chemical properties of lactose; hydrolysis of lactose; chemistry of fermentation of lactose into lactic acid; crystallization of lactose & purification.

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6. **ENZYMES:** (06 Periods)

Definition and function, classification of milk enzymes and their roles in different metabolic reactions.

7. **VITAMINS AND PIGMENTS IN MILK:** (06 Periods)

General qualitative and quantitative study.

8. **COMPOSITION AND PHYSICO CHEMICAL CHANGES :** (06 Periods)

Composition and physico chemical changes in preparation of dairy products, such as cream, butter, ghee, condensed milk, whole milk powder and skim milk powder, baby food, Ice-cream, cheese, paneer, chhenna, khoa, and dahi. Nutritive value of milk and milk products.

9. **MINOR CONSTITUENTS :** (06 Periods)

Minor constituents and effect of metal in milk and milk products. Detection of adulteration of milk & milk products. Preservation in milk and their detection.

**LIST OF EXPERIMENTS**

1. Determination of Sp. gravity of milk by lactometer.
2. Determination of fat by Gerber methods and by milk tester.
3. Determination of percentage of S.N.F. by lactometer.
4. Determination of lactose content by polarimetric and volumetric methods.
5. Determination of protein content of milk by kjeldahl method.
6. Common platform test of milk such as C.O.B, alcohol and sediment test.
7. Determination of acidity of milk.
8. Determination of freezing point of milk.
9. To analyze the following milk products-cream, ghee, butter, ice-cream, khoa, chhenna.
10. Estimation of strength of various sanitizers and detergents.

**INSTRUCTIONAL STATREGY**

Teacher may use various teaching aids like live models and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon.

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## MEANS OF ASSESSMENT

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Actual Lab & Practical Work,
- Viva Voce

## RECOMMENDED BOOKS

- 1- Outlines of Dairy Technology ; By – Sukumar Dey ; Publisher- Oxford University Press (Indian Branch)
- 2-Text book of Dairy Chemistry ; By- M P Mathur, D Datta Roy, P. Dinakar ; Publisher-ICAR New Delhi
- 3- Dairy Science and Technology Hand Book ; By Y .H. Hui Publisher; John Wiley
- 4-Dairy Engg Practical Book ; By-Seema Tanwar , V.D Mudgal, S K Jain ; Publisher- Satish Serial Publishing House.
- 5- Fundamentals of Dairy Chemistry; By- Webb .B. H ;Publisher-CBS Publisher
- 6- Dairy Process Engg (Practical Book) ; By VD Mudgal , KK Meena ; Publisher- Satish Serial Publishing House
- 7-A Text Book of Dairy Chemistry ; By – MP Mathur ;Publisher-ICAR
- 8- Dairy Chemistry ; By- Hary Synder Publisher; Nabu Press
- 9- Fundamentals of Dairy Chemistry; By-Webb Johnson and Alford; Publisher-CBS
- 10-दुग्ध रसायन एवं पशु पोषण- डॉ० तेज बहादुर सिंह
- 11- दुग्ध रसायन एवं पशु पोषण-विनय सिंह

## WEBSITES FOR REFERENCE:

1. <https://agrimoon.com/>
2. [Swayam.gov.in](http://Swayam.gov.in)
3. <https://www.researchgate.net/>
4. <https://www.perlego.com/>

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	12
2	10	12
3	10	12
4	10	12
5	10	12
6	8	9
7	8	9
8	10	12
9	8	10
Total	84	100

### 3.6 **FIELD EXPOSURE**

After the II Sem Exam. Student of II Sem Dairy Engineering will go for a two week visit of a small/medium size dairy plant.

It will be structured and supervised by the institution. Purpose of the visit is to give students an exposure of industrial setup and that of simple tools, instruments and the skill there in day-to-day use.

Every student will submit the institution a report of his visit.

The report will in variably contain the description of his observations about

(1) Products/Work

(2) Tools and Equipment's Used.

Students will be evaluated at institution level In III Sem. for 30 marks for the report presented.