

## 4.1 TECHNOLOGY OF MILK AND MILK PRODUCTS

L T P  
3 – 4

### RATIONALE

This subject is aimed at developing an understanding of various process technologies and handling of equipment used in the processing and value addition of milk and milk products in the students

### DETAILED CONTENTS

1. Introduction – Status and scope of dairy industry in India (01 hrs)
2. Milk (10 hrs)  
 Definition of milk, composition, nutritive value of milk, factors affecting composition of milk, types of milk,  
 Physico-chemical properties of milk: Colour, flavour, taste, specific gravity, & density, boiling and freezing point, refractive index, percentage acidity and pH, viscosity, surface tension, thermal conductivity. Basis for pricing of milk
3. Quality control tests (03 hrs)  
 Platform tests like-smell, appearance, temp, sediment, acidity, lactometer reading  
 Chemical/Laboratory test: Percentage Acidity, pH, alcohol, fat, SNF, etc.  
 Microbiological: SPC, MBRT, Resazurin tests etc.
4. Milk Processing (06 hrs)  
 Receiving, Filtration and clarification, straining, standardization Homogenization and its effects, Pasteurization: and various systems of Pasteurization; LTLT, HTST, UHT methods, Packaging of fluid milk
5. Coagulated Milk Products (04 hrs)  
 Chhanna, paneer, classification and manufacturing of processed cheese
6. Cream/Butter/Ghee – Manufacture and storage of butter and ghee (04 hrs)
7. Condensed Milk (04 hrs)  
 Types and factors affecting the quality of condensed milk, storage of condensed milk
8. Milk Powder (04 hrs)  
 Methods of drying milk (Drum and Spray drying), factors affecting the quality of milk powder. packaging of milk powder

9. Frozen Products (03 hrs)  
Manufacturing of and ice cream; factors affecting the quality of frozen products
10. Cleaning and sanitation of dairy plant and equipment (04 hrs)
11. Utilization of by products of milk processing industry: skim milk, butter milk, whey, casein (03 hrs)
12. Traditional milk products manufacturing (02 hrs)

### **LIST OF PRACTICALS**

1. Sampling of milk and conduct platform test of milk
2. Determination of SNF (Solids Not Fat), specific gravity, total solids of milk.
3. Testing efficacy of pasteurized milk
4. Determination of moisture & fat content of milk powder
5. Study of various parts and working of cream separator
6. Preparation of Khoa
7. Detection of adulterants in milk like water, urea, neutralizers, preservatives, sucrose starch
8. Preparation of chhanna and paneer
9. Preparation of ice cream
10. Visits to different dairy plants
11. Determination of titrable acidity of milk
12. Determination of fat by Gerber method

Note: Wherever the required equipment's are not available students may be demonstrated that topic the industry or other

### **INSTRUCTIONAL STRATEGY**

This being one of the most important subject, teacher should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students visit to various industries. Students may also be exposed to various National, BIS and international standards. Visits to the relevant industry for demonstrating various operations involved in the dairy technology, is a must. Experts from the industry may be invited to deliver lectures on the latest

technology. Knowledge about pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware about safety aspects.

### RECOMMENDED BOOKS

1. Milk and Milk Products by Eckles and Eckles, Tata *McGraw-Hill Education Pvt. Limited*;
2. Outlines of Dairy Technology by Sukmar De, Oxford University Press, India
3. Dairy Plant System and Layout by Tufail Ashmed, McGraw-Hill Education (India) Pvt Ltd
4. Principles of Dairy Technology by Woarner, Oxford University Press, India
5. Dairy Engineering by Forvall
6. Milk & Milk Products by CBSE, Oxford and IBH *Publishing Co.*, New Delhi
7. Chemistry & Testing of Dairy Products by Atherton Newlander, John Alvin *Newlander Publisher*. Westport

### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	01	02
2	10	20
3	03	06
4	06	12
5	04	08
6	04	08
7	04	08
8	04	08
9	03	08
10	04	08
11	03	08
12	02	04
<b>Total</b>	<b>48</b>	<b>100</b>

## 4.2 TECHNOLOGY OF FRUITS AND VEGETABLE PROCESSING

L T P  
3 – 4

### RATIONALE

This subject is aimed to develop an understanding in processing techniques and skills in handling equipment/machines used for preservation and value addition of perishables like fruits and vegetables

### DETAILED CONTENTS

1. Introduction (3 hrs)  
Status and scope of fruits and vegetables industry in India, Introduction to ripening of fruits; classification, composition and nutritive value of fruits and vegetables
2. Preparatory Operations and Related Equipments (5 hrs)  
Cleaning, sorting, grading, peeling and blanching methods
3. a) Ingredients and processes for the manufacture of: (8 hrs)  
i) jam, jellies, marmalade, preserves, (ii) pickles and chutneys  
b) Defects and factors affecting the quality of above
4. Tomato Products (4 hrs)  
Ingredients and their role, process for the manufacture of tomato ketchup, sauce, puree and paste.
5. Juices (4 hrs)  
Raw materials, extraction, classification, processing and aseptic packaging
6. Thermal Processing of Fruits and Vegetables (8 hrs)  
History, definition, various techniques of thermal processing and their effects on the quality of fruits and vegetable products, types of containers and their selection, spoilage of canned foods
7. a) Dehydration of fruits; equipment and process for dehydration of plums, apricot, apple, fig, grapes peach etc (4 hrs)  
b) Dehydration of Vegetables: equipment and process for dehydration of peas, cauliflower, potato, methi, mushroom, tomato etc  
c) Osmo-dehydration – basic concept and applications

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|-----|--|---------|
| 8.  | Freezing   | (4 hrs) |
|     | Freezing process of selected fruits and vegetables: peas, beans, cauliflower, apricot, mushroom – changes during freezing and spoilage of frozen foods |         |
| 9.  | Food Laws and standards for fruits and vegetable products  | (4 hrs) |
| 10. | By-products utilization  | (4 hrs) |

### **LIST OF PRACTICALS**

1. Orientation to different processing equipments, their functions and uses
2. Preparation of jam, jelly and preserve
3. Preparation of pickle by various methods
4. Preparation of chutney
5. Extraction of tomato juice by hot and cold break methods
6. Preparation of tomato sauce/ketchup
7. Preparation of tomato puree/paste
8. Extraction of juice by various methods
9. Bottling and processing of fruit juice
10. Preparation of syrup and brine solutions
11. Dehydration of peas, potatoes
12. Dehydration of grapes and apples
13. Freezing of peas
14. Preparation of tomato powder
15. Visits to different fruit and vegetable processing industries

### **INSTRUCTIONAL STRATEGY**

This being one of the most important subject, teacher should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students visit to various industries. Students may also be exposed to various National and international standards. Visits to the relevant industry for demonstrating various operations involved in fruits and vegetables processing, is a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge about pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware about safety aspects.

### **RECOMMENDED BOOKS**

1. Fruits and Vegetable Preservation by Girdhari Lal and Sidappa; ICAR (New Delhi)
2. Preservation of Fruits and Vegetable by Srivastava; IBD Co., Lucknow

3. Preservation of Fruits and Vegetable by Vijaya Khader; Kalyani Publication
4. Post Harvest Technology of Fruits and Vegetables – Handling, Processing, Fermentation and Waste Management y LR Verma and VK Joshi
5. Processing Fruits: Science & Technology vol 1-2 by Somogyi
6. Processing Vegetables: Science & Technology vol 1-2 by Somogyi
7. The Technology of Food Preservation by Desrosier
8. Food Science by Potter
9. Food Science by Mudambi
10. Basic Food Preparation( Manual)
11. Fruit & Vegetable Processing by Bhatt, Verma
12. Commercial Vegetable Processing by Woodroof
13. Preservation of Fruits & Vegetables by IRRI
14. Food Canning Technology by Larcousse & Brown
15. Food Composition & Preservation by Bhawna Sabarwal
16. Food Preservation by S.K. Kulshrestha
17. Processing Foods by Oliverra

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	03	06
2	05	10
3	08	16
4	04	08
5	04	08
6	08	18
7	04	10
8	04	08
9	04	08
10	04	08
<b>Total</b>	<b>48</b>	<b>100</b>

### 4.3 TECHNOLOGY OF MEAT, FISH AND POULTRY PRODUCTS

L T P  
3 – 4

#### RATIONALE

This subject is included in the curriculum to impart basic knowledge and skills of various technologies and equipment used for production of raw as well as processed meat, fish and poultry products, in the students

#### DETAILED CONTENTS

1. Introduction to Indian meat, fish and poultry industry (2 hrs)
2. Preparatory operations of meat and meat products (16 hrs)  
  
Composition of muscle, Different types of slaughtering methods, Different types of meat, Anti-mortem and post-mortem inspection of animal/and slaughtered animal, Abattoir – Definition and construction; basic preparatory procedures (culmination, emulsification, pre-blending) Cured and smoked meats, sausage products – classification, processing steps, and canned meat, meat pickles
3. Handling and Dressing of Poultry (6 hrs)  
  
Inspection of poultry birds, dressing and preparation of ready to cook poultry, factors affecting the quality
4. Egg and Egg Products (6 hrs)  
  
Structure, chemical composition and nutritive value, spoilage of eggs and preservation of whole egg and egg products, preparation of egg powder
5. Fish and Fish Products (6 hrs)  
  
Types of fish, composition and nutritive value, judging the freshness of fish, fish grading and cooking of fish, smoking, pickling, salting and dehydration, preservation of fish and processed fish products
6. Traditional Meat Products–Tikkas and Kabab (seekh, boti, glauti, pathar) (2 hrs)
7. Frozen Storage of fresh and processed meat, poultry and fish (4 hrs)
8. By-products of meat, fish, poultry and egg industry (6 hrs)

**LIST OF PRACTICALS**

1. Demonstration of slaughtering and different cuts in a slaughter house
2. Preparation of different types of meat products and their quality evaluation
3. Cutting of meat
4. Preparation of sausages
5. Calculation of shape and size index of egg
6. Preparation of ready to cook poultry
7. Retail cuts of dressed chicken
8. Calculation of Haugh unit of egg
9. Measurement of air cell of egg
10. Determination of effect of temperature on coagulation of egg protein
11. Determination of moisture and solid content of different egg constituents
12. Determination of specific gravity of eggs
13. Preparation of egg powder
14. Preparation of fish, meat and egg pickle
15. Candling and grading of eggs
16. Iron sulphide formation in cooked eggs
17. Preservation of whole egg
18. Visit to slaughter houses and abattoir
19. Demonstration of filleting & steaking of fish



## INSTRUCTIONAL STRATEGY

This being one of the most important subject, teacher should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students visit to various industries. Students may also be exposed to various National and international standards. Visits to the relevant industry for demonstrating various operations involved, in the fermentation of food, is a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge from pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware about safety aspects.

## RECOMMENDED BOOKS

1. Meat Science by Lawrie, Heinemann Educational *Books* Ltd., London
2. Egg Science and Technology by Mountney, *AVI Publish co.*, Westport
3. Egg Science and Technology by PC Pande, *Vikas Publishing House (P) Ltd*, New Delhi
4. Fish Processing and Preservation by CL Cutting (Agro Botanical Publisher)
5. Poultry, Meat and Egg Products by Parkursht and Mountney (CBS Publishers)
6. Fish and Fish Products by AL Winton, *Hill Book Company* U.K.
7. The Canning of Fish and Meat by RJ Footill and AS Lewis (Blackie Publishers)
8. Processed Meat by Pearson and Glite (CBS Publishers)
9. Fermented Meat by Campbell Platt and PE Cook (Blackie Publishers)
10. Fish Processing Technology by GM Hall (Blackie Publishers)
11. Introduction to Fish Technology by JM Regenstein and CE Regusten (CBS Publishers)

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	04
2	16	34
3	06	12
4	06	12
5	06	12
6	02	04
7	04	08
8	06	14
<b>Total</b>	<b>48</b>	<b>100</b>

#### 4.4 ENVIRONMENTAL SCIENCE

L T P  
3 - -

##### RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

##### DETAILED ONTENTS

1. Basics of ecology, eco system and sustainable development (03 hrs)
2. Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table (04 hrs)
3. Sources of pollution - natural and man made, their effects on living and non-living organisms, Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms, Pollution of air-causes and effects of man, animal, vegetation and non-living organisms, Sources of noise pollution and its effects (18 hrs)
4. Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods (06 hrs)
5. Mining, blasting, deforestation and their effects (03 hrs)
6. Legislation to control environment (04 hrs)
7. Environmental Impact Assessment (EIA), Elements for preparing EIA statements (04 hrs)
8. Current issues in environmental pollution and its control, role of non-conventional sources of energy in environmental protection (06 hrs)

##### RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Lqw and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
3. Environmental Engineering and Management by Suresh K Dhamija; SK Kataria and Sons, New Delhi.
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted</b>
1	03	6
2	04	10
3	18	40
4	06	12
5	03	04
6	04	08
7	04	08
8	06	12
<b>Total</b>	<b>48</b>	<b>100</b>

## 4.5 PRINCIPLES OF FOOD ENGINEERING

L T P  
3 – 2

### RATIONALE

This subject is aimed to develop in the students the knowledge and skills related to various operations of process equipment used in food processing industry

### DETAILED CONTENTS

1. Introduction (8 hrs)
  - Units of measurement and their conversion
  - Physical properties like colour, size, shape, density, specific gravity, thousand grain weight/bulk density, porosity, Rheological properties of food materials and their importance
  - Thermal conductivity, specific heat, thermal diffusivity and other physical properties of foods
2. Materials and energy Balance (8 hrs)
 

Basic principles, total mass & component mass balance, system boundaries, material balance calculations, principle of energy balance, Heat, Enthalpy, calculations of specific heat.
3. Fluid Mechanics (10 hrs)
 

Manometers, Reynolds number, fluid flow characteristics, pumps – principles, types, and working of most common pumps used in food industry
4. Heat and Mass Transfer during food processing – Modes of heat transfer i.e. conduction, convection and radiation. Different heat exchangers. Principle of mass transfer, diffusion. (10 hrs)
5. Thermal Processing of Foods (8 hrs)
 

Selection, operation and periodical maintenance of equipments used in food industry viz. pasteurizer, autoclave, heat exchangers, evaporators, driers, boilers etc.
6. Psychrometry (4 hrs)
 

Principle of psychrometry and its application

## LIST OF PRACTICALS

1. Determination of physical properties like size, shape, roundness, sphericity of the food products
2. Determination of angle of repose of grains
3. Study of thermal processing equipment
  - a) Pasteurizer
  - b) Heat Exchanger
  - c) Evaporator
  - d) Drier
4. Constructional and working details of different types of
  - a) Pumps for liquid transportation
  - b) Blower and fan for transportation for gases/air
5. Reading and interpretation of psychro-metric charts
6. Exercises related to material balance
7. Use of steam tables and their interpretation
8. Determination of thermal conductivity of a given food sample

**Note: Whenever the required equipment's are not available students may be demonstrated that topic in industry or other institution or industry.**

## INSTRUCTIONAL STRATEGY

This being one of the most basic subjects for the students of food technology, the teachers should lay a lot of emphasis on explaining the facts, concepts, principles and procedures involved in various topics. The students should be given appropriate tutorial exercises. Teachers should made use of chart and other appropriate media to support classroom instruction. Emphasis during the practical session should be on performance by individual students and teacher should develop instructional manual for various exercises to facilitate the students. Visits to some of the local industries may be arranged to demonstrate various equipment used in food processing Industries and cold stores to the students. Experts may be invited to deliver lectures on latest developments in the field.

### RECOMMENDED BOOKS

1. Post Harvest Technology of Cereal, Pulse and Oil Seeds by Chakraborty, AC, CBS *Publishers*, Delhi.
2. Unit Operations in Agriculture Processing by Singh and Sahay, Vikas *Publishing House* (P) Ltd, New Delhi
3. Fundamentals of Food Engineering by Brennen, AVI *Publishing Co.*, Westport
4. Fundamentals of Food Processing Engineering by Romeo T Toledo, AVI *Publishing Co.*, Westport,
5. Agricultural Process Engineering by Henderson and Perry, John Wiley and Sons, Inc., New York
6. Transfer Processes and Unit Operation by CJ Geankoplis, McGraw-Hill *Book Co.*, New York.
7. Physical Properties of Plants and Animal Materials by NK Mohsenin, Gordon and Breach Science *Publishers*, New York, USA
8. Principles of Food Engineering by TE Charm, McGraw-Hill *Book Co.*, New York.
9. Introduction to Food Engineering by Singh RP and DR Heldmann, McGraw Hill *Book Co.*, New York.
10. Unit Observation in Chemical Engineering by McCabe, Smith and others, McMillan *publishing company*, Newyork
11. Unit Operation in Food Processing by Earlle, oodhead *Publishing Limited*, Cambridge, England

### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	16
2	08	16
3	10	22
4	10	22
5	08	16
6	04	08
<b>Total</b>	<b>48</b>	<b>100</b>

## 4.6 BAKERY AND CONFECTIONERY TECHNOLOGY

L T P  
3 – 4

### RATIONALE

This subject is aimed at developing an understanding of process technology and skills in handling equipment involved for the preparation of bakery products in diploma students of food technology

### DETAILED CONTENTS

1. Introduction – Status of Bakery industry in India (4 hrs)
2. Raw Materials for Bakery Products (8 hrs)
 

Flour, sugar, shortening, yeast, salt etc as raw material for bakery products, their role and PFA specifications of these raw materials
3. Manufacturing of Bakery Products (22 hrs)
 

Different types of bread and preparation of bread using different methods, quality evaluation of bread, staling of bread

Different types of biscuits and preparation of biscuits using different methods, quality evaluation of biscuits

Different types of cakes and pastries, preparation of cakes and pastries using different methods, quality evaluation of cakes, different types of toppings

Preparation of other bakery products: rusks, crackers, buns, puffs, muffins and pizza

Types of Additives used in bakery products
4. Confectionery Products (8 hrs)
 

Introduction, classification of confectionery products, confectionery ingredients like starch, fats, colours, flavours additives. Brief account of sweeteners like Gur, refined sugar, beet sugar, white sugar and liquid sweeteners like Molasses, corn syrup, high fructose syrup, maple syrup. Reaction of sugar like caramelization, hydrolysis and crystallization, sugar boiled, chocolate and Indian confectionery
5. Layout out, setting up of units and hygienic conditions required in bakery plant, operation and maintenance of bakery equipment (6 hrs)

## LIST OF PRACTICALS

1. Quality analysis of raw materials used in bakery and confectionery industry according to PFA standards
2. Preparation and evaluation of bakery and confectionery products:
  - a) Bread
  - b) Cakes
  - c) Biscuits
  - d) Buns
  - e) Doughnuts
  - f) Puffs
  - g) Kulchas
  - h) Pizza base
  - i) Ginger candy
3. Study and analysis of the production charts used for different products by bakery industries
4. Visits to bakery and confectionery industry

## INSTRUCTIONAL STRATEGY

This being one of the most important subject, teacher should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students visit to various industries. Students may also be exposed to various National and international standards. Visits to the relevant industry for demonstrating various operations involved in the Bakery and Confectionery processing is a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge from pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware about safety aspects.

## RECOMMENDED BOOKS

1. Bakery Engineering and Technology, Vol. I and II by Matz; CBS
2. Bakery Products Published by SIRI
3. Cereal Technology by Kent; CBS
4. Wheat Chemistry and Technology by Y Pomeranz
5. Basic Baking by SC Dubey
6. Practical Baking by William Sultan Vol. I and II
7. Practical Handbook of Bakery by US Wheat Associates



**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	04	08
2	08	16
3	22	46
4	08	18
5	06	12
<b>Total</b>	<b>48</b>	<b>100</b>

### **ENTREPRENEURIAL AWARENESS CAMP**

This is to be organized at a stretch for two to three days during fourth semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject

1. Who is an entrepreneur?
2. Need for entrepreneurship, entrepreneurial career and wage employment
3. Scenario of development of small scale industries in India
4. Entrepreneurial history in India, Indian values and entrepreneurship
5. Assistance from District Industries Centres, Commercial Banks, State Financial Corporations, Small industries Service Institutes, Research and Development Laboratories and other financial and development corporations
6. Considerations for product selection
7. Opportunities for business, service and industrial ventures
8. Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs)
9. Legal aspects of small business
10. Managerial aspects of small business

## INDUSTRIAL TRAINING

Industrial Training aims at exposing the students to field practices, size and scale of operation and work culture at practical sites. For this purpose, students at the end of fourth semester are required to be sent for a period of 4 weeks to industry.

Each student is supposed to study the material and technology used at site and prepares a detailed report of the observation of process seen by him/her. These students should be supervised and guided by respective subject teachers. Each teacher may guide a group of four to five students.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following.

a) Punctuality and regularity	15%
b) Initiative in learning new things	15%
c) Relationship with workers	15%
d) Industrial training report	55%

