

4.1 TECHNOLOGY OF MILK AND MILK PRODUCTS

L T P
4 - 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 (02 hrs)
2. Fluid Milk (12 hrs)
Definition of milk, composition, physical and chemical properties of milk constituents and 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, acidity and pH, viscosity, surface tension, thermal conductivity. Basis for pricing of milk
3. Quality control tests (06 hrs)
Platform tests like-smell, appearance, temp, sediment, acidity, lactometer reading
Chemical/Laboratory test: Acidity, PH, alcohol, fat, SNF, etc.
Microbiological: SPC, MBRT, Resazurin tests etc.
4. Fluid Milk Processing (08 hrs)
Receiving, Filtration and clarification, straining, standardization
Homogenization and its effects, Pasteurization: and various systems of Pasteurization; LTLT, HTST, UHT methods, Pasteurizers (Heating system, cooling system, flow controller, regenerator, flow division valve) sterilization, packaging of fluid milk
5. Coagulated Milk Products (06 hrs)
Channa, paneer, classification and manufacturing process of cheese
6. Cream/Butter/Ghee – Manufacture and storage of butter and ghee (06 hrs)
7. Condensed Milk (06 hrs)
Types and factors affecting the quality of condensed milk, storage of condensed milk

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| 8. | Dry Milk Products | (06 hrs) |
| | Methods of drying milk (Drum and Spray drying), factors affecting the quality of dry milk. Introduction to instant non-fat dry milk packaging of dry milk products | |
| 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 | (05 hrs) |

LIST OF PRACTICALS

1. To 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 familiarization with 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 channa and paneer
9. Preparation of ice cream
10. Visits to different dairy plants
11. To perform sampling of milk
12. Determination of titrable acidity of milk
13. Determination of fat by garber method
14. Analysis of milk with the help of electronic milk tester

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	02	03
2	12	18
3	06	10
4	08	12
5	06	10
6	06	10
7	06	10
8	06	10
9	03	05
10	04	06
11	05	06
Total	64	100

4.2 FRUITS AND VEGETABLES TECHNOLOGY

L T P
3 - 3

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 (03 hrs)
Status and scope of fruits and vegetables industry in India, classification, composition and nutritive value of fruits and vegetables
2. Preparatory Operations and Related Equipments (05 hrs)
Cleaning, sorting, grading, peeling and blanching methods
3. a) Ingredients and processes for the manufacture of: (08 hrs)
i) jam, jellies, marmalade, preserves, (ii) pickles and chutneys
b) Defects and factors affecting the quality of above
4. Tomato Products (04 hrs)
Ingredients and their role, process for the manufacture of tomato ketchup, sauce, puree and paste.
5. Juices (04 hrs)
Raw materials, extraction, classification, processing and aseptic packaging
6. Thermal Processing of Fruits and Vegetables (08 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 (04 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 | (04 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 FPO standards for fruits and vegetable products | (04 hrs) |
| 10. | By-products utilization | (04 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
Total	48	100

4.3 TECHNOLOGY OF MEAT, FISH AND POULTRY PRODUCTS

L T P
3 - 3

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 (02 hrs)
2. Preparatory operations of meat and meat products (18 hrs)

Composition of muscle, Different types of slaughtering methods, Different types of meatcuts, Antimortem and post-mortem inspection of animal/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 (06 hrs)

Inspection of poultry birds, dressing and preparation of ready to cook poultry, factors affecting the quality
4. Egg and Egg Products (06 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 (06 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. Frozen Storage of fresh and processed meat, poultry and fish (04 hrs)
7. By-products of meat, fish, poultry and egg industry (06 hrs)

LIST OF PRACTICALS

1. Demonstration of slaughtering and different cuts in meat at 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 hogg 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 filtering & staking 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	18	38
3	06	12
4	06	12
5	06	12
6	04	10
7	06	12
Total	48	100

4.4 FOOD FERMENTATION TECHNOLOGY

L T P
3 - 2

RATIONALE

This subject is developed with an objective to impart knowledge and skills related to process technologies and equipment used for the production of various fermented food products to the students

DETAILED CONTENTS

1. Introduction (03 hrs)
Definition, advantages of fermentation and nutritive value of fermented food products
2. Type of fermentation processes; different substrates for fermentation process; pure cultures and their maintenance procedures (06 hrs)
3. Fermentor (06 hrs)
Basic configuration, different parts – agitator/impellers, sparger, baffles, process control, functions
4. Technology of Fermented Products (12 hrs)
Production of distilled beverages (whiskey, primary, rum), wine, beer, vinegar and bakers yeast
5. Fermented Foods (12 hrs)
Production technology of curd, yogurt, idli, dosa, dhokla, srikhand, tempeh and miso, sauerkraut, butter milk, lassi, sausages
6. Single Cell Protein (09 hrs)
Sources, micro-organism, process, nutritive value and advantages and limitations; Concept of production of vitamins and amino acids

LIST OF PRACTICALS

1. Demonstration and study of fermenter and its functioning
2. Preparation of wine
3. Preparation of beer
4. Preparation of vinegar
5. Preparation of traditional fermented products Preparation of sauerkraut

6. Preparation of gingerale
7. To determine alcohol content in alcoholic beverages
8. Visit to beverages and distillery (whiskey, Brandy, Rum)

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 food beverage, 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. Industrial Microbiology by Prescott and Don, *CBS Publishers and distributors Pvt. Ltd, New Delhi*
2. Industrial Microbiology by Casida, *Publishers, Inc., New York ... by Lester Earl Casida*
3. Biotechnology: Food Fermentation by VK Joshi and Ashok Pandey, *AVI Publish co.,. Westport*
4. Biotechnology – Food Processing Application by SS Marwaha, *Asiatech Publishers Inc., New Delhi*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	03	06
2	06	12
3	06	12
4	12	26
5	12	26
6	09	18
Total	48	100

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 (08 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 (08 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 (08 hrs)

Selection, operation and periodical maintenance of equipments used in food industry viz. pasteurizer, autoclave, heat exchangers, evaporators, driers, boilers etc.
6. Psychrometry (04 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 lecturers 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, foodhead *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
Total	48	100

4.6 BAKERY AND CONFECTIONERY TECHNOLOGY

L T P
2 - 3

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 (02 hrs)
2. Raw Materials for Bakery Products (05 hrs)
Flour, sugar, shortening, yeast, salt and leavening agents as raw material for bakery products, their role and PFA specifications of these raw materials
3. Manufacturing of Bakery Products (15 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, muffins, pizza and kulcha

Types of additives used in bakery products
4. Confectionery Products (05 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 confectionary
5. Layout, setting up of units and hygienic conditions required in bakery plant, operation and maintenance of bakery equipment (05 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) Pizza
 - f) Candy like ginger
 - g) Kulcha
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

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	06
2	05	16
3	15	46
4	05	16
5	05	16
Total	32	100

INDUSTRIAL TRAINING OF STUDENTS

(during summer vacation after IV Semester)

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of a minimum of 6 weeks duration to be organised during the semester break starting after second year i.e. after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An internal assessment of 50 and external assessment of 50 marks have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behaviour, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry.

Teachers and students are requested to see the footnote below the study and evaluation scheme of IV Semester for further details.