6.1 FOOD PACKAGING TECHNOLOGY

L	T	P
3	–	4

RATIONALE

The main objective of this subject is to impart knowledge and skills related to designing packaging system in food products and developing skills in handling of packaging equipment in the students

DETAILED CONTENTS

1. Introduction (2 hrs)

   Definition, importance and scope of packaging of foods

2. Packaging Materials (10 hrs)

   Origin of packaging materials, types, properties, advantages & disadvantages of packaging materials

3. Types of packaging (8 hrs)

   Forms of packaging – box, bottle, tetra, pouch, shrink, vacuum, gas, CAP, MAP, aseptic etc.

4. Brief Introduction to (4 hrs)

   WVTR, GTR, bursting strength, tensile strength, tearing strength, drop test, puncture test, impact test etc.

5. Packaging Requirements (16 hrs)

   Packaging requirements and their selection for raw and processed foods
   5.1 Meat, fish, poultry, eggs
   5.2 Milk and dairy products
   5.3 Fruits and vegetables
   5.4 Cereal grains and baked food products
   5.5 Beverages
   5.6 Snacks

6. Packaging Machinery (6 hrs)

   Bottling, can former, form fill and seal machines, bags – their manufacturing and closing, vacuum packs unit, shrink pack unit, tetra pack unit

7. Package labeling – functions and regulations (2 hrs)

LIST OF PRACTICALS

1. Identification of different types of packaging and packaging materials
2. Determination of tensile strength of given material
3. To perform different destructive tests for glass containers
4. To perform non-destructive tests for glass containers such as physical examination
5. Determination of wax weight
6. Determination of tearing strength of paper
7. Measurement of thickness of packaging materials
8. To perform grease-resistance test in plastic pouches
9. Determination of bursting strength of packaging material
10. Determination of water-vapour transmission rate for paper
11. Demonstration of can-seaming operation
12. Testing of chemical resistance of packaging materials
13. Determination of drop test of food package
14. Visit to relevant industries
15. Introducing the students with the latest trends in packaging consulting the web sites and magzines

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 packing technology, 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. Handbook of Packaging by Paine and Paine; Morgan-Grampian *Publishing* Co., New York (1976).

2. Manual of Analyzing for Fruits and Vegetables Products by S Ranganna; CBS *Publishers* & Disttributor, New Delhi.

Note: Wherever the necessary equipment is not available the students may demonstrated That topic in relevant industry or in any other institute

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	04
2	10	20
3	08	16
4	04	10
5	16	34
6	06	12
7	02	04
Total	**48**	**100**

6.2 FOOD ANALYSIS AND QUALITY CONTROL

L T P
4 – 4

RATIONALE

In the production of processed foods, one of the important aspects is to assure quality. This subject is introduced in the curriculum to impart knowledge and skills in the students related to various food quality parameters/systems, techniques of food analysis, food laws and standards

DETAILED CONTENTS

1. Introduction (14 hrs)
   1.1. Principle behind different methods of proximate analysis of:
      1.1.1. Moisture
      1.1.2. Ash
      1.1.3. Crude Fat
      1.1.4. Crude Protein
      1.1.5. Crude Fibre
      1.1.6. Total Carbohydrates
   1.2. Concept, objectives and need of
      1.2.1. quality,
      1.2.2. quality control and
      1.2.3. quality assurance
      1.2.4. TQM (Total Quality Management) and
      1.2.5. TQC (Total Quality Control),
      1.2.6. plan and methods of quality control
2. Sampling (6 hrs)
   2.1. Definition of sampling,
   2.2. purpose,
   2.3. sampling techniques requirements and
   2.4. sampling procedures for
      2.4.1. liquid,
      2.4.2. powdered and
      2.4.3. granular materials
3. Physicochemical and mechanical properties (10 hrs)
   3.1. Colour,
   3.2. gloss,
   3.3. flavour,
   3.4. consistency,
   3.5. viscosity,
   3.6. texture and their relationship with food quality
4. Sensory quality control (12 hrs)
   4.1. Definition,
   4.2. objectives,
   4.3. panel selection and their training,
   4.4. subjective and objective methods,

4.5. interpretation of sensory results in statistical quality control,
4.6. consumer preferences and acceptance

5. Food Laws and Regulations in India (8 hrs)
   5.1. Objectives,
   5.2. requirements and
   5.3. benefits of food grades and
   5.4. Agencies and standards
      5.4.1. BIS (Bureau of Indian Standards),
      5.4.2. AGMARK (Agricultural Marketing Board),
      5.4.3. PFA (Prevention of Food Adulteration Act),
      5.4.4. FSSA (Food Safety and Standards Act),
      5.4.5. FPO (Fruit Products Order),
      5.4.6. MoFPI (Ministry of Food Processing Industries)
      5.4.7. ISO (International Organisation for Standardisation)- Objectives and principles
      5.4.8. CAC (Codex Alimantarious Commission)
6. General Hygiene and Sanitation in food industry (10 hrs)
   Concepts of:
   6.1. GMP (Good Manufacturing Practices),
   6.2. GHP (Good Hygienic Practices),
   6.3. GLP (Good Laboratory Practices)
   6.4. HACCP (Hazard analysis and critical control point)
7. Layout of quality evaluation and control laboratories (4 hrs)

LIST OF PRACTICALS

1. Proximate analysis of marketed food products
   1.1. Moisture
   1.2. Ash
   1.3. Crude Fat
   1.4. Crude Protein
   1.5. Crude Fibre
   1.6. Total Carbohydrates
2. Detection of adulterants/ non-permitted food additives in food products viz.
   2.1. milk,
   2.2. ghee,
   2.3. honey,
   2.4. spices,
   2.5. pulses,
   2.6. oils,
   2.7. sweets, etc.
3. Test of sensory evaluation
   3.1. Hedonic scale
   3.2. Duo-trio test
   3.3. Ranking difference
   3.4. Triangle test

4. Detection of basic tastes and their threshold values
5. Consumer acceptability trial
6. Statistical analysis of sensory data
7. Visits to the quality control laboratories of the food industry, educational institutions and testing centres

INSTRUCTIONAL STRATEGY

This being one of the most important subjects, 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 evaluation and quality control 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.

LIST OF RECOMMENDED BOOKS

1. Food Analysis by Suzzane Nielsen
2. ISI Handbook of Food Analysis- (18 Volumes in 5 parts)- BIS
3. AOAC- 18th Edition- (CD ROM Edition)
4. Hand Book of Analysis of Fruits and Vegetables by S Ranganna (THM)
5. Food Analysis Theory and Practices by Pomeranz and Meloan (AVI)
6. Quality Control for the Food Industry (Vol. I and II) by Kramer and Twigg (AVI)
7. Laboratory Methods of Sensory Evaluation by Larmond
8. Sensory Analysis by Piggot
9. Hand Book of Food Analysis by S.N. Mahindru
10. The Chemical Analysis of Food and Food Products by Jacobs
11. A First Course in Food Analysis by A.K. Sathe

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	14	20
2	06	10
3	10	15
4	12	20
5	08	15
6	10	15
7	04	05
Total	**64**	**100**

6.3 WASTE MANAGEMENT IN FOOD INDUSTRY

L	T	P
3	–	4

RATIONALE

This subject is aimed at developing an understanding among the students on Management of agro-processing waste, by-product utilization as food/feed and environmental protection.

DETAILED CONTENTS

1. Introduction (4 hrs)

   Types of waste and magnitude of waste generation in different food processing industries; concept scope and maintenance of waste management and effluent treatment

2. Waste Characterization (12 hrs)

   Temperature, pH, Oxygen demands (BOD, COD, TOD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues

3. Environmental protection act and specifications for effluent of different food industries (6 hrs)

4. By-products and Waste utilization (8 hrs)

5. Effluent Treatment (12 hrs)

   5.1 Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation
   5.2 Secondary treatments: Biological oxidation – trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons

   5.3 Tertiary treatments: Advanced waste water treatment process-sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal

6. Assessment, treatment and disposal of solid waste; concept of vermin-composting and biogas generation (6 hrs)

LIST OF PRACTICALS

1. Waste characterization: (a) temperature (b) pH (c) solids content (d) turbidity (e) BOD (f) COD

2. Visit to effluent treatment plant attached with food industry and city

3. To estimate residual chlorine

4. Evaluation effect of lime treatment on waste water in respects of BOD, COD, solids content, phosphate content

5. Visits to various industries using waste and food by-products

6. Visit to Biogas plant and vermin-culture centre

INSTRUCTIONAL STRATEGY

Pollution control and waste utilization are important in food technology. Teacher should design suitable tutorial exercises for the students. Experts may be invited to deliver lectures on various themes. Students may be taken to some effluent treatment plant and industries engaged in requirements-cycling and utilization of wastes. Students may be given sufficient exposure to various national and international standards for quality parameters required for safe disposal of waste.

RECOMMENDED BOOKS

1. Food Processing Work Management by Green and Krammer; CBS Publication

2. Principles of Food Sanitation by Mariett NG; CBS Publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	04	08
2	12	24
3	06	12
4	08	16
5	12	26
6	06	14
Total	**48**	**100**

6.4 BASICS OF MANAGEMENT

L	T	P
3	-	-

RATIONALE

The diploma holders are generally expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Topics like Structure of Organization, Leadership, Motivation, Ethics and Values, Customer Relationship Management (CRM), Legal Aspects of Business, Total Quality Management (TQM), Intellectual Property Rights (IPR) etc. have been included in the subject to provide elementary knowledge about these management areas.

DETAILED CONTENTS

1. Principles of Management (06 hrs)

   1.1. Introduction, definition and importance of management.

   1.2. Functions of Management

   Planning, Organizing, Staffing, Coordinating, Directing, Motivating and Controlling

   1.3. Concept and Structure of an organization

   Types of industrial organization
   a) Line organization
   b) Functional organization
   c) Line and Functional organization

   1.4. Hierarchical Management Structure

   Top, middle and lower level management

   1.5. Departmentalization

   Introduction and its advantages.

2. Work Culture (06 hrs)

   2.1. Introduction and importance of Healthy Work Culture in organization

   2.2. Components of Culture

   2.3. Importance of attitude, values and behaviour

   Behavioural Science – Individual and group behaviour

   2.4. Professional ethics – Concept and need of Professional Ethics

3. Leadership and Motivation (06 hrs)

3.1. Leadership

a) Definition and Need of Leadership
b) Qualities of a good leader
c) Manager vs. leader

3.2. Motivation

a) Definition and characteristics of motivation
b) Factors affecting motivation
c) Maslow's Need Hierarchy Theory of Motivation

3.3. Job Satisfaction

4. Legal Aspects of Business: Introduction and need (06 hrs)

4.1. Labour Welfare Schemes

a) Wage payment : Definition and types
b) Incentives: Definition, need and types

4.2. Factory Act 1948

4.3. Minimum Wages Act 1948

5. Management Scope in different Areas (12 hrs)

5.1. Human Resource Development

a) Introduction and objective
b) Manpower Planning, recruitment and selection
c) Performance appraisal methods

5.2. Material and Store Management

a) Introduction, functions and objectives of material management
b) Purchasing: definition and procedure
c) Just in time (JIT)

5.3. Marketing and Sales

a) Introduction, importance and its functions
b) Difference between marketing and selling
c) Advertisement- print media and electronic media
d) Market-Survey and Sales promotion.

5.4. Financial Management – Introduction

a) Concept of NPV, IRR, Cost-benefit analysis

b) Elementary knowledge of Income Tax, Sale Tax, Excise duty, Custom duty, Provident Fund

5.5 Maintenance Management

a) Concept
b) Preventive Maintenance

6. Miscellaneous topics (12 hrs)

6.1. Customer Relationship Management (CRM)

a) Definition and Need
b) Types of CRM
c) Customer satisfaction

6.2. Total Quality Management (TQM)

a) Inspection and Quality Control
b) Concept of Quality Assurance
c) TQM

6.3. Intellectual Property Rights (IPR)

a) Introduction, definition and its importance
b) Infringements related to patents, copyright, trade mark

INSTRUCTIONAL STRATEGY

It is observed that the diploma holders generally take up middle level managerial positions, therefore, their exposure to basic management principles is very essential. Accordingly students may be given conceptual understanding of different functions related to management. Some of the topics may be taught using question answer, assignment or seminar method. The teacher will discuss success stories and case studies with students, which in turn, will develop appropriate managerial qualities in the students. In addition, expert lectures may also be arranged from within the institutions or from management organizations. Appropriate extracted reading material and handouts may be provided.

RECOMMENDED BOOKS

1. Principles of Management by Philip Kotler TEE Publication
2. Principles and Practice of Management by Shyamal Bannerjee: Oxford and IBM Publishing Co, New Delhi.
3. Financial Management by MY Khan and PK Jain, Tata McGraw Hill Publishing Co., 7, West Patel Nagar , New Delhi.
4. Modern Management Techniques by SL Goel: Deep and Deep Publications Pvt Limited , Rajouri Garden, New Delhi.
5. Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr. : Prentice Hall of India Pvt Ltd, New Delhi.
6. Essentials of Management by H Koontz, C O' Daniel , McGraw Hill Book Company, New Delhi.
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi
8. Total Quality Management by DD Sharma, Sultan Chand and Sons, New Delhi.
9. Intellectual Property Rights and the Law by Dr. GB Reddy.
10. Service Quality Standards, Sales & Marketing Department, Maruti Udyog Ltd.
11. Customer Relationship Management: A step-by-step approach, Mohamed & Sagadevan Oscar Publication, Delhi
12. Customer Relation Management, Sugandhi RK, Oscar Publication, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (hrs)**	**Marks Allotted (%)**
1.	06	15
2.	06	10
3.	06	15
4.	06	10
5.	12	25
6.	12	25
Total	**48**	**100**

6.5 PROJECT WORK

L	T	P
-	–	12

Towards the end of third year, after completion of course work, the students should be sent to food processing and preservation industries for project work. The objectives of the project work are:

1. To develop understanding of various field activities in which students are going to play a role as food technologists after completing diploma programme

2. To Develop understanding of subject based knowledge given in the class room in the context of its application at work places

3. To gain first hand experience and confidence amongst the students to enable them to use and apply knowledge and skills to solve practical problems in the field

4. Development of special skills and abilities like interpersonal skills communication skills, attitudes and values

For the fulfillment of above objectives, polytechnic(s) offering diploma course in food technology may establish close linkages with 8 – 10 food processing and preservation industries/organizations. The industries/organizations may be contacted by the teachers and students for project oriented and professional training of students during third year. The practical industrial training has to be well planned, structured and supervised by polytechnic teachers clearly specifying complete schedule of the students on day to day basis for whole of their training period. Proforma may be prepared by polytechnics related to the concerned industries to access daily, weekly and monthly progress of the students and the students must be asked to fill these proformas regularly duly signed by them and countersigned by personnel from industry and concerned teacher attached to a particular student. Each teacher is suppose to supervise and guide 4 to 6 students. Following schedule, as a sample, is proposed for the training

Familiarization and Training about Various Food Processing Operations

Students should be familiarized with various materials, principles and operations involved in processing of different types of food used for different purposes

Specific Task

Students should be given specific task related to following:

- Complete flow chart and plant layout for food-processing unit
- Preparation and preservation of food products, including raw material identification, testing and processing

- Hygiene and sanitation for a food processing and preservation unit

- Fault diagnosis and rectification

Problem-Solving Work Site

After undergoing above two phases of vigorous practical project orientation professional training, students may be given practical problems, which are of interest to industry where he/she is taking practical training. The problem should be identified and guided by the personnel from industry in collaboration with teacher and the solutions suggested by the students may be tried

Note: **Students are supposed to prepare detailed notes of each of above phases of training and write complete report of the whole of practical industrial training which shall be used for the learning and evaluation purposes**

***Assessment Criteria**

Students may be assessed by the external (personnel from industry) and internal (teacher) examiners based on the criteria given in Table 1 below:

Sr. No.	Performance Criteria Items	** Max. Marks	Rating Scale				
			Excellent	Very Good	Good	Fair	Poor
1.	Punctuality and Regularity	10	10	8	6	4	2
2.	Initiative in Learning/ Working at site	10	10	8	6	4	2
3.	Level/proficiency of practical problems	20	20	16	12	8	4
4.	Ability to solve live practical problems	20	20	16	12	8	4
5.	Sense of Responsibility	10	10	8	6	4	2
6.	Self Expression/ Communication Skills	5	5	4	3	2	1
7.	Interpersonal skills/human Relations	5	5	4	3	2	1
8.	Report Writing Skills	10	10	8	6	4	2
9.	Viva Voce/Presentation	10	10	8	6	4	2
Total		**100**	**100**	**80**	**64**	**40**	**20**

The overall grading of the practical training shall be made as per following:

Range of maximum Marks	Overall Grade
More than 80	Excellent
79 < > 60	Very Good
59 < > 40	Good
39 < > 20	Fair
Less than 20	Poor

In order to qualify for the diploma students must get “overall good” grade failing which the students may be given just one more chance of undergoing project oriented professional training in the same industry before being disqualified from the diploma and declared “not eligible to receive diploma in food technology”. It is also important to note that the students must get more than six “goods or above good” grades, in different performance criteria items, in order to get “Overall Good” grade

* The criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks and following the criteria

** The criteria for evaluation of the students have been worked out for 100 maximum marks. The internal and external examiners shall use multiple (1 and 2) of marks original to internal (100 marks) and external (200 marks) respectively to evaluate the students and shall further overall grade them excellent, very good, good, fair or poor

RECOMMENDED BOOKS

1. Food Preservation by SK Kulshrestta, Vikas Publishing House, New Delhi
2. Fundamentals of Food and Nutrition by Sumati R. Mudambi & MV Rajagolap, New Age International Pvt. Ltd. New Delhi
3. Food Processing and Preservation by Bibliography Sivasankar, Prentice Hall of India Pvt. Ltd., New Delhi
4. Managing Food Processing Industries in India by U.K. Srivastva

5. Hand Book of Entrepreneurship by B.S. Rathore
6. Microbiological Safety of Processed Foods by Crowther
7. Food Poisoning & Food Hygiene by Hobbs
8. Drying & Storage of Grains & Oilseeds by Brodoker
9. Fundamentals of Food Process Engg. By Toledo
10. Chocolate, Cocoa & Confectionery by Minifie
11. Safe Food Handling by M. Jacob
12. Food & Beverage Service by Andrews
13. The Science of Cookie & Cracker Production by Faridi
14. Snack Foodby Booth
15. Food Additives by Mahindru
16. Dough Rheology & Baked Product Texture by Faridi