

**Model Curriculum for**  
**B.Voc/ D.Voc**  
**in**  
**Food Processing**



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**Nelson Mandela Marg, New Delhi**

## 1. Introduction

All India Council for Technical Education (AICTE) Ministry of HRD, Government of India has introduced Entrepreneurship oriented Skill development courses of B.Voc/D.Voc/Skill Diploma. These courses will be run by AICTE approved institutes by using available infrastructure and facilities. In these courses the institute will conduct general education content and sector specific skills will be imparted by Skill Knowledge Providers/ Training Providers/ Industries.

### 1.1 Key Features:

#### Objectives

- To provide judicious mix of skills relating to a profession and appropriate content of General Education.
- To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.
- To provide flexibility to the students by means of pre-defined entry and multiple exit points.
- To integrate NSQF within the Diploma, undergraduate level of higher education to enhance employability of the students and meet industry requirements. Such student apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.
- To provide vertical mobility to students admitted in such vocational courses.
- The certification levels will lead to Diploma/Advanced Diploma/B. Voc. Degree in Food Processing and will be offered by respective affiliating University/Board of Technical Education.
- Students may be awarded Level Certificate/Diploma/Advance Diploma /Degree as out-lined in the Table below:

Award	Duration after class X	Corresponding NSQF level
Level 3 Certificate	1 Year	3
Level 4 Certificate	2 Years	4
Diploma	3 Year	5
Advance Diploma	4 Years	6
B.Voc Degree	5 Years	7

## 2. Course Objectives

After successfully completing the vocational course, the student would have acquired relevant appropriate and adequate technical knowledge together with the professional skills and competencies in the field of Food Processing so that he/she is properly equipped to take up gainful employment in this Vocation. Thus he/she should have acquired: -

### A. Understanding of

- (a) The relevant basic concepts and principles in basic science subjects (Physics, Chemistry and Mathematics) so that he/she is able to understand the different vocational subjects.
- (b) The basic concepts in IT.
- (c) The concepts, principles of working of Food Industry.
- (d) The procedure of making Quality Control Standards.
- (e) The concepts and principles used in Plant and Sanitation Equipments.

### **B. Adequate Professional Skills and Competencies in**

- (a) Knowledge of Food Industrial Technologies.
- (b) Testing the performance of various equipment's and instruments.
- (c) Knowledge of component level and at the stage level.

### **C. A Healthy and Professional Attitude so that He/She has**

- (a) An analytical approach while working on a job.
- (b) An open mind while locating/rectifying faults.
- (c) Respect for working with his/her own hands.
- (d) Respect for honesty, punctuality and truthfulness

### **D. NSQF compliant skills in Qualification developed by sector skill council in Food Processing sector**

## **3. Course Structure**

The course will consist of combination of practice, theory and hands on skills in the Food Processing sector.

### **Curriculum**

The curriculum in each of the years of the programme would be a suitable mix of general education and skill components.

### **Skill Components:**

- The focus of skill components shall be to equip students with appropriate knowledge, practice and attitude, to become work ready. The skill components will be relevant to the industry as per its requirements.
- The curriculum will necessarily embed within itself, National Occupational Standards (NOSs) of specific job roles within the industry. This would enable the students to meet the learning outcomes specified in the NOSs.
- The overall design of the skill development component along with the job roles selected will be such that it leads to a comprehensive specialization in few domains.
- The curriculum will focus on work-readiness skills in each of the year of training.
- Adequate attention will be given in curriculum design to practical work, on the job training, development of student portfolios and project work.

### **General Education Component:**

- The general education component adhere to the normal senior secondary and university standards. It will emphasize and offer courses which provide holistic development. However, it will not exceed 40% of the total curriculum.
- Adequate emphasis is given to language and communication skills.

The curriculum is designed in a manner that at the end of each year after class Xth students can meet below mentioned level descriptors of NSQF:

Level	Process required	Professional Knowledge	Professional skill	Core skill	Responsibility
Level 3	Person may carry out a job which may require limited range of activities routine and predictable	Basic facts, process and principle applied in trade of employment	Recall and demonstrate practical skill, routine and repetitive in narrow range of application	Communication written and oral with minimum required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment	Under close supervision some responsibility for own work within defined limit
Level 4	Work in familiar, predictable, routine, situation of clear choice	Factual knowledge of field of knowledge or study	Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts	Language to communicate written or oral, with required clarity, skill to basic arithmetic and algebraic principles, basic understanding of social political and natural environment	Responsibility for own work and learning
Level 5	Job that requires well developed skill, with clear choice of procedures in familiar context	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools materials and information	Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication.	Responsibility for own work and learning and some responsibility for other's works and learning

Level 6	Demands wide range of specialized technical skill, clarity of knowledge and practice in broad range of activity involving standard/ non-standard practices	Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Reasonably good in mathematical calculation, understanding of social, political and reasonably good in data collecting organizing information, and logical communication	Responsibility for own work and learning and full responsibility for other's works and learning
Level 7	Requires a command of wide ranging specialized theoretical and practical skill, involving variable routine and non-routine context	Wide ranging, factual and theoretical knowledge in broad contexts within a field of work or study	Wide range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Good logical and mathematical skill understanding of social political and natural environment good in collecting and organizing information, communication and presentation skill	Full responsibility for output of group and development

## Curriculum Food Processing

Level	Code	Educational Component	Credit	Marks
3 Semester I	<b>Theory</b>			
	3.GE.01	Language - I	3	50
	3.GE.02	Applied Chemistry	3	50
	3.GE.03	Applied Physics	3	50
	3.GE.04	Applied Mathematics-I	3	50
	<b>Lab/Practical</b>			
	3.GP.01	Applied Chemistry Lab	1.5	50
	3.GP.02	Applied Physics Lab	1.5	50
	<b>On-Job-Training (OJT)/Qualification Packs</b>			
	Industrial Production Worker –FIC/Q9005		(Any one)	15
3 Semester II	<b>Theory</b>			
	3.GV.01	Introduction to Food Processing	3	50
	3.GV.02	Crop Production Technology	3	50
	3.GV.03	Milk Processing	3	50
	3.GV.04	Applied Mathematics - II	3	50
	<b>Lab/Practical</b>			
	3.VP.01	Food processing Lab	1.5	50
	3.VP.02	Milk processing Lab	1.5	50
	<b>On-Job-Training (OJT)/Qualification Packs</b>			
	Fruits and Vegetable Selection Incharge FIC/Q0108		(Any one)	15
Dairy Product Processor FIC/Q2001				
4 Semester I	<b>Theory</b>			
	4.GV.01	Food Process Technology-I	3	50
	4.GV.02	Milling of cereals	3	50
	4.GV.03	IT Tools-I	3	50
	4.GE.01	Language - II	3	50
	<b>Lab/Practical</b>			
	4.VP.01	Milling of cereals Lab	1.5	50
	4.VP.02	IT Tools-I Lab	1.5	50
	<b>On-Job-Training (OJT)/Qualification Packs</b>			
	Grain Mill Operator- FIC/Q1003		(Any one)	15
Squash and Juice Processing Technician FIC/Q 0101				
Pickle Making Technician FIC/Q0102				
4	<b>Theory</b>			
	4.GV.04	IT Tools-II	3	50

Level	Code	Educational Component	Credit	Marks	
Semester II	4.GV.05	Food Process Technology-II	3	50	
	4.GV.06	Food safety and hygiene (1.5 TISS)	3	50	
	4.GV.07	Milling of pulses and oil seeds	3	50	
	<b>Lab/Practical</b>				
	4.VP.03	Milling of pulses and oil seeds Lab	1.5	50	
	4.VP.04	Food Process technology-II Lab	1.5	50	
	<b>On-Job-Training (OJT)/Qualification Packs</b>				
	Jam, Jelly and Ketchup Processing FIC/Q0103		(Any one)	15	200
	Milling Technician FIC/Q1002				
Pulse Processing Technician FIC/Q1004					
5 Semester I	<b>Theory</b>				
	5.GV.01	Food Quality Analysis	3	50	
	5.GV.02	Food Refrigeration and Supply Chain	3	50	
	5.GV.03	Food Plant Sanitation	3	50	
	5.GV.04	Food Plant Equipment's	3	50	
	<b>Lab/Practical</b>				
	5.VP.01	Food Quality Analysis Lab	1.5	50	
	5.VP.02	Food Refrigeration and Supply Chain Lab	1.5	50	
	<b>On-Job-Training (OJT)/Qualification Packs</b>				
	Assistant Lab Technician FIC/Q7601		(Any one)	15	200
	Cold Storage Technician FIC/Q7004				
	Plant Biscuit Production Specialist FIC /Q5003				
5 Semester II	<b>Theory</b>				
	5.GV.05	Entrepreneurship Development	3	50	
	5.GV.06	Bakery , Confectionery and snack products	3	50	
	5.GV.07	Food Packaging Technology	3	50	
	5.GV.08	Processing of Meat and Poultry Products	3	50	
	<b>Lab/Practical</b>				
	5.VP.03	Bakery , Confectionery and snack products-Lab	1.5	50	
	5.VP.04	Food Packaging Technology-Lab	1.5	50	
	<b>On-Job-Training (OJT)/Qualification Packs</b>				
	Baking Technician FIC/Q5005		(Any one)	15	200
Packing Machine Worker FIC/Q7002					

Level	Code	Educational Component	Credit	Marks
		Food Products Packaging Technician FIC/Q7001		
<b>6</b> <b>Semester I</b>	<b>Theory</b>			
	6.GV.01	Food Process Technology-III	3	50
	6.GV.02	Energy conservation and management	3	50
	6.GV.03	Sensory Evaluation of Food	3	50
	6.GV.04	Food Plant Layout	3	50
	<b>Lab/Practical</b>			
	6.VP.01	Food Processing Technology and Sensory Evaluation – Lab	1.5	50
	6.VP.02	Food Plant Layout- Lab	1.5	50
	<b>On-Job-Training (OJT)/Qualification Packs</b>			
		Fruits and Vegetable Canning Technician FIC/Q0107	(Any one)	15
	Fruit Pulp Processing Technician FIC/Q 0106			
	Fruits and Vegetable Drying/Dehydration FIC/Q0105			
<b>6</b> <b>Semester II</b>	<b>Theory</b>			
	6.GV.05	Fish and Poultry Processing	3	50
	6.GV.06	By Product Utilization	3	50
	6.GV.07	Marketing Management and Trade	3	50
	6.GV.08	Instrumentation and Process Control	3	50
	<b>Lab/Practical</b>			
	6.VP.03	Fish and Poultry Processing –Lab	1.5	50
	6.VP.04	By product Utilization-Lab	1.5	50
	<b>On-Job-Training (OJT)/Qualification Packs</b>			
		Fish and Sea Food Processing Technician FIC/Q4001	Any one)	15
	Purchase Assistant Food and Agriculture FIC/Q7005			
<b>7</b> <b>Semester I</b>	<b>Theory</b>			
	7.GV.01	Ice cream and Frozen Desserts	3	50
	7.GV.02	Traditional Indian Dairy Products	3	50
	7.GV.03	Food Quality, Safety and Certification	3	50
	7.GV.04	Financial Management and Cost Accounting	3	50
	<b>Lab/Practical</b>			
	7.VP.01	Ice cream and Frozen Desserts –Lab	1.5	50
7.VP.02	Traditional Indian Dairy Products –Lab	1.5	50	



Level	Code	Educational Component	Credit	Marks	
	<b>On-Job-Training (OJT)/Qualification Packs</b>				
		Ice Cream Technician FIC/Q2004	(Any one)	15	200
		Traditional Snack and savoury Maker FIC/Q8501			
		Butter and Ghee Processing Operator FIC Q/2003			
<b>7</b>  <b>Semester II</b>	<b>Theory</b>				
	7.GV.05	Project Preparation and Management	3	100	
	<b>Lab/Practical</b>				
	7.GV.06	Project Work	12	200	
	<b>On-Job-Training (OJT)/Qualification Packs</b>				
		Production Manager FIC Q/9003	(Any one)	15	200
		Processed Food Entrepreneur FIC/Q9001			
		Multi Skill Technician FIC/Q9007			

## **Detailed Curriculum**

### **Level 3 (Semester I)**

#### **(3.GE.01) Language - I**

#### **Module 1: Reading comprehension (prescribed texts) and functional grammar**

A variety of genres – short stories, expository pieces, biographies, poems, plays, newspaper and magazine excerpts have been included. Teaching of grammar has been integrated with the reading texts. The emphasis is on functional grammar.

The following ten prose texts and five poems have been selected for development of different reading skills.

#### **Prose texts (Prescribed)**

1. A warmer or a colder earth (popular science) Arthur – C. Clark
2. The tiger in the tunnel (narrative) – Ruskin Bond.
3. First two or four pages from Sunny Days (autobiographical) – By Sunil Gavaskar
4. Case of suspension (narrative)
5. Big brother (narrative) Shekhar Joshi
6. Father, dear father (news paper article form the Hindu)
7. Face to face (autobiographical) Ved Mehta
8. I must know the truth (narrative) Sigrun Srivastva
9. If I were you (play) Douglas James
10. India, her past and her future (speech) Jawahar Lal Nehru

#### **Poems**

1. Leisure – WH Davis
2. The road not taken – Robert Frost
3. Where the mind is without fear- Tagore
4. My grandmother's house – Kamla Das
5. The night of the scorpion – Nissi, Ezekiel

#### **Non prescribed**

In this section learners will be exposed to newspaper, articles, tables, diagrams, advertisements etc. which they have to read carefully and interpret. In the examination similar pieces will be used.

#### **Grammar and usage:**

The following points of grammar and usage have been selected from the reading passages.

1. agreement/concord: number – gender etc.
2. Tenses: simple past (negatives/interrogatives) present perfect, past perfect continuous, past perfect, expressing future time (will and going to)
3. Passive voice (perfect tenses and modals)
4. Modals (must, should ought to, would)
5. Linking words (to like because although, instead of, if, as, since, who, which that, when however, inspite of)
6. Reported speech, statements, questions (yes/no)

## **Module 2: Functional writing and study skills**

This module help the learner to write descriptive and narrative paragraph, letters, reports notices etc. and also practice skills of note making

1. Paragraph writing
  - Describing objects
  - Describing people
  - Narrating events, stories
2. Letter writing
  - Application for leave
  - Application for jobs
  - Asking for information form various agencies (e.g. Last date for getting prospects; price of items before placing doers etc.)
3. Note making
4. Ending (punctuation, spelling, appropriate vocabulary, structures)

### **(3.GE.02) Applied Chemistry**

#### **1. Structure of Atom:**

Rutherford model of the structure of atom, Bohr's theory of electrons, quantum numbers and their significance, de-Broglie equation and uncertainty principle, electronic configuration of 1 to 30 elements.

#### **2. Periodic Properties of Elements:**

Periodic law, periodic table, periodicity in properties like atomic radii and volume, ionic radii, ionization energy and electron affinity. Division of elements into s, p, d and f blocks.

#### **3. Chemical Bonds:**

Electrovalent, covalent and coordinate bond and their properties. Metallic bonding (electron cloud mode) and properties (like texture, conductance, luster, ductility and malleability).

#### **4. Fuel and their Classification:**

Definition, characteristics, classification into solid, liquid and gaseous fuel. Petroleum and brief idea of refining into various factions and their characteristics and uses. Calorific value of fuel, Gaseous fuels- preparation, properties, composition and use of producer gas, water and oil gas.

#### **5. Water:**

Impurities in water, methods of their removal, hardness of water, its types, causes and removal, disadvantages of hard water in boilers, pH value and its determination by calorimetric method.

#### **6. Corrosion:**

Its meaning, theory of corrosion, prevention of corrosion by various methods using metallic and non-metallic coatings.

#### **7. Plastic and Polymers:**

Plastic-thermo-plastic and thermo-setting. Introduction of Polythene. P.V.C. Nylon, synthetic rubber and phenol-formal-dehyde resin, their application in industry.

### **(3.GE.03) Applied Physics**

1. **Units & Dimensions:** M.K.S. fundamentals & derived units, S.I. base units supplementary units and derived units, Dimensions of various physical quantities, uses of dimensional analysis.
2. **Surface Tension and Viscosity:** molecular forces, molecular theory of surface tension, surface energy, capillary action, concept of viscosity, coefficient of viscosity, principle and construction of viscometers.
3. **Vibrations:** Vibration as simple spring mass system, elementary and qualitative concept of free and forced vibrations, resonance. Effects of vibrations on building bridges and machines members.
4. **Heat:** Temperature and its measurement, thermoelectric, platinum resistance thermometers and pyrometers. Conduction through compound media and laws of radiations.
5. **Ultrasonics:** Productions of ultrasonic waves by magnetostriction and piezo-electric effect, application of ultrasonics in industry.
6. **Optics:** Nature of light, reflection and refraction of a wave from a plane surface. Overhead projector and Epidiascope.

### **(3.GE.04) Applied Mathematics - I**

#### **Sets, Relations and Functions**

1. Sets
2. Relations and Functions-I
3. Trigonometric Functions-I
4. Trigonometric Functions-II
5. Relation between Sides and Angles of A triangle

#### **Sequences and Series**

1. Sequences and Series
2. Some Special Sequences

#### **Algebra-I**

1. Complex Numbers
2. Quadratic Equations and Linear inequalities
3. Principle of Mathematical Induction
4. Permutations and Combinations
5. Binomial Theorem

#### **Co-ordinate Geometry**

1. Cartesian System of Rectangular Co-ordinates
2. Straight Lines
3. Circles
4. Conic Sections

**Statistics and Probability**

1. Measures of Dispersion
2. Random Experiments and Events
3. Probability

**(3.GP.01) Applied Chemistry - Lab**

1. Proximate analysis of solid fuel.
2. Experiments based on Bomb Calorimeter.
3. Determination of turbidity in a given sample.
4. To determine the flash and fire point of a given lubricating oil.
5. To determine the viscosity of a given lubricating oil by Redwood viscometer.
6. To determine cloud and pour point of a given oil.

**(3.GP.02) Applied Physics - Lab**

1. To determine the surface tension of a liquid by rise in capillary.
2. To determine the viscosity of a given liquid.
3. To determine the frequency of tuning fork using a sonometer.
4. To determine the frequency of AC main using sonometer.
5. Time period of a cantilever.

### Level 3 (Semester II)

#### **(3.GV.01) Introduction to Food Processing**

Sources, types and perishability of foods; Causes and types of food spoilage; Scope and benefit of food preservation; Methods of food preservation; Preservation by salt and sugar: Principle, method and effect on food quality. Preservation by heat treatment: Principle and equipment for blanching, canning, pasteurization, sterilization; Preservation by use of low temperature: Principle, methods, equipment; Preservation by drying, dehydration and concentration: Principle, methods, equipment; Preservation by irradiation: Principle, methods, equipment; Preservation by chemicals-antioxidants, mould inhibitors, antibodies, acidulants, etc.; Preservation by fermentation: Principles, methods, equipment; Non-thermal preservation processes: Principles, equipment – Pulsed electric field and pulsed intense light, ultrasound, dielectric heating, ohmic and infrared heating, high pressure processing, microwave processing, etc.; Quality tests and shelf-life of preserved foods.

#### **(3.GV.02) Crop Production Technology**

Classification of crops; Effect of different weather parameters on crop growth and development; Principles of tillage; Soil-water-plant relationship, crop rotation, cropping systems, relay cropping and mixed cropping; Crop production technology for major cereal crops; Major varieties, sowing time, method of sowing, spacing, interculturing, fertilizer and water requirement, time of harvest, maturity index, yield potential, cost of cultivation, income from production, etc.; Crop production technology for major oilseed crops; Major varieties, sowing time, method of sowing, spacing, inter-culturing, fertilizer and water requirement, time of harvest, maturity index, yield potential, cost of cultivation, income from production, etc.; Crop production technology for major pulse crops; Major varieties, sowing time, method of sowing, spacing, inter-culturing, fertilizer and water requirement, time of harvest, maturity index, yield potential, cost of cultivation, income from production, etc.; Crop production technology for major spices and cash crops; Major varieties, sowing time, method of sowing, spacing, inter-culturing, fertilizer and water requirement, time of harvest, maturity index, yield potential, cost of cultivation, income from production, etc.; Crop production technology for major vegetable crops; Major varieties, sowing time, method of sowing, spacing, interculturing, fertilizer and water requirement, time of harvest, maturity index, yield potential, cost of cultivation, income from production, etc.

#### **(3.GV.03) Milk Processing**

Composition and nutritive value of milk and factors effecting composition of milk; Physiochemical properties of milk; Determination of microbial load in milk and milk products; Milk Processing: Collection, chilling, standardization, pasteurization and homogenization; Toxins and pesticide residues in milk and milk products; Organic milk food products; Bureau of Indian Standards for milk and milk products; Sanitation in milk plant.

#### **(3.GV.04) Applied Mathematics – II**

##### **Algebra-II**

1. Matrices
2. Determinants
3. Inverse of a Matrix and its Applications

##### **Relations and Functions**

1. Relations and Functions-II
2. Inverse Trigonometric Functions

##### **Calculus**

1. Limits and Continuity

2. Differentiation
3. Differentiation of Trigonometric functions
4. Differentiation of Exponential and Logarithmic functions
5. Application of Derivatives
6. Integration
7. Definite Integrals
8. Differential Equations

### **Vectors and Three Dimensional Geometry**

1. Introduction to Three Dimensional Geometry
2. Vectors
3. Plane
4. Straight Line

### **Linear Programming and Mathematical Reasoning**

1. Linear Programming
2. Mathematical Reasoning

#### **(3.VP.01) Food Processing Lab**

Demonstration of various perishable food items and degree of spoilage; Blanching of selected food items; Preservation of food by heat treatment- pasteurization; Preservation of food by high 406 Report of the ICAR Fifth Deans' Committee concentration of sugar: Jam; Preservation of food by using salt: Pickle; Preservation of food by using acidulants i.e. pickling by acid, vinegar or acetic acid; Preservation of food by using chemical preservatives; Preservation of bread, cake using mold inhibitors; Drying of fruit slices pineapple slices, apple slices in cabinet drier; Drying of green leafy vegetables; Drying of mango/ other pulp by foam-mat drying; Drying of semisolid foods using roller dryers; Drying of foods using freeze-drying process; Demonstration of preserving foods under cold vs. freezing process; Processing of foods using fermentation technique, i.e. preparation of sauerkraut; Study on effect of high pressure on microbe; Study on effect of pulse electric field on food.

#### **(3.VP.02) Milk Processing Lab**

Sampling of milk, estimation of fat, solids not fat (SNF) and total solids, Platform tests, cream separation, Microbiological quality of milk and milk products. Chilling/freezing of milk, milk products, preservation of milk and milk products. Visit to modern milk processing units.

### Level 4 (Semester I)

#### (4.GV.01) Food Process Technology-I

Status of food processing industries in India and abroad, magnitude and inter- dependence of dairy and food industry, prospects for future growth in India. Harvesting, transportation and storage of fruits and vegetables. *Post harvest processing of fruits and vegetables*: Peeling, sizing, blanching, Canning of fruits and vegetables, Drying and freezing of fruits and vegetables. *Juice processing*: General steps in juice processing, role of enzymes in fruit. Juice extraction, equipment's and methods of fruit juice extraction, preservation of fruit juices, fruit juice clarification, concentration of fruit juices, fruit juice powders. Fruit juice processing; Orange and tangerine, Lemon and lime juice, Apple juice, Grape juice, Nectars, pulpy juices, tropical blends, Vegetable juices. *Manufacture of Jam, Jelly and Marmalade*: Role played by pectin, sugar and acid in jellied fruit products. Fruits and vegetable preserves, Glazed, Crystallized fruits. Tomato based products: Juice, puree, paste, sauce, ketchup. Pickles: Principle of pickling, technology of pickles. *Beverages*: Classification, scope, carbonated non-alcoholic beverages and their manufacture. Fruit beverages and drinks, additives for fruit based beverages. *Coffee*: Production practices, structure of coffee/cherry, Coffee processing including roasting, grinding, brewing extraction, dehydration, aromatization, instant coffee. *Tea*: Tea leaf processing, green, red, yellow, instant tea.

#### (4.GV.02) Milling of Cereals

Morphology, physico-chemical properties of cereals, major and minor millets; Chemical composition and nutritive value; Paddy processing and rice milling: Conventional milling, modern milling, milling operations, milling machines, milling efficiency; Quality characteristics influencing final milled product; Parboiling; Rice bran stabilization and its methods; Wheat milling: Break system, purification system and reduction system; extraction rate and its effect on flour composition; quality characteristics of flour and their suitability for baking; Corn milling: Dry and wet milling of corn, starch and gluten separation, milling fractions and modified starches; Barley: Malting and milling; Oat/Rye: Processing, milling; Sorghum: Milling, malting, pearling; Millets (Pearl millets, finger millets): Processing of millets for food uses; Secondary and tertiary products processing of cereals and millets; By-products processing of cereals and millets; Processing of infant foods from cereals and millets; Breakfast cereal foods: Flaked, puffed, expanded, extruded and shredded.

#### (4.GV.03) IT Tools-I

- I. Computer Organization & OS: User perspective.
  - Understanding of Hardware.
  - Basics of Operating System.
- II. Networking and Internet.
  - Network Safety concerns.
  - Network Security tools and services.
  - Cyber Security.
  - Safe practices on Social networking.
- III. Office automation tools:
  - Spreadsheet.
  - Word processing.
  - Presentation.

#### (4.GE.01) Language-II

### Module – 3: Listening and speaking skills



In this module the learners will be exposed to a variety of listening activities recorded on audiotapes. These will be samples of good spoken English, which the learners can use as models. Work sheets will accompany the listening material.

This module will include the following:

1. Introducing yourself/friends in formal and informal situations.
2. Inviting people (over the phone and face to face) giving details of occasion, time place and date. Acceptance and refusal of invitation – formal and informal.
3. Seeking and supplying information (example opening an account in a bank, applying for loans etc.)
4. Talking and conveying messages (over the phone and face to face).
5. Giving directions / instruction.
6. Discussing contemporary issues related to environment, child labour, gender bias etc.
7. Listening to excerpts from television and radio.
8. Listening to poems/plays (prescribed).
9. Listening to speeches / talks.
10. Listening to songs like “We shall overcome”.

### **Module – 4 to 6** **(English for specific purposes) (opt any one)**

There modules are being offered. A learner has to opt for any one. The first is for academic purposes and the next two are for vocational purposes. The focus is not on the teaching of the subject matter like science and literature but on the way in which language is used in the different subjects.

#### **Module 4: English for Science**

This course will introduce learners to some interesting pieces of popular science

1. Health and hygiene
2. Conservation of (nearly extinct) animals.
3. Plant life.
4. Bio gas / solar energy.

These pieces illustrate the use of English in scientific writing: giving information factually, logically and objectively.

#### **Module 4: English for Receptionist**

This module will introduce the learners to a variety of exercises, tasks and meaningful activities related to the receptionist’s use of English. The printed course materials will be supported by tapes. The following competencies be developed:

1. Receiving messages, making request etc.
2. Supplying information
3. Giving advice and making suggestions
4. Dealing with complaints
5. Making entries in an appointment book, register etc.

#### **Module 4: English for Office Use**

This course will help the learner to use English effectively and appropriately in the office environment. The competencies will be developed.

1. Using the telephone taking and passing messages.
2. Receiving messages
3. Marking noting on files and circular.
4. Writing office notes, memos, notices, agendas for meetings.
5. Telegrams and fax messages.

6. Writing business letters, application enquires, complaints.
7. Filling in forms, cheques, pay in slips etc.

#### **(4.VP.01) Milling of Cereals Lab**

Morphological characteristics of cereals; Physical properties of cereals; Chemical properties of cereals; Parboiling of paddy; Cooking quality of rice; Milling of rice; Conditioning and milling of wheat; Production of sorghum flakes; Production of popcorns, flaked rice, puffed rice, noodles; Preparation of sorghum malt; Determination of gelatinization temperature by amylograph; Processing of value added products from millets; Visit to Cereal processing unit.

#### **(4.VP.02) IT Tools-I Lab**

- Spreadsheets, Word, Presentation
- Multimedia Design
- Troubleshooting
- Project / Practical File
- Viva Voce

**Level 4 (Semester II)****(4.GV.04) IT Tools-II**

- I. Multi Media Design: (Open Source Design Tools)
  - Interface and Drawing Tools in GIMP.
  - Applying Filters.
  - Creating and handling multiple layers.
  - Using Stamping and Smudging tools.
  - Importing pictures.
- II. Troubleshooting: Hardware, Software and Networking.
  - Commonly encountered problems.
  - (Monitor: No display, KB/Mouse not responding, monitor giving beeps, printer not responding, check for virus, Delete temporary files if system is slow, adjust mouse speed).
- III. Work Integrated Learning IT – ISM
  - Identification of Work Areas.
  - Work Experience.

**(4.GV.05) Food Process Technology-II**

*Technology of confectionery foods:* Candies, Chewing gums and bubble gums, Toffees, Caramels, Standards of confectionery products. *Chocolate products:* Cocoa bean processing, chocolate liquor, Standards of confectionery products. *Functional foods:* Introduction, Phytochemicals, Milk ingredients as nutraceuticals, fiber-rich food products etc.

*Cereal grains, legumes and oilseeds:* Structure and composition of cereals, legumes and oilseeds, Milling of paddy, quality factors of rice grains, processing of rice bran oil, Instant rice, quick cooking rice, canned rice, Milling technology of wheat, Criteria of wheat flour quality, improvers for wheat flour, Types of wheat flour, Milling technology of maize, wet milling of corn, Milling technology of barley, malting of barley and its utilization in manufacture of value added food products including malted milk foods, Dehulling and processing technology of important pulses, Dehulling and extraction of oil in major oilseed crops like soy bean, mustard, sunflower, ground nut, Vegetable protein concentrates/isolates, Utilization of oil cake in food formulation.

**(4.GV.06) Food Safety and Hygiene****INTRODUCTION TO HYGIENE AND SANITATION**

1. Introduction
2. Importance of hygiene in catering establishments
3. Sanitation and its importance ,principles-chemicals, heat and water

**CONTAMINATION AND SPOILAGE**

1. Contamination and food spoilage, sources
2. Conditions which lead to spoilage
3. Signs of spoilage in various foods
4. Microbes and its role in food spoilage
5. Factors affecting and controlling microbial growth
6. Food borne illness (case studies)

**PURCHASING, RECEIVING AND STORAGE OF FOODS**

1. Procedures while purchasing and receiving foods
2. Importance on storage of food

3. Points to be considered while storing food
4. Classification of food according to ease of spoilage
5. Storage of leftover food, hot food and cooling of foods
6. Various storage zones-dry, refrigerator freezer- special reference to temperatures
7. Sanitary procedure followed while preparing and storing foods

#### **SAFETY MANAGEMENT IN CATERING ESTABLISHMENTS**

1. Accidents -commonly occurring in catering establishments
2. Preventive methods
3. Education/training in sanitation
4. Food safety regulations- all food laws and standards and HACCP

#### **(4.GV.06) Milling of pulses and oilseeds**

##### Milling of pulses:

Traditional milling methods, commercial methods, pre-conditioning, dry milling and wet milling methods: CFTRI and Pantnagar methods. Pulse milling machines, Milling of corn and its products. Dry and wet milling.

##### Milling of oilseeds:

Mechanical expression, screw press, hydraulic press, solvent extraction methods, preconditioning of oilseeds, refining of oil, stabilization of rice bran., Extrusion cooking: principle, factors affecting, single and twin screw extruders. By-products utilization.

#### **(4.VP.03) Milling of pulses and oilseeds Lab**

- Study of different equipment's in pulse mills and their performance evaluation
- Study of different equipment's in oil mills and their performance evaluation
- Type of process flow charts with examples relating to processing of cereals pulses and oil seeds
- Visit to grain processing industries

#### **(4.VP.04) Food Process Technology-II Lab**

Manufacture of barley malt. Determination of cooking quality of rice. Manufacture of bread and bun. Manufacture of biscuits. Preparation of noodles. Preparation of cake. Manufacture of potato chips. Preparation of malt based food products. Manufacture of malted milk foods, Manufacture of soy beverage and tofu, Preparation of salami. Preparation of chicken soup. Manufacture of chicken pickle.

## **Level 5 (Semester I)**

### **(5.GV.01) Food Quality Analysis**

Basics of Food Science and Food Analysis, Concept, objectives and need of food quality. Measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition. Sampling; purpose, sampling techniques, sampling procedures for liquid, powdered and granular materials, Sensory evaluation methods, panel selection methods, Interpretation of sensory results. Instrumental method for testing quality. Food adulteration and food safety. TQM and TQC, consumer preferences and acceptance, Food Safety Management Systems GAP, GHP, GMP, Hazards and HACCP (Hazard analysis and critical control point), Sanitation in food industry (SSOP), Food Laws and Regulations in India, FSSAI, Food grades and standards BIS, AGMARK, PFA, FPO, ISO 9000, 22000 Series. CAC (Codex Alimentarius Commission), Traceability and Quality Assurance system in a process plant, Bio safety and Bioterrorism.

### **(5.GV.02) Food Refrigeration and Supply Chain**

Principles of refrigeration: Definition, background with second law of thermodynamics, unit of refrigerating capacity, coefficient of performance; Production of low temperatures: Expansion of a liquid with flashing, reversible/ irreversible adiabatic expansion of a gas/ real gas, thermoelectric cooling, adiabatic demagnetization; Air refrigerators working on reverse Carnot cycle: Carnot cycle, reversed Carnot cycle, selection of operating temperatures; Air refrigerators working on Bell Coleman cycle: Reversed Brayton or Joule or Bell Coleman cycle, analysis of gas cycle, polytropic and multistage compression; Vapour refrigeration: Vapor as a refrigerant in reversed Carnot cycle with p-V and T-s diagrams, limitations of reversed Carnot cycle; Vapour compression system: Modifications in reverse Carnot cycle with vapour as a refrigerant (dry vs wet compression, throttling vs isentropic expansion), representation of vapor compression cycle on pressure-enthalpy diagram, super heating, sub cooling; Liquid-vapour regenerative heat exchanger for vapour compression system, effect of suction vapour super heat and liquid sub cooling, actual vapour compression cycle; Vapour-absorption refrigeration system: Process, calculations, maximum coefficient of performance of a heat operated refrigerating machine, Common refrigerants and their properties: classification, nomenclature, desirable properties of refrigerants-physical, chemical, safety, thermodynamic and economical; Azeotropes; Components of vapour compression refrigeration system, evaporator, compressor, condenser and expansion valve; Ice manufacture, principles and systems of ice production, Treatment of water for making ice, brines, freezing tanks, ice cans, air agitation, quality of ice; Refrigerated transport: Handling and distribution, cold chain, refrigerated product handling, order picking, refrigerated vans, refrigerated display; Air conditioning: Meaning, factors affecting comfort air-conditioning, classification, sensible heat factor, industrial air-conditioning, problems on sensible heat factor;

### **(5.GV.03) Food Plant Sanitation**

Good manufacturing practices, current good manufacturing practices; Standard operating procedures, good laboratory practices, sanitation; Sanitation and the food industry: Sanitation, sanitation laws and regulations and guidelines, establishment of sanitary, potential risks of food borne bioterrorism, bioterrorism protection measures, role of pest management in bio-security; Relationship of microorganisms to sanitation, allergens, allergen control; Food contamination, protection against contamination; Personal hygiene and sanitary food handling: Role of HACCP in sanitation, quality assurance for sanitation cleaning compounds, handling and storage precautions; Sanitizers, sanitizing methods, sanitation equipment, waste product handling, solid waste disposal, liquid waste disposal; Pest control: Insect infestation, cockroaches, insect destruction, rodents, birds, use of pesticides, integrated pest management; Sanitary design and construction for food processing: Site selection, site preparation, building construction considerations, processing and design considerations, pest control design; Low-moisture food manufacturing and storage sanitation: Sanitary construction considerations, receipt and storage of raw materials, cleaning of

low-moisture food manufacturing plants; Dairy processing plant sanitation: Role of pathogens, sanitary construction considerations, soil characteristics in dairy plants, sanitation principles, cleaning equipment; Meat and poultry plant sanitation: Role of sanitation, sanitation principles, cleaning compounds for meat and poultry plants, sanitizers for meat and poultry plants, sanitation practices, sanitation procedures; Sea food plant sanitation: Sanitary construction considerations, contamination sources, sanitation principles, recovery of by-products; Fruit and vegetable processing plant sanitation: Contamination sources, sanitary construction considerations, cleaning considerations, cleaning of processing plants, cleaners and sanitizers, cleaning procedures, evaluation of sanitation effectiveness; Beverage plant sanitation: Mycology of beverage manufacture, sanitation principles, non-alcoholic beverage plant sanitation, brewery sanitation, winery sanitation, distillery sanitation;

#### **(5.GV.04) Food Plant Equipment's**

Materials and properties: Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment, choice of materials, material codes; Design considerations: Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations; Design of pressure and storage vessels: Operating conditions, design conditions and stress; Design of shell and its component, stresses from local load and thermal gradient, mountings and accessories; Design of evaporators and crystallizers: Design of single effect and multiple effect evaporators and its components; Design of rising film and falling film evaporators and feeding arrangements for evaporators; Design of crystalliser and entrainment separator; Design of agitators and separators: Design of agitators and baffles; Design of agitation system components and drive for agitation; Design of centrifuge separator; Design of equipment components, design of shafts, pulleys, bearings, belts, springs, drives, speed reduction systems; Design of freezing equipment: Design of fermenters: Design of fermenter vessel, design problems; Hazards and safety considerations: Hazards in process industries, analysis of hazards, safety measures, safety measures in equipment design, pressure relief devices.

#### **(5.VP.01) Food Quality Analysis Lab**

Examination of cereals & pulses from one of go-downs and market shops in relation to FPO and BIS specifications, Detection of adulteration and examination of ghee for various standards of AGMARK & BIS standards, Detection of adulteration and examination of spices for AGMARK and BIS standards, Detection of adulteration and examination of milk and milk products for BIS standards, Detection of adulteration and examination of fruit products such as jams, jellies, marmalades for FPO specification, Study of registration process and licensing procedure under FSSAI, Study of sampling techniques from food processing establishments, Visit to food processing laboratory and study of records and reports maintained by food processing laboratory.

#### **(5.VP.02) Food Refrigeration and Supply Chain Lab**

Study of vapour compression refrigeration system; Determination of COP of vapour compression refrigeration system; Study of various types of compressors, condensers, expansion valves and evaporative coils used in refrigeration systems; Study of refrigerants, their properties and charts; Study of direct and indirect contact freezing equipment for foods; Study of spray freezing process for foods; Study of food cold storage; Estimation of refrigeration load for cold storage; Estimation of refrigeration load for meat and poultry products; Study of refrigeration system of dairy plant; Estimation of refrigeration load for ice-cream; Study of cooling system for bakery and estimation of refrigeration loads; Estimation of refrigeration load during chocolate enrobing process; Study of refrigerated van; Study of deep freezing and thawing of foods; Study of refrigerated display of foods and estimation of cooling load.

## Level 5 (Semester II)

### **(5.GV.05) Entrepreneurship Development**

*Entrepreneurship:* Importance and growth, characteristics and qualities of entrepreneur, role of entrepreneurship, ethics and social responsibilities; *Entrepreneurship development:* Assessing overall business environment in the Indian economy; Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs; Globalization and the emerging business/entrepreneurial environment; Concept of entrepreneurship, entrepreneurial and managerial characteristics, managing an enterprise, motivation and entrepreneurship development, importance of planning, monitoring, evaluation and follow up, managing competition, entrepreneurship development programs, SWOT analysis, generation, incubation and commercialization of ideas and innovations; *Women entrepreneurship:* Role and importance, problems; *Corporate entrepreneurship:* Role, mobility of entrepreneur; *Entrepreneurial motivation;* *Planning and evaluation of projects:* Growth of firm, project identification and selection, factors inducing growth; *Project feasibility study:* Post planning of project, project planning and control; *New venture management;* *Creativity.* Government schemes and incentives for promotion of entrepreneurship; Government policy on small and medium enterprises (SMEs)/SSIs; Export and import policies relevant to food processing sector; Venture capital; Contract farming and joint ventures, public-private partnerships; Overview of food industry inputs; Characteristics of Indian food processing industries and export; Social responsibility of business.

### **(5.GV.06) Bakery, confectionery and snack products**

*Bakery products:* Types, specifications, compositions, ingredients, formulations, processing, equipment, packaging, storage and quality testing; *Confectionery and chocolate products:* Types, specifications, compositions, ingredients, formulations, processing, equipment, packaging, storage and quality testing; *Product quality characteristics, defects, causes and corrective measures;* *Snack foods:* Types, specifications, compositions, ingredients, formulations, processing, equipment, packaging, storage and quality testing; *Snack food seasonings;* *Breakfast cereals, macaroni products and malts:* Specifications, compositions, ingredients, formulations, processing, equipment, packaging, storage and quality testing.

### **(5.GV.07) Food Packaging Technology**

Factors affecting shelf life of food material during storage, Interactions of spoilage agents with environmental factors as water, oxygen, light, pH, etc. and general principles of control of the spoilage agents; Difference between food infection, food intoxication and allergy. Packaging of foods, requirement, importance and scope, frame work of packaging strategy, environmental considerations, Packaging systems, types: flexible and rigid; retail and bulk; levels of packaging; special solutions and packaging machines, technical packaging systems and data management packaging systems, Different types of packaging materials, their key properties and applications, Metal cans, manufacture of two piece and three piece cans, Plastic packaging, different types of polymers used in food packaging and their barrier properties. manufacture of plastic packaging materials, profile extrusion, blown film/ sheet extrusion, blow molding, extrusion blow molding, injection blow molding, stretch blow molding, injection molding. Glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers. Paper and paper board packaging, paper and paper board manufacture process, modification of barrier properties and characteristics of paper/ boards. Relative advantages and disadvantages of different packaging materials; effect of these materials on packed commodities. Nutritional labelling on packages, CAS and MAP, shrink and cling packaging, vacuum and gas packaging; Active packaging, Smart packaging, Packaging requirement for raw and processed foods, and their selection of packaging materials, Factors affecting the choice of packaging materials, Disposal and recycle of packaging waste, Printing and labelling, Lamination, Package testing: Testing methods for

flexible materials, rigid materials and semi rigid materials; Tests for paper (thickness, bursting strength, breaking length, stiffness, tear resistance, folding endurance, ply bond test, surface oil absorption test, etc.), plastic film and laminates (thickness, tensile strength, gloss, haze, burning test to identify polymer, etc.), aluminium foil (thickness, pin holes, etc.), glass containers (visual defects, colour, dimensions, impact strength, etc.), metal containers (pressure test, product compatibility, etc.).

### **(5.GV.08) Processing of Meat and Poultry Products**

Sources and importance of meat and poultry; Status of Meat and poultry industry in India; Preslaughter operations and slaughtering operations for animals and poultry; Evaluation of animal carcasses; Factors affecting post-mortem changes, properties and shelf life of meat; Mechanical deboning, grading and aging; Eating and cooking quality of meat; Preservation of meat by chilling, freezing, pickling, curing, cooking and smoking, dehydration, radiation, chemical and biological preservatives; Meat tenderization; Meat emulsions; Meat cutting and handling; Preparation, preservation and equipment for manufacture of smoked meat and its quality evaluation; Preparation, packaging and equipment for manufacture of dehydrated meat products and their quality evaluation; Preparation, preservation and equipment for manufacture of meat sausages and their quality evaluation; Abattoir design and layout; Eggs: Structure, composition, quality characteristics, processing, preservation of eggs; Processing and preservation of poultry meat and chicken patties; Meat plant sanitation and safety; By-products of meat, poultry and eggs and their utilization; Safety standards in meat industry: HACCP/ISO/MFPO/FSSAI/Kosher/Halal.

### **(5.VP.03) Bakery, confectionery and snack products Lab**

Identifications and composition of various ingredients for snacks, bakery and confectionery products; Flours, their classifications and characterization; preparation, packaging and quality evaluation of selected snack items; preparation, packaging and quality evaluation of selected bakery items; preparation, packaging and quality evaluation of selected confectionery items; preparation, packaging and quality evaluation of selected chocolates; Preparation of traditional Indian confection. Visit to bakery, confectionary and snack units (industry).

### **(5.VP.04) Food Packaging Technology Lab**

Identification of different types of packaging materials, Determination of tensile/ compressive strength of given material/package, To perform different destructive and non-destructive tests for glass containers, Vacuum packaging of agricultural produce, Determination of tearing strength of paper board, Measurement of thickness of packaging materials, To perform grease-resistance test in plastic pouches, Determination of bursting strength of packaging material, Determination of water-vapour transmission rate, Shrink wrapping of various horticultural produce, Testing of chemical resistance of packaging materials, Determination of drop test of food package and visit to relevant industries.



## **Level 6 (Semester I)**

### **(6.GV.01) Food Process Technology – III**

*Bakery and Snack technology:* Technology of bread, biscuits, crackers and cakes, Technology of manufacturing process of Pasta foods- Macaroni, Noodles and Spaghetti, Technology of breakfast cereals: corn flakes, puffed, extruded snacks, Potato chips. *Meat, fish and egg technology:* Development of meat, poultry, egg and fish industry in India, Pre-slaughter care, handling and ante-mortem inspection of animal, Stunning and slaughtering techniques, Postmortem inspection, rigor mortis and conversion of muscle to meat Slaughterhouse sanitation, meat hygiene and zoonotic diseases, Processing of poultry meat, Egg and egg products – quality assessment of egg, Types, handling, transportation and marketing of fish, Preservation of fish., Manufacturing process of dehydrated fish and fish pickles. Cleaning and sanitation, Waste management of food processing plants.

### **(6.GV.02) Energy Conservation and Management**

Introduction: Potential and opportunities of industrial energy conservation in dairy and food processing. Energy conservation Act 2001 and its important features, Schemes of Bureau of Energy Efficiency (BEE). Electricity Act 2003, Integrated energy policy. Energy management & audit: Definition, energy audit, need, types of energy audit. Energy audit approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution. Energy balances and computation of efficiencies of equipment. Role of Energy inspectors and Auditors in energy management. Electrical load management: Demand management, energy management information systems, Energy saving controllers and cost saving techniques. Quality of power, Power factor and its improvement. Transformers, losses in transformers. Energy savings in transformers. Electric motor-selection and application, Energy efficient motors. Variable Speed Drives and Variable Frequency Drives (VFD) and their role in saving electric energy. Bureau of Energy Efficiency (BEE): Power saving guide with “Star Ratings” of electrical appliances: Induction Motors, Air conditioners, Refrigerators and Water Heaters. Energy efficiency and conservation in utilities: High efficiency boilers, improved combustion techniques for energy conservation. Energy conservation in steam distribution systems, efficient piping layouts, protective & insulation coverings in utility pipes. Steam conservation opportunities. Upkeep and maintenance of steam auxiliaries and fittings. Energy conservation in Refrigeration and AC systems (HVAC), Cooling towers, Pumps and pumping systems, Fans, Blowers, Air compressors. Maintenance and upkeep of Vacuum lines and Compressed air pipe lines. Conservation and reuse of water, water auditing. Energy conservation opportunities in Wastewater treatment. Energy conservation in buildings: Concepts of “Green Buildings”. Waste-heat recovery and thermal energy storage in food processing facilities. Condensate recovery and reuse. Application of recuperator to recover energy from flue gases from boiler, DG exhaust, hot air from spray dryer, FBD etc. Diesel generating sets (stand by AC Gen sets): Energy saving opportunities in DG sets, Fuel and Oil conservation; important regular maintenance aspects. Carbon credits and carbon trade: Concepts of CDM, economic and societal benefits. Cleaner energy sources: Introduction to Solar, and Bio-mass Energy; Solar thermal and photo-voltaic energy options for food processing industries. Role of automation in conservation of energy in dairy and food processing: Incorporation of enhanced PLC based computer controls and SCADA.

### **(6.GV.03) Sensory Evaluation of Food**

Introduction, definition and importance of sensory evaluation in relation: to consumer acceptability and economic aspects; factors affecting food acceptance. Terminology related to sensory evaluation. Principles of good practice: the sensory testing environment, test protocol considerations, Basic principles: Senses and sensory perception, Physiology of sensory organs, Classification of tastes and odours, threshold value factors affecting senses, visual, auditory, tactile and other responses.

Discrimination Tests, Procedure: Types of tests – difference tests (Paired comparison, due-trio, triangle) ranking, scoring, Hedonic scale and descriptive tests. Panel selection, screening and training of judges; Requirements of sensory evaluation, sampling procedures; Factors influencing sensory measurements; Consumer Research – Affective Tests: Objectives. Methods, types or questionnaires, development of questionnaires, comparison of laboratory testing and Consumers studies, limitations. Interrelationship between sensory properties of food products and various instrumental and physico-chemical tests; Quality Evaluations Application of sensory testing: sensory evaluation in food product development, sensory evaluation in quality control.

#### **(6.GV.04) Food Plant Layout**

Food plant location, selection criteria, Selection of processes, plant capacity, Requirements of plant building and its components, Project design, flow diagrams, selection of equipment, process and controls, Objectives and principles of food plant layout. Salient features of processing plants for cereals, pulses, oilseeds, horticultural and vegetable crops, poultry, fish and meat products, milk and milk products. Introduction to Finance, Food Product Marketing, Food Business Analysis and Strategic Planning, Government schemes and incentive for promotion of entrepreneurship, Govt. policy on small and medium scale food processing enterprise, export and import policies relevant to food processing sector, procedure of obtaining license and registration under FSSAI, Cost analysis and preparation of feasibility report.

#### **(6.VP.01) Food Processing Technology and Sensory Evaluation Lab**

Manufacture of toffees and caramels, testing the efficacy of blanching process, Drying of fruits and vegetables, Preparation of fruit based drinks and beverages: Ready-to-serve drink, Nectar, Squash, Whey-fruit based beverages. Manufacture of fruit jam. Manufacture of fruit jelly. Manufacture of chocolate confections. Manufacture of tomato ketchup/tomato sauce. Manufacture of soups. Manufacture of fruit preserve. Manufacture of candied fruits. Manufacture of fruit bar; Manufacture of pickles.

Determination of threshold value for basic tastes; Odour recognition, difference (PC, Duotrio, triangle); Determination of threshold value for various odours; Selection of judging panel; Training of judges, for recognition of certain common flavour and texture defects using different types of sensory tests; Descriptive analysis methodology; Sensory evaluation of various food products using different scales, score cards and tests; Texture profile methodology; Estimation of color; Relationship between objective and subjective methods; Designing a sensory laboratory.

#### **(6.VP.02) Food Plant Layout Lab**

Preparation of project report, Preparation of feasibility report, Salient features and layout of pre-processing house, Salient features and layout of Milk and Milk product plants, Evaluation of given layout, Salient features, design and layout of modern rice mill, Salient features, design and layout of Bakery and related product plant, Study of different types of records relating to production of a food plant, Study of different types of records relating to finance of a food plant, Study of different types of records relating to marketing of a food business, Brain storming and SWOT analysis to start a food processing business.

## Level 6 (Semester II)

### **(6.GV.05) Fish and Poultry Processing**

Sources and importance of poultry; Status of poultry industry in India; Preslaughter operations and slaughtering operations for poultry; Eggs: Structure, composition, quality characteristics, processing, preservation of eggs; Processing and preservation of poultry meat and chicken patties; By-products of poultry and eggs and their utilization.

Fisheries resources, global and Indian scenario; Types of fish and other marine products; Classification of fish (fresh water and marine), composition of fish, characteristics of fresh fish, spoilage of fish- microbiological, physiological, biochemical; Relationship between chilling and storage life, MAP, general aspects of fish freezing, changes in quality during chilled and frozen storage; Principles of canning, effect of heat processing on fish, storage of canned fish, preprocess operations, post-process operations, cannery operations for specific canned products; Fish products: Introduction, fish muscle proteins, surimi process, traditional and modern surimi production lines, quality of surimi products, comparison of surimi and fish mince products; Fish protein concentrates (FPC), fish protein extracts (FPE), fish protein hydrolysates (FPH); Preparation protocols of indigenous products: Fish sauce and paste. Novel methods; Low dose irradiation; High pressure treatment, MAP, vacuum packaging, gas packaging; Oxygen absorbents and CO<sub>2</sub> generators, ethanol vapour generation, hurdle barrier concept, value added fish products, packaging.

### **(6.GV.06) By Product Utilization**

Types and formation of by-products; Magnitude of waste generation in different food processing industries; Uses of different agricultural by-products from rice mill, sugarcane industry, oil mill etc., Concept, scope and maintenance of waste management and effluent treatment, Temperature, pH, Oxygen demands (BOD, COD), 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, Waste utilization in various industries, furnaces and boilers run on agricultural wastes and byproducts, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization, Waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermin-composting, Pretreatment of waste: sedimentation, coagulation, flocculation and floatation, Secondary treatments: Biological and chemical oxygen demand for different food plant waste- trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons, Tertiary treatments: Advanced waste water treatment process-sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal, Assessment, treatment and disposal of solid waste; and biogas generation, Effluent treatment plants, Environmental performance of food industry to comply with ISO-14001 standards.

### **(6.GV.07) Marketing Management and Trade**

Concept of marketing; Functions of marketing; concepts of marketing management; scope of marketing management; marketing management. Process; concepts of marketing- mix, elements of marketing- mix. Market Structure and Consumer Buying Behaviour: Concept of market structure, marketing environment, micro and macro environments. Consumers buying behaviour, consumerism. Marketing Opportunities Analysis: Marketing research and marketing information systems; Market measurement- present and future demand; Market forecasting; market segmentation, targeting and positioning. Allocation and marketing resources. Marketing Planning Process. Product policy and planning; Product-mix; product line; product life cycle. New product development process. Product brand, packaging, services decisions. Marketing channel decisions. Retailing, wholesaling and distribution. Pricing Decisions. Price determination and pricing policy of

milk products in organized and unorganized sectors of dairy industry. Promotion-mix decisions. Advertising; How advertising works; Deciding advertising objectives, advertising budget and advertising message; Media Planning; Personal Selling, Publicity; Sales Promotion. Food and Dairy Products Marketing. Marketing and Trade. Composition & direction of Indian exports; Exports-Direct exports, indirect exports, Licensing, Joint Ventures, Direct investment & internationalization process, Deciding marketing Programme; Product, Promotion, Price, Distribution Channels. Deciding the Market Organization.

### **(6.GV.08) Instrumentation and Process Control**

Introduction, definitions, characteristics of instruments, static and dynamic characteristics; Temperature and temperature scales; Various types of thermometers; thermocouples, resistance thermometers and pyrometers; Pressure and pressure scales, manometers, pressure elements differential pressure; Liquid level measurement, different methods of liquid level measurement; Flow measurement: Kinds of flow, rate of flow, total flow differential pressure meters, variable area meters, food flow metering; Weight measurement: Mechanical scale, electronic tank scale, conveyor scale; Measurement of moisture content, specific gravity, measurement of humidity, measurement of viscosity, turbidity, color, measurement of density, brix, pH, enzyme sensors, automatic valves; Transmission: Pneumatic and electrical; Control elements, control actions, pneumatic and electrical control systems; Process control: Definition, simple system analysis, dynamic behaviour of simple process, Laplace transform, process control hardware; Frequency response analysis, frequency response characteristics, Bode diagram and Nyquist plots and stability analysis; Transducers: Classification, self-generating transducers, variable parameter type, digital, actuating and controlling devices; Controllers and indicators: Temperature control, electronic controllers, flow ratio control, atmosphere control, timers and indicators, food sorting and grading control, discrete controllers, adaptive and intelligent controllers; Computer-based monitoring and control: Importance, hardware features of data acquisition and control computer, signal interfacing, examples in food processing.

### **(6.VP.03) Fish and Poultry Processing Lab**

Pre-slaughter operations of poultry birds; Evaluation of quality and grading of eggs; Preservation of shell eggs; Preparation of value added poultry meat products; Value added egg products; Visit to abattoir.

Study of anatomy and dressing of fish; Identification of different types of fish - Selection and grading; Quality evaluation of fish; Preparation of sun dried and salt cured fish, fish sauce; Chilling and freezing of fish; Preparations of fish protein concentrate; Preparation of fish meal; Preparation of marine fish oils and various fish products; Utilization of fish by-products; Preservation of fish: Drying, pickling; Preservation of marine products using fermentation process; Processing of fish oils; Estimation of TVB and TMA; Determination of iodine value; Protein estimation by Folin-Lowrey's method; Visit to fish processing industry.

### **(6.VP.04) By Product Utilization Lab**

Determination of temperature, pH, turbidity solids content, BOD and COD of waste water, Determination of ash content of agricultural wastes and determination of un-burnt carbon in ash, Study about briquetting of agricultural residues, Estimation of excess air for better combustion of briquettes, Study of extraction of oil from rice bran, Study on bioconversion of agricultural wastes, Recovery of germ and germ oil from by-products of cereals, Visit to various industries using waste and food by-products.

## Level 7 (Semester I)

### (7.GV.01) Ice Cream and Frozen Desserts

History, development and status of ice cream industry, History, development and status of ice cream industry, Definition, classification and composition and standards of ice cream and other frozen desserts, Stabilizers and emulsifiers-their classification, properties and role in quality of ice cream, Technological aspects of ice cream manufacture, Thermodynamics of freezing and calculation of refrigeration loads, Types of freezers, refrigeration control / instrumentation, Types of freezers, refrigeration control / instrumentation, Hygiene, cleaning and sanitation of ice cream plant, Effect of process treatments on the physico-chemical properties of ice-cream mixes and ice cream, Processing and freezing of ice-cream mix and control of over run, Packaging, hardening, storage and shipping of ice-cream, Defects in ice cream, their causes and prevention, Recent advances in ice-cream industry (flavourings, colourings, fat replacers, bulking agents) and plant management, Nutritive value of ice-cream.

### (7.GV.02) Traditional Indian Dairy Products

Status and significance of traditional Indian milk products in India. *Khoa*: Classification of types, standards methods of manufacture and preservation, factors affecting yield of khoa. Mechanization in manufacture of khoa. *Khoa based sweets*: Burfi, Peda, Milkcake, Kalakhand, Gulabjaman and their compositional profile and manufacture practices. *Rabri and Basundi*: Product identification, process description, factors affecting yield, physico-chemical changes during manufacture. *Channa*: Product description, standards method of manufacture, packaging and preservation. *Chhana-based sweets*: Rasogolla, Sandesh, Rasomalai. Mechanization of manufacturing process, advances in preservation and packaging. *Paneer*: Product description, standards, method of manufacture, packaging and preservation. Mechanization of Paneer manufacturing/packaging process. *Chakka/Maska and Shrikhand*: Product description, standards, method of manufacture, small scale and industrial process of production, packaging and preservation aspects. *Misti Dahi*: Product description method of manufacture and packaging process. *Kheer and Payasam*: Product description methods of manufacture, innovations in manufacturing and packaging processes. Bio preservative principles in enhancing the self-life of indigenous milk products including active packaging.

### (7.GV.03) Food Quality, Safety and Certification

Food quality: Definition and its role in food industry; Quality attributes, classification; Color and gloss: Definition, different colors, color measurement by spectrophotometer, Muncell color system and Lovibond tintometer; role in food qualities. Role of viscosity and consistency in food quality; Physical properties: Size and shape, weight, volume, weight volume ratio, length, width, diameter, symmetry, curvature, area; Defects, classification. Genetic-physiological defects: Structural, off color, character; Entomological defects: Holes, scars, lesions, off coloring, curled aves, pathological defects; Mechanical defects, extraneous or foreign material defects; Measurement of defects: Improving visibility by dilution, white background, color differences, standardization of conditions, reference standards, counts and measures, isolation of defects by floatation, elution, electronic sorting and internal defects; Flavour: Definition and its role in food quality; Taste: Classification, taste qualities, relative intensity, reaction time, effect of disease, temperature, and taste medium on taste, basic tastes, interaction of tastes; Odour: Definition, classification, neutral-mechanisms, olfactory abnormalities, odor testing, techniques, thresholds, odor intensities, olfaction; Visual, auditory, tactile and other senses, vision, audition, oral perception other than taste; Factors influencing sensory measurements: Attitudinal factors, motivation psychological errors in judgment, relation between stimulus and perception adaptation; Correlation of sensory and instrumental analysis; Laboratory quality measurement: Types of tests, panel selection and testing environment, serving procedures, instruction to judges, difference tests, directional difference tests, classification of difference tests, two-sample tests, three sample tests, multisampling tests,

comparison of procedures, ranking, scoring, hedonic scaling, dilution procedures, descriptive sensory analysis, contour method, other procedures; Consumer measurement: Factors influencing acceptance and preference, objectives of consumer preference studies, information obtained from consumer study, factors influencing results from consumer surveys, methods of approach, development of the questionnaire, types of questionnaires, serving procedures; Comparison of laboratory panels with consumer panels; Limitations of consumer survey; Quality of raw materials: Physical, chemical and microbial quality; Quality of products during processing and after processing: Color, taste, texture, flavour, appearance; Factors influencing the food qualities: Soil, field practices, harvesting practices, procedures, packaging, transportation, storage, conditions, processing conditions, packaging and storage conditions of finished products. Recording and reporting of quality. Quality inspection, quality control; Quality management and quality assurance: Total quality management, good manufacturing practices, good agricultural practices, good laboratory practices; Quality management systems, Certification, certification procedures, certifying bodies, accrediting bodies, international bodies.

#### **(7.GV.04) Financial Management and Cost Accounting**

*Introduction:* Definition, scope and objectives of financial management. Different Systems of Accounting: Financial Accounting, Cost accounting, Management Accounting. Double entry system of Book-Keeping. Preparation of Accounting Records: Journal, Purchases and Sales Book and Posting in Ledger, Cash Book. Preparation of Final Accounts and adjustments at the end of trading period. Preparation of Trial Balance Banking Transactions and Bank reconciliation statements. Statements of Financial Information: Accounting system: A source of financial statements, Classification of capital and revenue expenditure, Balance Sheet, Profit and Loss Account, Statement of changes in the financial position, funds flow statements, cash flow statement, uses of funds flow and cash flow statements in financial decision making. *Financial Analysis:* Nature and uses of financial analysis, Liquidity ratios, Leverage ratios, Activity ratios, Profitability ratios, Utility of Ratio analysis. Cost Volume – Profit analysis and operating leverage, Break-even analysis, Profit analysis and operating analysis, Utility of CVP analysis. Capital Structure: C.S Planning, risk return trade off, financial leverage. Cost of capital: Management of cost of capital, cost of debt, debentures, preference share capital, equity share capital & retained earning, overall cost of capital. *Investment decision:* Time value of money, Net present value, Investment evaluation criteria, NPV method, Internal rate of return method, Profitability index method, Pay back period method, Accounting rate of return method. Capital budgeting: Complex Investment Decisions: Investment timing & duration Investment decisions under inflation, Investment decisions under capital rationing. *Project Report;* Feasibility Report Valuation. Working capital management-Concept & determinants of working capital, Estimating working capital needs. Depreciation-Concept and method. Introduction, Definition, Objectives, Common terms. *Costing:* Essentials of sound costing system. Different methods of costing, elements of cost: Labour- recording of time, idle time, methods of remunerating labour, Premium & Bonus Plans, Materials, Overheads. *Cost classification:* Direct and Indirect expenses, fixed and variable costs. Various methods of apportioning indirect expenses. Inventory Management: Planning, control and costing. Stores & storekeeping, scope & importance, purchase procedure, types of purchase, location of stores & materials, procedure for the movement of stores, different methods of pricing materials, store records. Cost Sheets-Different methods, Statement of cost and statement of profit estimates, Tenders or Quotations. Contract or Terminal costing. Process Costing: Process losses and interprocess profits, joint products and by products costing. Ascertainment of cost of milk production. Preparation of Cost Account Information for managerial decisions.

#### **(7.VP.01) Ice Cream and Frozen Desserts Lab**

Calculation of standardization of ice-cream mixes. Manufacture of plain and fruit flavoured ice-cream. Manufacture of chocolate, fruit and nut ice cream. Preparation of sherbets/ices. Preparation of soft served and filled ice-cream. Manufacture of kulfi. Study of continuous and batch type

freezers. Manufacture of ice-cream by continuous process. Determination of overrun in ice cream. Factory visit.

**(7.VP.02) Traditional Indian Dairy Products Lab**

Preparation of Khoa from cow, buffalo and concentrated milk. Preparation of Burfi, Peda, Kalakand, Milkcake and Gulabjamun. Preparation of Paneer from cow, buffalo and mixed milk. Preparation of Chhana from cow and buffalo milk and mixed milk. Preparation of Sandesh and Rasogolla. Preparation of kheer. Preparation of Rabri, Misti Dahi, Chhaka and Shrikhand. Visit to industry.

**Level 7 (Semester II)****(7.GV.05) Project Preparation and Management**

Overview of project management: Functions and viewpoints of management, evolution of project management, forms and environment of project management; Project life cycle; Project selection: Project identification and screening, project appraisal, project charter, project proposal, project scope, statement of work; Project planning and scheduling: Work breakdown structure, planning and scheduling of activity networks, network scheduling, precedence diagrams, critical path method, program evaluation and review technique, assumptions in PERT modelling, decision CPM, GERT; Project cost estimating: Types of estimates and estimating methods, dynamic project planning and scheduling, time-cost trade-offs, resource considerations in projects, resource profiles and levelling, limited resource allocation; Project implementation, monitoring and control: Project management process and role of project manager, team building and leadership in projects, organizational and behavioural issues in project management, project monitoring and control, PERT/cost method, earned value analysis; Project completion and future directions: Project completion and review; Project management: Recent trends and future directions; Computers in project management.