

**Mugberia Gangadhar Mahavidyalaya**  
**Bhupatinagar, Purba Medinipur,**  
**West Bengal, India**  
*(Under Vidyasagar University)*



**Syllabus of**  
**B. Voc (Food Processing)**

**Effective from 2018-2019 session**

**Curriculum for Bachelor of Vocational Education**  
**(B. Voc.) in Food Processing**

## **Preface**

Mugberia Gangadhar Mahavidyalaya, Purba Medinipur, West Bengal is offering a three year Bachelor Program in Vocational Education (B. Voc.) in Food Processing from Academic year 2018-19. Although there has been remarkable progress in all sectors of education in last couple of decades, the less regulated area of the education sector vocational training—seems to have lost its significance/importance. This has led to the widening gap between the supply and demand for skilled manpower across various food processing industries and R&D organizations. This shortage of skills has translated directly into unemployment among an increasing number of graduates who pass-out every year and are forced to bare- trained in order to become marketable. This program is designed to produce a skilled manpower so that wide variety of options in different sectors of Food Processing would be available and it will improve the opportunities for the unemployed youths in the country in both the private and public sectors.

According to recent survey of FICCI (Federation of Indian Chambers of Commerce & Industry) on skill demand in food processing industries, it has been observed that a majority percentage of organizations are dissatisfied with the skills of the available trained manpower. For instance, 58% of the respondents were dissatisfied with technical skills and knowledge needed for the job. Also 72% showed discontent with employees' ability to use appropriate and modern tools, equipment, and technologies specific to their job roles. This programme aims to provide some solution for this problem and this would facilitate to improve:

- (i) Quality of training
- (ii) High drop-out rates
- (iii) Linkages with Universities and industry
- (iv) Inadequacy of resources

This program is intended to offer practical, hands on training and skills needed to pursue an occupation. It will provide options to the students to select the courses of their choice which are directly aligned to land a job in a chosen profession or a skilled trade. The end result of this program is to enable an individual to at train self-employment.

The Bachelor of Vocational Education in Food Processing is divided into six semester having 180 credits. Each semester will have courses based on General Education Components and Skill Development Components. The General Education Components offered by this programme includes Communication skill in English, Computer fundamental, Environment Science and Management etc. whereas the Skill Development Components includes Food chemistry, biochemistry, Microbiology and Biotechnology, Processing Technology of Fruits & Vegetables, Cereals, Legumes, oil seeds, spices and condiments , Meat, fish and poultry, milk and milk products, Bakery and confectionary technology. Food analysis, food safety, Regulations and quality management, special implant training, seminar and project etc.

## Exit options

Bachelor of Vocation (B. Voc.) is launched under the scheme of University Grants Commission for skill development based on higher education leading to Bachelor of Vocation (B. Voc.) Degree with multiple exits as Diploma/Advanced Diploma under the National Skill Qualification Framework (NSQF). The B. Voc. programme incorporates specific job roles and their National Occupational Standards along with broad based general education. B. Voc. Programme has been designed as per National Skill Qualification Framework emphasizing on skill based education.

## Levels of Award

Award	Duration	Corresponding NSQF Level
Certificate in Food Processing	6 Months	4
Diploma in Food Processing	1 Year	5
Advanced Diploma in Food Processing	2 Year	6
B. VOC. Degree in Food Processing	3 Year	7

The suggested credits for each of the years are as follows:

NSQF level	Skill component credits	General education credits	Normal calendar duration	Exit point /awards
6 Month	18	12	One Semester	Certification in Food Processing
Year 1	36	24	Two Semesters	Diploma in Food Processing
Year 2	36	24	Four Semesters	Advanced Diploma in Food Processing
Year 3	36	24	Six Semesters	Degree in Food Processing

## Eligibility criteria for Admission

1. A candidate will be eligible to join 1st semester of B. Voc. Food Processing course, if he/she has passed 10+2 examination (Science Stream) or 10+2 vocational stream related to Food Production/Food Processing of recognized Board/university, or any other examination recognized as equivalent thereto.

2. The course of study of B. Voc. shall be divided in to six semesters and university examination will be held at the end of every semester in the months of November/December (for semester I, III & V) and May/June (for semester II, IV & VI) or as fixed by the University.

3. Semester examination will be open to regular candidates who have been on the rolls of a college affiliated to this University and meet the attendance and other requirements.

### **Vocational Educational Programme Implementation Committee (VEPIC)**

The Vocational Educational Programme Implementation Committee (VEPIC) will consist of the Principal as a Chairman, course coordinator and two faculty of the concern course/specialization as members. The Committee will monitor the smooth functioning and implementation of the B. Voc. program in Food Processing.

### **Choice Based Credit and Grading System (CBCS)**

The choice based credit and grading system has been adopted. This provides flexibility to make the system more responsive to the changing needs of our students, the professionals and society. It gives greater freedom to students to determine their own pace of study.

- Students will have to earn 30 credits for the award of Six Month Certificate in Vocation in Food Processing.
- Students will have to earn 60 credits for the award of one year Diploma in Vocation (D. Voc.) in Food Processing.
- Students will have to earn 120 credits for the award of two year Advance Diploma in Vocation (Adv. D. Voc.) in Food Processing.
- Students will have to earn 180 credits for the award of three year Bachelor Degree in Vocation (B. Voc.) in Food Processing.

### **Attendance**

Students must have 75 % of attendance in each course for appearing examination otherwise he / she will not be strictly allowed for appearing the examination of each course. However, students having 65 % attendance may request Head of the concerned Institution for the consideration of attendance on medical ground.

### **Evaluation Methods**

The assessment will be based on Continuous Internal Assessment (CIA) and End Semester examination (ESE). There shall Continuous Internal Assessment for each theory paper. In each semester, 20% (i.e. 15) marks shall be for CIA and 80% (i.e. 60) marks for ESE. Marks obtained by the student in all heads viz. CIA and ESE shall be added while declaring the final result. **Continuous Internal Assessment (CIA)**

The internal marks shall be assigned on the basis of tutorials/home assignment/seminar presentation and weekly tests/class test/ preliminary examination to be conducted by the

concerned college. These marks shall be communicated to the University before commencement of semester end examination.

### **End Semester Examination (ESE)**

- The end semester examination for General component for each theory and practical paper shall be conducted by the University at the end of each semester.
- The skill component will be conducted by NSDC.

### **Grading System**

- The grading reflects a student-own proficiency in the course. A ten point rating scale shall be used for the evaluation of the performance of the students to provide letter grade for each course and overall grade for the B. Voc. Program. Grade points are based on the total number of marks obtained by him / her in all heads of the examination of the course. The grade points and their equivalent range of marks are shown in Table-I

**Table I: Ten point grade and grade description**

<b>Letter Grade</b>	<b>Marks Obtained (%)</b>	<b>Grade Point</b>
O (Outstanding)	90-100	10
A+(Excellent)	80-89	9
A (Very Good)	70-79	8
B+(Good)	60-69	7
B (Above Average)	55-59	6
C(Average)	50-54	5
P(Pass)	40-49	4
F(Fail)	<40	0
Ab (Absent)	-	0

- Non-appearance in any examination / assessment shall be treated as the students have secured zero marks in that subject examination / assessment.
- Minimum P grade (4.00 grade points) shall be the limit to clear / pass the course / subject. A student with F grade will be considered as “failed” in the concerned course and he / she has to clear the course by appearing in the next successive semester examinations. There will be no revaluation or recounting under this system.
- Every student shall be awarded grade points out of maximum 10 points in each subject (based on 10 point scale). Based on the grade points obtained in each subject, Semester

Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and CGPA will be given at respective exit point.

### **Paper Code Description**

The course offered by the university shall have an alphanumeric course code consisting of a string of eight characters. The first two characters (BV) in a course code shall be capital letters identifying the responsible B. Voc. Degree, next two capital characters (FP) will identify the course Food Processing on which grant is sanctioned, next capital character (G) or (S) identifies General component or Skill component. The next three numerical digits give the following information. The first digit specifies the first semester of first year of the UG course. Second and third digit specifies the serial number of the general and skill development component.

## B.VOC (FOOD PROCESSING)

### SYLLABUS

<b>B.Voc.(Food Processing) Skill oriented courses</b>				
<i>NSQF level</i>	<i>Sem</i>	<i>Coode</i>	<i>Paper</i>	<i>Credit</i>
<i>Multi skill technician (Food processing) level – 4</i> QP Code-FIC/Q9007	<b>Sem – I</b>			<b>(CrTh-CrPr-TotalHr)= Total Credit</b>
		BVFPS101T&P	BASIC PRINCIPLES OF FOOD PROCESSING & PRESERVATION	(2-1-4)=3
		BVFPS102T&P	CEREAL AND PULSE PROCESSING TECHNOLOGY	(2-1-4)=3
		BVFPS103T&P	LIQUID MILK PROCESSING TECHNOLOGY	(4-1-6)=5
		BVFPS104T&P	FOOD ADDITIVES AND INGREDIENTS	(2-1-4)=3
		BVFPS105T&P	FOOD CHEMISTRY	(3-1-5)=4
				<b>Total credit = 18</b>
<i>Dairy products processor level -5</i> QP Code-FIC/Q2001	<b>Sem – II</b>			
		BVFPS201T&P	DAIRY PRODUCTS PROCESSING TECHNOLOGY	(3-2-7)=5
		BVFPS202T&P	PRINCIPLES OF FOOD ENGINEERING	(3-1-5)=4
		BVFPS203T&P	FOOD MICROBIOLOGY AND SAFETY	(3-1-5)=4
		BVFPS204T&P	INTRODUCTION TO COMPUTER APPLICATION AND STATISTICS	(1-2-5)=3
	BVFPS205P	EDUCATIONAL EXCURSION	=2	
			<b>Total credit = 18</b>	
<i>Quality assurance manager level -6</i> QP Code-FIC/Q7602	<b>Sem – III</b>	BVFPS301T	SANITATION AND HYGIENE	(2-0-2)=2
		BVFPS302T&P	MEAT, POULTRY & FISH PROCESSING TECHNOLOGY	(3-1-5)=4
		BVFPS303T&P	FRUITS AND VEGETABLE PROCESSING TECHNOLOGY	(3-1-5)=4
		BVFPS304T&P	FATS AND OILS PROCESSING TECHNOLOGY	(3-1-5)=4
		BVFPS305T&P	INSTRUMENTATION AND PROCESS CONTROL IN FOOD INDUSTRY	(3-1-5)=4
				<b>Total credit = 18</b>
	<b>Sem – IV</b>	BVFPS401T&P	FOOD LAWS, STANDARD & REGULATIONS	(3-1-5)=4
		BVFPS402T&P	BAKERY, CONFECTIONERY AND SUGAR PROCESSING TECHNOLOGY	(3-2-7)=5
		BVFPS403T&P	FOOD BEVERAGE TECHNOLOGY	(2-1-4)=3
		BVFPS404T&P	FOOD PLANT UTILITIES & SERVICES	(3-1-5)=4
		BVFPS405P	EDUCATIONAL EXCURSION	=2
			<b>Total credit = 18</b>	
<i>Production manager level- 7</i> QP Code-FIC/Q9003	<b>Sem – V</b>	BVFPS501T&P	ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT	(3-1-5)=4
		BVFPS502T&P	DOCUMENTATION IN FOOD PROCESSING	(1-1-3)=2
		BVFPS503T&P	FOOD INDUSTRY WASTE AND BYPRODUCT MANAGEMENT	(3-1-5)=4
		BVFPS504T	INDUSTRIAL SAFETY AND HAZARDS	(3-0-3)=3
		BVFPS505P	IN-PLANT TRAINING IN PRODUCT PLANT	=5
				<b>Total credit = 18</b>
	<b>Sem – VI</b>	BVFPS601T	FOOD BUSINESS MANAGEMENT	(3-0-3)=3
		BVFPS602T&P	FOOD PLANT LAYOUT & DESIGN	(3-1-5)=4
		BVFPS603T&P	FOOD PACKAGING TECHNOLOGY	(3-1-5)=4
		BVFPS604P	PROJECT	=5
		BVFPS605P	SEMINAR	=1
BVFPS606P		COMPREHENSIVE VIVA-VOCE	=1	
			<b>Total credit = 18</b>	

## DETAILED SYLLABUS

### BVFPS101T&P: BASIC PRINCIPLES OF FOOD PROCESSING & PRESERVATION

#### THEORY

##### Unit I

**Food Processing:** Scope and importance of food processing; historical developments in food processing, classification of food on basis of shelf life, pH and origin

##### Unit II

**Food spoilage:** microbial, physical, chemical & miscellaneous.

##### Unit III

**Thermal processing methods and preservation:** heat resistance of microorganisms, thermal death curve. Blanching, pasteurization, sterilization, Canning of foods, heat penetration

##### Unit IV

**Preservation by low temperature** Refrigeration, refrigeration load, refrigeration systems, Freezing and frozen storage: freezing curves, slow and quick freezing, factors determining freezing rate, freezing methods, advantages and disadvantages, changes in food during freezing, freeze drying in food processing

##### Unit V

**Moisture removal:** Evaporation, drying, dehydration and concentration, Principle, Methods, equipment and effect on quality: Drying curve, drying methods and type of dryers; physical and chemical changes in food during drying. Need and principle of concentration, methods of concentration (thermal concentration, freeze concentration, membrane concentration) changes in food quality by concentration

##### Unit VI

**Preservation by salt and sugar:** Pickling, fermentation, intermediate moisture foods

##### Unit VII

**Food Additives:** Different types of food additives (preservatives, acidulants, emulsifiers, antioxidant, leavening agents etc.) and its application in food industry

##### Unit VIII

**New and unconventional methods of preservation:** pulse electric field processing, high pressure processing, ohmic and infrared, microwave heating.

#### PRACTICALS

1. Demonstration of various machineries used in food processing.
2. To study the effect of enzymatic browning in fruits and vegetables and its prevention.
3. To study different types of blanching of fruits and vegetables.
4. Preservation of food by canning.
5. To perform cut out analysis of caned product.
6. Preservation of food by high concentration of sugar i.e. jam.
7. Preservation of food by high concentration of salt/acid i.e. pickle.
8. Preservation of food by addition of chemicals i.e. tomato ketchup.
9. Preservation of food by drying in a cabinet drier.
10. Preservation of fruits & vegetables by freezing.
11. Preservation of milk by pasteurization and sterilization.
12. Preservation of food by using acidulants i.e. pickling by acid, vinegar or acetic acid
13. Demonstration on drying of green leafy vegetables



1. Osmotic dehydration of foods e.g. candy
2. Drying of foods using freeze-drying & spray drying process.
3. Preservation of milk by condensation/concentration.
4. Preservation of food by fermentation (Sauerkraut, idli, tempeh, curd, dhokla etc.)
14. Roasting of food items.
15. Visit to any food processing industry/unit.

#### **SUGGESTED READING:**

1. Norman, N.P and Joseph, H.H.(1997). Food Science, Fifth edition, CBS Publication, New Delhi
2. Kalia M. and Sangita, S. (1996). Food Preservation and Processing, First edition, Kalyani Publishers, New Delhi.
3. Sivasankar, B. (2002): Food Processing and Preservation, Prentice Hall of India Pvt.Ltd., New Delhi.
4. Fellows, Food process technology: Principles and Technology, CRC publications.
5. Khetarpaul N. (2005). Food Processing and Preservation, Dya Publishing House , New Delhi

### **BVFP5102T&P: CEREAL AND PULSE PROCESSING TECHNOLOGY**

#### **THEORY**

##### **UNIT I**

Present status and future prospects of cereals and millets; Morphology: physico-chemical properties; Chemical composition and nutritive value

Rice: Paddy processing and rice milling: conventional milling, modern milling, milling operations, milling machines, milling efficiency, byproducts of rice milling. Quality characteristics influencing final milled products. Parboiling: rice bran stabilization and its methods; Aging of rice; Enrichment – need, methods; processed foods from rice – breakfast cereals, flakes, puffing, canning and instant rice.

Wheat: 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: Corn milling – dry and wet milling, starch and gluten separation, milling fractions and modified starches.

Barley: Malting and milling Sorghum: milling, Malting, Pearling and industrial utilization

Millets: Importance of Millet, composition, processing of millets for food uses, major and minor millets

Products and Byproduct of cereal and millets: infant foods from cereals and millets, breakfast cereal foods – flaked, puffed, expanded, extruded and shredded products, etc.

##### **UNIT II**

Present status and future prospects of legumes; Morphology of legumes; Classification and types of legumes, Anti-nutritional compounds in legumes; Methods of removal of anti-nutritional compounds, Milling of legumes: home scale, cottage scale and modern milling methods, milling quality, efficiency and factors affecting milling; problems in dhal milling industry, Soaking and germination of pulses, Cooking quality of legumes – factors affecting cooking quality, Byproduct of pulses and their value addition.

#### **PRACTICALS**

1. Determination of physical properties of cereal grains
2. Determination of chemical properties of cereal grains
3. Germination of grains
4. Studies on cooking quality of cereals (cooking time, grain elongation, etc)
5. Functional properties of different cereal flour
6. Determination of starch content of cereal
7. Study on gelatinization of starch
8. Determination of amylase content of rice
9. Determination of fat acidity of cereals
10. Phenol test for cereals

11. Determination of sedimentation value
12. Milling of cereal grains
13. Visit to milling industry
14. Determination of physical properties of legumes
15. Determination of antinutritional factors in legumes
16. Cooking quality of dhal
17. Puffing of legumes
18. Milling of legumes
19. Preparation of composite legume flour
20. Preparation of soy milk and soy paneer
21. Preparation of protein isolate
22. Preparation of quick cooking dhal
23. Visit to dhal mill

### **SUGGESTED READING**

1. Technology of Cereals, Kent NL
2. Post Harvest Technology of Cereals, Pulses and Oil seeds
3. Modern Cereal Science & Technology
4. Hand Book of Cereal Science and Technology
5. Principles of Cereal Science and Technology A. Chakravarthy Y. Pomeranz Keral Kulp Hosney RS

## **BVFP5103T&P: LIQUID MILK PROCESSING TECHNOLOGY**

### **THEORY**

#### **UNIT I**

Milk Production Management - Distinguishing characteristics of Indian and exotic breeds of dairy animals and their performance; feed resources for milk production and their nutritive values; structure and function of mammary system; milk secretion and milk let-down; milking procedure and practices for quality milk production (clean milk production)

#### **UNIT II**

History and status of dairy in India, Annual milk production and per capita availability, Five year plans and dairy development, public sector milk supply schemes, co-operative dairy organizations, Anand pattern and perspectives, milk products manufacture in private sector, National Dairy Development Board - aim and objectives, Operation Flood, Dairy problems and policies. Contribution of Verghese Kurien in Indian dairy.

#### **UNIT III**

Milk - Definition, Composition, factors affecting composition of milk, nutritive value, Physico-chemical properties of milk constituents, Physico-chemical properties of milk, microbiology of milk.

#### **UNIT IV**

Importance of market milk, Collection and transportation of milk-Organization of milk collection routes, Practices for collection of milk, preservation at farm, refrigeration, natural microbial inhibitors, lactoperoxidase system., Adulterations in milk and its detection, processing, packaging and storage. UHT sterilization, Aseptic packaging, Judging and grading of milk, Flavour defects in milk, their causes and prevention, Effect of thermal treatment on milk constituents.

#### **Unit V**

Special milk: manufacture, packaging, storage of sterilized milk, homogenized milk, soft-curd milk, flavoured milk, vitaminized milk, frozen concentrated milk, fermented milk (natural butter milk, cultured butter milk, acidophilus milk, bulgarian butter milk, Kumiss, Kefir, yoghurt), standardized milk, reconstituted milk,

recombined milk, toned milk, double toned milk, humanized milk, filled milk, imitation milk, vegetable toned milk, soya milk

### **Unit VI**

Liquid milk collection, processing, packaging and storage systems and equipment - bulk milk coolers, milk chilling units, milk reception equipment, milk tanks/silos, centrifuges, clarifiers, filtration units, cream separator, homogenizers, pasteurizers, sterilizers, packaging and filling machines

### **Unit VII**

Cleaning and sanitization of dairy equipments, CIP units, etc.; Hygienic design concepts, sanitary pipes and fittings, corrosion process and their control.

### **PRACTICALS**

1. Method for milking of dairy animals
2. Cleaning and sanitation of milking equipments
3. Method for sampling of milk
4. Microbiological tests for grading raw milk - MBRT
5. Chemical tests for grading raw milk- Platform tests of raw milk.
6. Detection of adulterants in milk
7. Determination of physical properties of milk - pH, titratable acidity of milk.
8. Determination of Moisture, fat, SNF, casein, whey proteins, total milk proteins, lactose, ash
9. Determination of phosphorus and calcium, chloride in milk.
10. Estimation of alkaline phosphatase and lipase in milk.
11. Identification and demonstration of liquid milk processing equipment, pipes and fittings
12. Preparing standardized milk as per requirement
13. Separation of fat from milk
14. Pasteurization and homogenization of milk
15. Packaging of liquid milk
16. Preparation of sterilized flavored milk, reconstituted milk/rehydrated milk, buttermilk, yogurt, Lassi
17. Campaign on clean milk production in rural area
18. Visit to chilling center and dairy plant

### **SUGGESTED READING**

1. Sukumar De. 2005. Outlines of Dairy Technology. Oxford University Press, New Delhi. H.G. Kessler. 1981. Food Engineering and Dairy Technology.
2. Adnan Y. Tamime. 2009. Milk Processing and Quality Management. Blackwell Publishing Ltd., UK.
3. Pieter Walstra, Jan T.M. Wouters, Tom J. Geurts. 2006. Dairy Science and Technology, 2nd Ed. CRC Press, Boca Raton, FL, USA.
4. Verlag A. Kessler, Fraising (F.R. Germany). Y.H. Hui. 1993. Dairy Science and Technology Handbook, Vol. I, II and III. Wiley-VCH, USA.
5. Aneja, R. P.; Mathur, B. N.; Chandan, R. C.; Banerjee, A. K., 2002, Technology of Indian Milk Products: Handbook of Procees Technology Modernization for Professionals Entrepreneurs and Scientists, Dairy India Yearbook

### **BVFPS104T&P: FOOD ADDITIVES AND INGREDIENTS**

#### **THEORY**

#### **UNIT I**

Food additives- definitions, classification and functions, Preservatives, antioxidants, colours and flavours (synthetic and natural), emulsifiers, sequesterants, humectants, hydrocolloids, sweeteners, acidulants, buffering

salts, anticaking agents, etc. - chemistry, food uses and functions in formulations; indirect food additives; toxicological evaluation of food additives. Food additives as toxicants - Artificial colours, preservatives, sweeteners; toxicants formed during food processing such as nitrosamines, maillard reaction products acrylamide, benzene, heterocyclic amines and aromatic hydrocarbons; risk of genetically modified food, food supplements, persistent organic pollutants, toxicity implications of nanotechnology in food.

## **UNIT II**

Scope of spice processing industry in India. Spices -definition. Chemical composition, uses and processing of different spices-pepper, cinnamon, turmeric, fennel, chilli, cardmom (small and big), cumin, mint, ginger cloves and fenugreek. Condiments- definition. Spice oleoresins, spice essential oils, encapsulated spices (Brief). Packaging of spices and spice products. Microbial contamination and insect infestation in spices and its control.

## **UNIT III**

Food flavours- natural and synthetic flavourings. Flavour enhancers their properties and toxicity. Flavours from vegetables, cocoa, chocolate, coffee, vanilla beans. Evaluation tests for flavours. stability of flavours during food processing, analysis of flavours, extraction techniques of flavours, flavour emulsions; essential oils and oleoresins; authentication of flavours etc.

## **UNIT IV**

Proteins, starches and lipids as functional ingredient; isolation, modification, specifications, functional properties and applications in foods and as nutraceuticals

## **PRACTICAL**

1. Determination of moisture in whole and ground spices.
2. Determination of total ash in spices.
3. Sampling and determination of extraneous matter in spices.
4. Determination of pungency rating (Scoville method) in red pepper.
5. Adulteration tests for different spices.
6. Organoleptic evaluation of flavours.
7. Identification of saffron by sulphuric – diphenylamine test.
8. Determination of cold water extract.
9. Determination of alcohol soluble extract.
10. Determination of calcium oxide.
11. Determination of volatile oil.
12. Microscopic examination of spices.
13. Detection of Argemone seeds in mustard.
14. Detection of oil soluble color.
15. Extraction of oleoresins from spices.
16. Analysis of different types of flavours such as essential oils, oleoresins, synthetic flavours, plated and dispersed spices-general tests.
17. Sensory analysis of flavours; monitoring flavours during food processing
18. Preparation of flavour emulsions and their stability
19. Study of off-flavours in different foods.
20. Extraction of flavors from various fruits and vegetables

## **SUGGESTED READING**

1. Purseglove, J.W. (1998). Spices Vol and Vol II, Longman Publicationers.
1. Tainter, D.R. And Grenis, A.T. (1993). Spices and Seasonings- A Food Technology Handbook, VCH Publisheers, Inc.
2. Merory, J. (1978). Food flavorings, Composition, Manufacture and Use, 2 edition, AVI Publishing, INC.
3. Farrel, K.T. (1985). Spices, condiments and Seasonings, AVI Publishing, INC.
4. Heath, H. B. & Reineccius, G. (1996). Flavour Chemistry and Technology. CBS Publishers & Distributors, New Delhi.

## **BVFPS105 T&P: FOOD CHEMISTRY**

### **THEORY**

#### **UNIT I:**

**Water-** Introduction to food chemistry- Definition, scope and importance, structure of water molecule, hydrogen bonding, effect of hydrogen bonding on the properties of water, moisture in foods, free water, bound water, water activity, estimation of moisture in foods, determination of moisture and water activity.

#### **UNIT II**

**Carbohydrates** Nomenclature, composition, sources, structure, reactions, functions, classification - monosaccharide, disaccharides, oligosaccharides and polysaccharides. Properties of Starch – gelatinisation, gel formation, syneresis, starch degradation, dextrinisation, retrogradation, Qualitative and quantitative tests of carbohydrates.

#### **UNIT III**

**Proteins** Nomenclature, sources, structure, functions, classification - essential and non-essential amino acids, Physical and chemical properties of proteins and amino acids, functional properties - denaturation, hydrolysis, changes in proteins during processing. Enzymes - criteria for purity of enzyme, Specificity, mechanism of enzyme action, factors influencing enzymatic activity, controlling enzyme action, enzymes added to food during processing, **Browning reaction-** Enzymatic and non enzymatic browning, advantages and disadvantages, factors affecting their reaction and control.

#### **UNIT IV**

**Fats and oils** Nomenclature, composition, sources, structure, functions, classification, essential fatty acids. Physical and chemical properties - hydrolysis, hydrogenation, rancidity and flavour reversion, emulsion and emulsifiers, saponification value, acid value and iodine value, Reichert-Meissl number, Polenske value, smoke point. Lipids of biological importance like cholesterol and phospholipids

#### **UNIT V**

**Minerals and Vitamins** Minerals and Vitamins: Sources and structures of minerals & vitamins; Effect of processing and storage of vitamins, Pro vitamins A & D; Vitamins as antioxidants.

### **PRACTICALS**

1. Determination of water activity of different food materials
2. Determination of moisture in food sample
3. Determination of Protein in food sample
4. Determination of Fat in food sample
5. Determination of Carbohydrate in food sample
6. Determination of Acidity and pH in food sample/beverages
7. Determination of total, non-reducing and reducing sugars
8. Determination of Vitamin C in food sample
9. Estimation of crude fibre in food sample
10. Analysis of lysine content in animal /vegetable sources
11. Estimation of mineral in food products
12. Estimation of Carotenoids
13. Precipitation of proteins by acid, alkali and metals.
14. Estimation of rancidity of fats.
15. Estimation of crude fibre in food sample
16. Determination of total, non-reducing and reducing sugars
17. Calculate activity of enzymes from various food samples.

## **SUGGESTED READINGS**

1. Essentials of Food & Nutrition by Swaminathan, Vol. 1 & 2
2. Food Chemistry by L. H. Moyer
3. Hand Book of Analysis of fruits & vegetables by S. Ranganna
4. Food Chemistry by Fennema
5. Chemical changes in food during processing by Richardson
6. Nutrition and Dietetics by Rose

## **BVFPS201 T&P: DAIRY PRODUCTS PROCESSING TECHNOLOGY**

### **THEORY**

#### **UNIT I**

Cream: Definition, classification, composition, nutritive value, Physico-chemical properties, manufacture of different types of cream, processing of cream; defects in cream and their prevention

Butter: Definition, composition; nutritive value, processing and production steps, overrun, butter making machines, quality testing of table butter, butter- defects, causes and their prevention, packaging and storage

Butter oil and ghee: Definition, composition, nutritive value, processing, equipment, quality tests;

#### **UNIT II**

Ice cream and frozen desserts: Definition, composition, nutritive value, role of the constituents in ice cream, types, Processing steps, equipment, quality testing, defects causes and prevention, packaging and storage.

#### **UNIT III**

Condensed and Dried milk: Definition, composition, role of milk constituents in condensed milk, manufacture of condensed milk, Heat stability and its control , uses, defects, causes and prevention of condensed milk.

Types of standards for dried milk, Role of milk constituents, Manufacture of SMP and WMP using roller and spray drying, cyclone separation, instantization, quality testing, defects, causes and prevention, packaging and storage. malted milk powder, infant milk food

#### **UNIT IV**

Cheese: Definition, composition, standards, origin and history of cheese, status and scope in India and abroad, types, manufacture of different varieties of cheese: Cheddar, Swiss, Mozzarella, Cottage, processed cheese, cheese spread and processed cheese foods; equipment, Microbiological changes during preparation ripening in cheese. Role of milk constituents and changes during manufacture and ripening in cheese. Accelerated ripening of cheese. quality defects, causes and prevention, packaging and storage.

#### **UNIT V**

Traditional Indian Dairy Products: Definitions, compositions, processing, packaging, storage, equipment and quality testing – Desiccated milk-based products-Khoa and Khoa based sweets, Heat-acid coagulated products-Channa and Channa based sweets, Paneer, Fermented products-Srikhand, dahi, Milk-based puddings/Dessert-Kheer

#### **UNIT-VI**

By-products-manufacturing and uses of Casein, sodium and calcium caseinates, casein hydrolysates, Cooprecipitates, Whey, Whey protein concentrates, Lactose, Butter milk, Ghee residue

## **PRACTICALS**

1. Process of sampling of milk products
2. Cream: Different parts of cream separators, cream separation from milk, standardization, neutralization, pasteurization of cream, chemical and microbiological examination of cream
3. Butter: Study of construction and cooperation of the power operated butter churn and butter packaging machine, manufacture of butter, examination of the quality of sodium chloride for butter making, chemical and microbiological examination of butter
4. Ghee: Study and operation of continuous ghee plant. Preparation of ghee from cream and butter. Determination of melting/slip point, moisture, B.R. Index and Baudouin Test, Acidity, R.M. value and Polenske value, Saponification value, Iodine value, Peroxide value. Detection of animal body fats and vegetable oils, Helphen Test for the presence of cotton-seed oil.
5. Preparation of ice-cream and selected frozen desserts- kulfi, sherbets/ices, Compositional analysis of ice-cream. Microbiological examination of ice-cream and other frozen desserts; SPC, coliform.
6. Preparation of condensed milk, evaporated milk, spray dried milk powder, instant milk powder, tea and coffee whitener, malted milk powder, infant milk food, Chemical and microbiological analysis of condensed and dried milk. Evaluation of bulk density and solubility index of dried milk.
7. Cheese Technology: Familiarization with equipments, accessories and standardization numericals. Study of factors affecting rennet action. Manufacture of Cheddar cheese, Mozzarella cheese, Swiss cheese, Cottage cheese, processed cheese, processed cheese spread, processed cheese food. Analysis of cheese; proximate composition. Determination of ripening index,
8. Preparation of selected Indian dairy products – Chhana, chhana based sweets, paneer, khoa, khoa based products, misti dahi, Shrikhand, kheer etc, their chemical and microbiological analysis
9. Dairy byproduct; Manufacture casein, sodium caseinate, calcium caseinate. co-precipitate, whey drinks, dried whey, whey protein concentrate, lactose, buttermilk, ghee residue, products of ghee residue,. Whey concentration by ultra filtration process. Chemical and microbiological analysis of casein , whey, dried whey, whey protein concentrates, co-precipitates and lactose, buttermilk.
10. Visit to milk product plant

## **BVFP202T&P: PRINCIPLES OF FOOD ENGINEERING**

### **THEORY**

#### **UNIT I**

Process time calculations; Sterilizers and accessories used in canning industries; Engineering aspects of pasteurizer; homogenizer, evaporators (basic principle and single-effect evaporator) and concentrators used in food industries; Seaming machine.

#### **UNIT II**

Construction of cold storage; Different types of freezers including plate contact freezer, air blast freezer, cryogenic freezing and refrigerated vans.

#### **UNIT III**

Various types of driers (basic principle and drying time) – Tray drier, roller drier, spray drier, fluidized bed drier, freeze drier and solar drier.

#### **UNIT IV**

Heat exchangers (including paraflow HEs); Extruders – Basic principles and types, Difference between single- and twin-screw extruders; Kneader; Oil expeller

## UNIT V

Liquid transport system- pipelines and pumps for food processing plants-positive displacement pumps, air-lift pumps, propeller pumps, centrifugal pumps and jet pumps.

## UNIT VI

Advanced separation processes: Dialysis, ultrafiltration, reverse osmosis, electro dialysis and membraneseperation.

### **PRACTICALS:**

1. Determination of conductivity, calorific value and filtration properties of food& water.
2. Calculation of freezing time for some typical foods
3. Determination of Textural characteristics TPA of food product
4. Study of single effect evaporator and estimation of heat/mass balance during concentration of liquid foods
5. Study of sterilizer / pasteurizers/ homogenizers
6. Study of dryers, and its efficiency
7. Visit to food processing plants.

### **SUGGESTED READINGS:**

1. Fundamentals of Food Engineering by Stanley Charm.
2. Introduction to Food Engineering - R. Paul Singh, Dennis R.
3. Fundamentals of Food Process Engineering; Toledo RT; 2nd ed, 2000, CBS Publishers.
4. Food process engineering, D.R. Heldman and R.P.Singh

## **BVFP203T&P: FOOD MICROBIOLOGY AND SAFETY**

### **UNIT-I**

Microorganisms important in food industry: Types of microorganisms, their importance in foods, classification of food borne bacteria, their morphology and distinguishing features with examples.

### **UNIT-II**

Growth of microorganisms in foods: Intrinsic (pH, moisture content, redox potential, nutrient content, antimicrobial constituents and biological structures) and extrinsic factors (temp., RH, presence and concentration of gases) governing growth of microorganisms in food.

### **UNIT-III**

Food spoilage: Chemical changes caused by microorganisms in foods (breakdown of proteins, carbohydrates, fats and other constituents during spoilage), specific microorganisms causing spoilage of milk and milk products, meat, fish, egg, cereals, fruits, vegetables and their processed products, quality defects in canned foods, sugar and confectionary products, Antimicrobial substances in milk: immunoglobulin, lactoferin, lysozymes, LP systems etc.

### **UNIT-IV**

Food fermentations: General description of fermenters, parts and their functions, different types of fermentations (static, submerged, agitated, batch, continuous). Microbial culture selection by screening methods and strain improvement. Starter cultures - definition, types, Fermentation - definition, types (acid, alcohol). Fermented foods - types, methods of manufacture for vinegar, ethyl alcohol, cheese, yoghurt, baker's yeast and traditional Indian foods.



## **PRACTICAL**

1. Study and experiments with different microscopes.
2. Measurement of microorganisms.
3. Simple staining and Gram staining.
4. Sterilization techniques and equipments.
5. Preparation of culture media.
6. Isolation of microorganisms and Enumeration.
7. Growth of bacteria - Colorimetric method - Plating method.
8. Purification of bacteria.
9. Purification of fungi.
10. Detection of sources of contamination: air, water, utensils, equipment and personnel line testing
11. Enumeration of coliforms, yeasts and molds and total viable bacteria in fruits and vegetables, Dairy products
12. Enumeration of aerobic spore forming bacteria in food sample.
13. Estimation of alcohol content in fermented product
14. Isolation and identification scheme for detection of Salmonella in foods
15. Casein hydrolysis by microorganism on SMA
16. Starch hydrolysis by microorganism using starch agar
17. Evaluation of Starter Culture by Starter Activity Test
18. Assessment of surface sanitation by swab /rinse method and assessment of personnel hygiene by hand wash
19. To study the given sample (milk) using Methylene blue reduction test (MBRT)
20. To find total viable bacteria and coliforms in water by membrane filtration technique
21. Evaluation of canned products for anaerobic spore formers
22. Spoilage of milk caused by microorganisms souring, sweet curdling, gassiness, lipolysis, ropiness, proteolysis and discoloration.
23. Detection of mastitis milks, pH, SLST, somatic cell count, chloride content, Hotis test, CAMP test. Detection and estimation of coliforms; presumptive test, rapid coliform count, IMVIC test. Estimation of microbial load in milk by SPC and Dye reduction tests-(MBRT, RRT).
24. Detection of antibiotic residues using qualitative test

## **SUGGESTED READINGS**

1. Food Microbiology, TMH, New Delhi by W C Frazier & D C Westhoff
2. Modern Food Microbiology, CBS Publication, New Delhi by J M Jay
3. Essentials of Food Microbiology, Arnold, London by John Garbutt
4. Fundamentals of Food Microbiology AVI Publishing Co. Inc., Connecticut, USA by M L Fields
5. Microbiology of foods by J C Ayres, J O Mundt, W E Sandine, W H Freeman

## **BVFP204T&P: INTRODUCTION TO COMPUTER APPLICATION AND STATISTICS**

### **THEORY**

#### **UNIT I**

Components of Computers – Hardware: Hardware elements – input devices, storage devices, processing & output devices. Block diagram of computer; Software concept

#### **UNIT II**

Microsoft Word and its applications ( in relation with Food Industry) - Font formatting, Paragraph formatting, Inserting images, auto shapes symbols, diagrams, header & footer, References, watermarks and Hyperlinks, Style

& Formatting, Mail Merge through word, Access database, Page setup, Printing a document. Concept of files and folders.

### UNIT III

MS Excel and its applications (in relation with Food Industry) - Making column chart & pie chart and chart formatting, Use of general functions & formula (autosum, using basic arithmetic operators: +, -, \*, /), Use of filter & sorting, Cell references, header & footer, page setup, use of page break preview, printing worksheets.

### UNIT IV

MS PowerPoint and its applications (in relation with Food Industry) - Creating own design, formatting objects on a slide, Use of Slide Master to control the design & formatting of a presentation, Use of Image, audio, video in the presentation, Slide show setup, slide transition, use of animation, Use of narration in presentation, Print setup & Printing handouts of a presentation.

### UNIT V

Internet & Web Applications (in relation with Food Industry)

### UNIT VI

Websites, Internet applications, Google Applications (G mail, Google search, G Drive, Google Docs) and other Email Services, Industry customer approach.

### UNIT VII

Statistics: Data and Data Types: Primary data and Secondary Data; Measures of Central Tendency: Mean, Median, Mode; Dispersion: Range, Standard Deviation, Standard error; Kurtosis, Skewness. Hypothesis Testing: Chi-square Test, Student 't' test, One Way Analysis of Variance (ANOVA).

### PRACTICAL

1. Typing practice (ability of typing without watching keyboard).
2. Use of Microsoft word and Excel with specific problem.
3. Tabular form of data presentation in computer.
4. Graphical presentation of data.
5. PowerPoint presentation
6. Opening e-mail account and its different uses
7. Problem of Mean, Median, Mode Chi-square Test, Student 't' test, One Way ANOVA

### SUGGESTED READING

1. Fundamentals of Computers by E. Balagurusamy (Author) Publisher: McGraw Hill Education (India) Private Limited
2. Ms Office 2007 in a Nutshell by S. Saxena (Author) Publisher: S.Chand (G/L) & Company Ltd
3. Computer Fundamentals Paperback – by P. K. Sinha (Author) Publisher: BPP

### BVFPS205P: EDUCATIONAL EXCURSION

### BVFPS301T: SANITATION AND HYGIENE

#### Unit I

**Sanitation and Health:** Definition, importance of sanitation, application of sanitation to food industry and food service establishments. ~~Microorganisms and their characteristics~~, control of microbial growth in food. Food contamination and spoilage, food borne diseases- Introduction, types of microbial foodborne diseases

(foodborne intoxications and foodborne infections), symptoms and prevention of some commonly occurring food borne diseases.

## **Unit II**

**Hygiene and food handling:** Purchasing and receiving safe food, food storage, sanitary procedures in food preparation, serving and displaying of food, special food operations.

## **Unit III**

**Environmental Sanitation:** Location and layout of premises, constructional details, sanitary requirements for equipments, guidelines for cleaning equipments, cleaning procedures, pest control, water supply, storage and waste disposal, environmental pollution.

## **Unit IV**

**Hygiene Practices in food industry:** Introduction, necessity, personnel hygiene, sanitary practices, management and sanitation, safety at work place.

## **Unit V**

**Sanitation regulations and Standards:** Introduction, regulatory agencies, control of food quality, local health authority. Food sanitation check lists.

## **SUGGESTED READINGS**

1. Marriott, Norman (2013), "Principles of Food Sanitation", Springer Science & Business Media Publishing.
2. Roday S, (2011) (2002), "Food Hygiene and Sanitation", McGraw Hill Publishing Company Limited.
3. H. L. M. Lelieveld, John Holah, David Napper, (2014), "Hygiene in Food Processing: Principles and Practice", Elsevier Publications.

## **BVFP302T&P: MEAT, POULTRY & FISH PROCESSING TECHNOLOGY**

### **THEORY**

#### **UNIT-I**

Introduction to meat and poultry industries; Pre-mortem selection of animals; Modern Abattoir Practices: slaughtering techniques of animal and slaughtering practices; Meat cuts and portions of meat; Inspection and grading of meat; Physico-chemical composition of muscle; Post-mortem changes in muscle; Conversion of muscle to meat.

#### **UNIT-II**

Chemical and nutritional composition of meat ; The eating quality of meat - color, water holding capacity (WHC) and juiciness, texture and tenderness, odour and taste; Meat microbiology and safety; Spoilage characteristics of meat; Endogenous and exogenous infections; Preventive (prophylaxis) measures for avoiding meat spoilage.

#### **UNIT-III**

Meat processing- comminution, emulsification, curing, smoking, cooking, ageing and tenderization; Meat products - meat emulsion, fermented meats, sausages, ham, bacon and comminuted meat products; Meat analogs; Meat storage and preservation- by temperature control (refrigeration, freezing, thermal processing), by moisture control (dehydration, freeze drying, curing, IMF meat), by microbial inhibition (chemical preservation, ionizing radiation); Packaging of meat products. Meat production, processing and consumption trends; Meat plant sanitation and waste disposal; By-products from meat industries and their utilization.

## UNIT-IV

Inspection of birds, poultry slaughter and dressing, Factors affecting quality of poultry; Classification of poultry meat; Composition and nutritional value of poultry meat; Processing of poultry meat, spoilage and control; By-product utilization.

Egg and egg products- Structure, composition and functions of eggs; Abnormalities in eggs; Functions of eggs in food products; Inspection and grading for egg quality; Preservation and safe handling of eggs; Coagulation of eggs, egg foams, egg powder and egg based products.

## UNIT-V

Fish as raw material for processing and its biochemical composition. Factors affecting the quality of product and post harvest losses. Chilling and freezing of fish and other aquatic products. Physical, chemical, microbiological and sensory changes during storage. Principles of thermal processing. decimal reduction time, thermal death time, "Z" and "F" values, 12D concept, determination of process time. Canning process for fish. Value added fish products. Hurdle technology and its application. Composition and role of muscle proteins, Factors influencing denaturation of muscle proteins. Fisheries Byproducts Technology-

## PRACTICALS

5. Physico-chemical and microbiological quality of different types of meat.
6. Canning of meat products and determination of thermal process time.
7. Preservation of meat by curing, freezing, smoking, drying and determination of shelf-life
8. Preparation of Various value added meat products
9. Estimation of nitrites/nitrates in processed meat products.
10. Estimation of Water Holding Capacity and emulsification capacity of various types of meat.
11. Physico-chemical and micro-biological quality of raw egg and their products.
12. Preservation of shell eggs by various methods
13. Studies on hygiene and sanitation in meat, poultry and egg processing plants.
14. Evaluation of meat quality
15. Evaluation of quality of eggs
16. Preparation of meat products
17. Visit to meat/poultry/egg processing plant for hands on training.

## SUGGESTED READINGS

1. Vaclavik V.A. and Christian EW, Essentials of food science; Springer International.
2. Laurie R.A., Lawrie's meat Science; Woodhead Publishing Ltd.
3. Stadelman W.J. and Cotterill O.J., Egg science and technology; CBS Publishers.
4. Pearson A.M. and Gillett T.A., Processed Meats; CBS Publishers.
5. Stadelman W.J., Olson V.M., Shemwell G.A. and Pasch S., Egg and poultry meat Processing; Elliswood Ltd.
6. Aitken A., Mackie M., Merritt S.H. and Windsor M.L., Fish Handling and Processing; Ministry of Agriculture, Fisheries and Food, Edinburgh.
7. Balachandran K.K., Post-harvest Technology of Fish and Fish Products; Daya Publ. House.

## BVFP303T&P: FRUITS AND VEGETABLE PROCESSING TECHNOLOGY

### THEORY

#### UNIT-I

Fruits and vegetables as living products: Current status of production and processing of fruits and vegetables, Composition and nutritive value of fruits and vegetables; spoilage of fruits and vegetables. Pre-packaging of fresh fruits and vegetables. Storage techniques for fresh fruits and vegetables. Primary processing: grading, sorting,

cleaning, washing, peeling, slicing and blanching, Maturity standards for storage and desirable characteristics of fruits and vegetables for processing, Supply chain management of Fruits and vegetables. Pre-cooling, Concept of evaporating cooling, conditions for transportation and storage.

#### **UNIT-II**

Introduction to dehydration techniques of Fruits and Vegetables: Tray drying, vacuum drying, foam mat drying, fluidized bed drying. spray drying, freeze drying, microwave drying, heat pump drying, osmotic dehydration. Technology of dry nuts. Physical and chemical changes in food during drying and dehydration. Quality of dried products.

#### **UNIT-III**

Principles of Thermal processing- review. Process of blanching, Canning and bottling, Effect of canning and bottling on nutritive value, spoilage of canned foods, detection and control. UHT processing: Aseptic processing and packaging.

#### **UNIT-IV**

Juice extraction and clarification, preparation of syrups, and chemical preservation Products processing: squashes, cordials, nectars. Principle of jel formation - Jam, jelly, marmalade and defects in manufacturing, fortified fruit drinks, Candies; chutneys; fruit juice concentrates and powders; Tomato product: sauce and ketchup, Cut fruits and vegetable, fruit toffee,

#### **UNIT-V**

Preservation by fermentation- Definition, Advantages, disadvantages, Types of fermentation, equipments. Pickles making and Vinegar; Fruit wine. Irradiation applications for fruits and Vegetable. Minimally processed fruits and vegetables, Emerging technologies for fruits and vegetables processing technologies: Hurdle technology, Ozone application and ultrasound.

#### **PRACTICALS**

1. Estimation of sugar-acid ratio of fruits
2. Evaluation of washer and grader
3. Testing of adequacy of blanching
4. Pectin determination in fruits and vegetable products.
5. Preparation fruit juices and concentrates
6. Canning of fruits and vegetables
7. Preparation of jams and jellies, marmalade, preserves and candies
8. Preparation of pickles, chutneys
9. Preparation of tomato products
10. Drying of fruit and vegetables
11. Processing of mushrooms.
12. Visit to fruits and vegetable processing industries

#### **SUGGESTED READINGS:**

1. Cruess W.V. 2000. Commercial Fruit and Vegetable Products. Agrobios.
2. MirceaEnachescaDanthy. 1997. Fruit and Vegetable Processing. International Book Publ.
3. Srivastava R.P and Sanjeev Kumar. 1994. Fruit and Vegetable Preservation. Principles and Practices. International Book Distr.
4. Sumanbhatti and Uma Varma. 1995. Fruit and Vegetable Processing. CBS.
5. Thompson A.K. 1996. Post Harvest Technology of Fruits and Vegetables. Blackwell.
6. Verma L.R and Joshi V.K. 2000. Post Harvest Technology of Fruits and Vegetables. Vols. I-II. Indus Publ.

# **BVFPS304T&P: FATS AND OILS PROCESSING TECHNOLOGY**

## **THEORY**

### **UNIT-1**

What is fat - Importance - chemical composition of fats. Triglycerides - their structure and composition - mono and diglycerides - free fatty acids - phosphatides- sterols, fatty acid alcohols - tocopherols.

### **UNIT-2**

Factors affecting physical characteristics of fats and oils - chemical reactions of fats and fatty acids, stability of oils and fats. Important characteristics of oils from coconut, cotton seeds, palm, sunflower, sesame, safflower, rice bran, rape seed, mustard, linseed, soybean, castor and lard.

### **UNIT-3**

Processing techniques - Degumming, refining, bleaching, deodorizing, fractionation, hydrogenation, inter-esterification and esterification. Alternative methods for extraction and processing of oils.

### **UNIT-4**

Common products preparation - Salad and cooking oils, shortenings (baking and frying fats), hard butters, margarine and spreads, dressings for food (Mayonnaise and Salad dressings, pourable - type dressings, reduced calorie dressing), toppings, coffee whiteners, confectionaries coatings, low - fat spreads for traditional breakfast foods etc.

### **UNIT-5**

Value added products from vegetable oil refining industry like lecithin, wax, Vitamin-E, oryzanol. Value added products from non-traditional oils and fat. By-products from bran oil and oil refining industry, utilization of lingo cellulosic waste from oil industry, bakery fats with zero trans fatty acids.

## **PRACTICALS**

Common Test methods for **Fats** -

1. Cold Test
2. Colour, (Lovibond)
3. Dropping point
4. Flavour
5. FFA
6. Melting Point
7. Oil stability index
8. Peroxide Value
9. Solid fat index
10. Solid fat content
11. Total lipids and thiobarbituric and reactive substances (TBARS)
12. Karl-Fischer' titration- application.

### **Oilseeds**

13. Experimental expeller processing
14. Experimental solvent extraction
15. Production of protein concentrates and isolates.
16. Lab model hydrogenator (for hydrogenation of vegetable oils).
17. Visit to oil mills

## **SUGGESTED READINGS**

1. Bailey's industrial oils and fat products, D. Swern, Wiley - Inter Science, Publications, New York
2. Food lipids B.B. Min, C,C Akoh, 1998- Marcel, Decker.
3. Food Lipids and Health Decker D.B. Min, RE McDonald, 1996
4. Food lipids: chemistry, nutrition, and biotechnology, by Casimir C. Akoh, David B. Min.
5. Introduction to Fats and Oils Technology, 2nd Edition, by Editor:, Richard D. O'Brien, Walter Farr, and Peter J. Wan, ISBN:, 978-1-893997-13-4. AOCS publication

## **BVFPS305T&P: INSTRUMENTATION AND PROCESS CONTROL IN FOOD INDUSTRY**

### **THEORY**

#### **UNIT I**

Introduction, definitions, characteristics of instruments, static and dynamic characteristics

#### **UNIT II**

Temperature and temperature scales; Various types of thermometers; thermocouples, resistance thermometers and pyrometers

#### **UNIT III**

Pressure and pressure scales, manometers, pressure elements differential pressure

#### **UNIT IV**

Liquid level measurement, different methods of liquid level measurement, flow measurement, differential pressure meters, variable area meters

#### **UNIT V**

Weight measurement: Mechanical scale, electronic tank scale, conveyor scale

#### **UNIT VI**

Transmission: Pneumatic and electrical, Control elements: control actions, pneumatic and electrical control systems

#### **UNIT VII**

Process control: Definition, simple system analysis, dynamic behavior of simple process, Laplace transform, process control hardware

#### **UNIT VIII**

Frequency response analysis, characteristics, Bode diagram and Nyquist plots and stability analysis

#### **UNIT IX**

Controllers and indicators: Temperature control, electronic controllers, timers and indicators, discrete controllers, adaptive and intelligent controllers

#### **UNIT X**

Computer-based monitoring and control: Importance, hardware features of data acquisition and control computer, signal interfacing, examples in food processing

#### **UNIT XI**

Introduction of 8051/8085 based system and applications in processing

### **PRACTICALS:**

1. Study on instrumentation symbols;
2. Study of P&I diagram and flow sheet diagrams in instrumentation.
3. Study of characteristics of Pressure transducers
4. Real-time study of Pressure transducers characteristics with PC
5. Study of Pressure Control by s On/Off Controller
6. Study of characteristics of IC temperature sensor
7. Study of characteristics of Thermocouple.
8. Study of characteristics of Platinum RTD
9. Study of Temperature controlled alarm system
10. Study of Data logger
11. Study of 8051 based programming examples.
12. Study of Programmable Logic Controllers (PLC) Hardware
13. Study of Programmable Logic Controllers (PLC) Ladder programming,
14. To study PLC based control of Multiprocess system
15. Study of various transducers for measurement of pressure ,temperature, flow, combinely
16. Visit to food processing plant and dairy industry.

### **SUGGESTED READING**

1. Bela G. Liptak. 2003. Instrument Engineer's Handbook, Vol. I and II, 4 th Ed. CRC Press, Boca Raton,FL, USA.
2. Curtis D. Johnson. 2003. Process Control Instrumentation Technology, 7 th Ed. Prentice Hall of India Pvt. Ltd., New Delhi.
3. D.V.S. Murty. 2004. Transducers and Instrumentation. Prentice Hall of India Pvt. Ltd. New Delhi.

### **BVFPS401T&P: FOOD LAWS, STANDARD & REGULATIONS**

#### **THEORY**

#### **UNIT-I**

Introduction, concept of total quality control and quality assurance, concept of food safety and standards (FSSAI), food safety strategies. Food hazards and contaminations - biological (bacteria, viruses and parasites), chemical (toxic constituents / hazardous materials) pesticides residues / environmental pollution / chemicals) and physical factors. Preventive food safety systems - monitoring of safety, wholesomeness and nutritional quality of food. Prevention and control of microbiological and chemical hazards. Food safety aspects of novel methods of food processing such as PEF, high pressure processing, thermal and non thermal processing, irradiation of foods.

#### **UNIT-II**

Indian and Food Regulatory Regime (Existing and old), PFA Act and Rules, Food Safety and Quality Requirements, Additives, Contaminants and Pesticide Residue. Food Safety and Standards Act, 2006, Essential Commodities Act, 1955, Global Scenario, Codex Alimentarius, WHO/FAO Expert Bodies (JECFA/JEMRA/JMPR) WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR). Food safety inspection services (FSIS) and their utilization. Legal Metrology act, Weight and Measurement act, Introduction to Factory Act.

#### **UNIT-III**

Introduction to OIE and IPPC, Other International Food Standards (e.g. European Commission, USFDA etc). WTO: Introduction to WTO Agreements: SPS and TBT Agreement, Export and Import Laws and Regulations, Export (Quality Control and Inspection) Act, 1963.

Customs Act and Import Control Regulations, Other Voluntary and mandatory product specific regulations, Other



Voluntary National Food Standards: BIS Other product specific standards; AGMARK. Nutritional Labeling, Health claims.

#### **UNIT-IV**

Risk assessment studies: Risk management, risk characterization and communication.

#### **UNIT-V**

Voluntary Quality Standards and Certification GMP, GHP, HACCP, GAP, Good Animal Husbandry Practices, Good Aquaculture Practices ISO 9000, ISO 22000, ISO 14000, ISO 17025, PAS 22000, FSSC 22000, BRC, BRCIOP, IFS, SQF 1000, SQF 2000. Role of NABL, CFLS. Halal & Kosher Standard.

#### **UNIT-VI**

Food Adulteration: Laws governing food standards, significance – PFA, FPO, ISI, Agmark, Meat Products order, Codex Alimentations. Common adulterants in food and their effects on health, common adulterants in food and their effects on health, common household methods to detect adulterants in food.

#### **PRACTICAL**

1. Licensing and registration process
2. Examination of Cereals as per specifications
3. Examination of milk and milk products as per specifications
4. Examination of Oil and Oil products as per specifications
5. Examination of fruits and vegetable products as per regulations
6. Visit to FDA department

#### **SUGGESTED READINGS**

1. Singal RS, Handbook of indices of food quality and authenticity; Woodhead Publ. Cambridge, UK.
2. Shapton DA, Principles and practices of safe processing of foods; Butterworth Publication, London.
3. Winton AL, Techniques of food analysis; Allied Science Publications New Delhi.
4. Pomeranze Y, Food analysis - Theory and Practice; CBS Publications, New Delhi.
5. Jacob MB, The chemical analysis of foods and food products; CBS Publ. New Delhi
6. FSSAI website: [www.fssai.gov.in](http://www.fssai.gov.in)

### **BVFP402T&P: BAKERY, CONFECTIONERY AND SUGAR PROCESSING TECHNOLOGY**

#### **THEORY**

##### **UNIT-1**

Global Status of bakery and confectionery industry. Review of raw materials and quality parameters of wheat flour, flour standards; dough development; methods of dough mixing; dough chemistry, rheological testing of dough-Farinograph, mixograph. Extensograph, Amylograph/ Rapid- visco analyzer, Falling number, Hosney's dough stickiness tester and interpretation of data.

##### **UNIT-2**

Bread: various methods of production and effect of various formulations and process parameters on quality. Staling of bread, losses during manufacture and methods to control them; machinery used in bakery industry, multigrain bread, gluten free products, traditional bakery products, shelf life.

Biscuits and Cookies: Ingredients and flour specification; types of biscuits, doughs -developed doughs, short doughs, semi-sweet, enzyme modified doughs and batters importance of the consistency of the dough.

### **UNIT-3**

Cakes: Flour specifications-, ingredients, manufacturing process and quality evaluation. Preparation of other bakery products - rusks, crackers, buns, muffins, pizza; raw materials, methods of production, quality parameters.

Confectionery manufacture: Raw materials used in the confectionery manufacturing and processing industry - including quality control methods. Cocoa, Sugar, Dried milk products, Special fats, Emulsifiers, Nut kernels. Production of cocoa liqueur from the cocoa bean, Dark, milk and white chocolate, manufacturing processes.

### **UNIT-4**

Chocolate Processing Technology : Compound coatings and candy bars; tempering technology, chocolate hollow figures, chocolate shells, enrobing technology, manufacture of candy bars, Presentation and application of vegetable fats; production of chocolate mass.

### **UNIT-5**

Sugar Confectionery manufacture: General technical aspects of industrial sugar confectionery manufacture, Manufacture of high boiled sweets-Ingredients, Methods of manufacture- Types-Center-filled, lollipops, coextruded products. Manufacture of gums and jellies-Quality aspects

Manufacture of Miscellaneous Products: Caramel, Toffee and fudge-Liquorice paste and aerated confectionery, Lozenges, sugar panning and Chewing gum, Countlines-Quality aspects

### **UNIT 6**

Equipment used in bakery and confectionary industry: Construction and working of various equipments like Mixers, proofing chambers, dough dividers, moulder and sheeter, baking ovens, cooling chamber, sealing and packaging machines, Rolling and cutting machines.

### **UNIT 7**

Bakery Plant - Layout, setting up of units and hygienic conditions, operation and maintenance.

### **UNIT 8**

Sugarcane and sugarbeet as sugar raw materials. Flow charts for manufacture of Granulated sugar and Liquid sugars. Properties of Granulated sucrose and Liquid Sugars. Invert sugar and their characteristics. Speciality products of Sugar Industry. Back strap Molasses and its uses. Applications in animal feed

### **UNIT 9**

Sugar production processes: Extraction of juice, extraction yields, drying and uses of Bagasse, Purification of juices-Juice filtration and chemical purification, Clarification stages, Lime addition, pH control, Treatment of clarified juice, evaporation –multiple effect evaporators, Vacuum pans, Crystallization, Washing of sugar crystals and centrifugal separation/dewatering of sugar and other related processes. Sugar Refining, Sugar analysis, Sugar recovery –improvement, Sugar balance, energy conservation, Sugar plant sanitation.

### **PRACTICAL**

1. Quality assessment: Flour (Maltose Number, Water Absorption, Sedimentation value, Alcohol Acidity), yeast, water, leavening agents.
2. Dough characteristics - determination of gluten.
3. Manufacturing of bread (sandwich bread, milk bread) and its sensory evaluation.
4. Preparation and quality evaluation of nan khatai
5. Manufacturing of Cookies and its sensory evaluation.
6. Manufacturing and sensory evaluation of Rusk.
7. Manufacturing and sensory evaluation of cakes and pastries.
8. Preparation of melting marvels
9. Preparation of sweet and salt biscuits
10. Preparation of pizza
11. Manufacturing of milk and dark chocolate and its sensory evaluation.
12. Preparation of different varieties of candies and its sensory evaluation.
13. Preparation of Fudge, Caramel, Fondant Jellies and its sensory evaluation.
14. Farinographic and Extensographic studies
15. Identification of types of confectioneries, sugar cookery.
16. Effect of syrup consistency and temperature on the quality characteristics of hardboiled sweets
17. Manufacture of chocolate, toffee, fruit drops, fruit toffees, candies and preservers.
18. Visit to bakery and confectionery plants.
19. Determination of sugar content in juice.
20. Determination of reducing and non reducing sugars in sugar product.
21. To study the equipments related to sugar manufacturing.
22. To determine ash content of sugar product.
23. To determine moisture content of sugar product.
24. To estimate acidity and TSS of sugar product

### **SUGGESTED READINGS**

1. Samuel A. Matz , Bakery Technology and Engineering ,Chapman and Hall
2. A Bent, E B Bennion, G S T Bamford , The technology of cake making, Blackie-Academic and Professional
3. Duncan J R Manley, Technology of Biscuits, Crackers, and Cookies, Ellis Horwood Ltd.
4. William Sultan Bakery Engineering and Technology, Practical baking, Matz. SA.
5. EB Jackson, Sugar Confectionery Manufacture, Aspen publishers Inc., Great Britain.

### **BVFP403T&P: FOOD BEVERAGE TECHNOLOGY**

#### **THEORY**

#### **UNIT I**

Introduction to beverages: Types of beverages and their importance, status of beverage industry in India, Manufacturing technology for juice-based beverages, synthetic beverages; technology of still, carbonated, low-calorie and dry beverages, isotonic and sports drinks; role of various ingredients of soft drinks, carbonation of soft drinks

#### **UNIT II**

Manufacturing process of beverages: Beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, Dairy-based beverages.

#### **UNIT III**

Types of coffee and tea: Chemical composition and processing of tea and coffee and their quality assessment. Types of tea: black tea, green tea, oolong tea. Types of coffee: Vacuum coffee, drip coffee, iced coffee. Espresso coffee, instant coffee. Decaffeination of Coffee types of decaffeination: Roselius method, swiss water process, direct and indirect method, triglyceride method, carbon dioxide method.

#### **UNIT IV**

Alcoholic beverages: Types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipments used for brewing and distillation, wine and related beverages, distilled spirits.

## **UNIT V**

Packaged drinking water: Definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water.

## **PRACTICAL**

1. Chemical and microbiological analysis of raw water quality;
2. Preparation of regional fruit juices;
3. Preparation of whey-based beverages;
4. Preparation of crush, nectar, blended juice
5. Preparation of soy milk, fruit milkshakes, herbal beverages;
6. Visit to relevant processing units.

## **SUGGESTED READINGS :**

1. Srivastava RP & Kumar S. 2003. Fruit and Vegetable Preservation - Principles and Practice International Book Distributors.
2. Hardwick WA. 1995. Handbook of Brewing. Marcel Dekker.
3. Hui YH. et al 2004. Handbook of Food and Beverage Fermentation Technology. Marcel Dekker.
4. Priest FG & Stewart GG. 2006. Handbook of Brewing. 2nd Ed. CRC.
5. Richard P Vine. 1981. Commercial Wine Making - Processing and Controls. AVI Publ.

## **BVFPS404T&P: FOOD PLANT UTILITIES & SERVICES**

### **THEORY**

#### **UNIT I**

Introduction: Classification of Various Utilities and Services in food Plant/ industry. Commercial energy Pricing

#### **UNIT II**

Electrical System: Introduction to electric power supply systems, electrical billing, electrical load management & maximum demand control, power factor improvement & benefits, transformers, system distribution losses, harmonics, trouble shooting of electrical power system

#### **UNIT III**

Electrical Motors: Types, losses in Introduction motor, motor efficiency, factors affecting motor performers, performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors

#### **UNIT IV**

Compressed air system: Requirement, types, compressor efficiency, efficient compressor operation, compressed air system components, capacity assessment, leakage test, factors affecting the performance & efficiency

#### **UNIT V**

HV AC & Refrigeration system: Requirement, vapor compression refrigeration cycle, refrigerants, coefficient of performance, capacity, factors affecting refrigeration & air conditioning system performance & saving opportunities.

Vapor absorption refrigeration system: Working principle, types & comparison with VCR system, saving potential

#### **UNIT VI**

Fans and blowers: Requirement, types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities

#### **UNIT VII**

Pumps and pumping systems: Requirement, types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities

#### **UNIT VIII**

DG set system: Requirement, introduction, factors affecting selection

#### **UNIT IX**

Fuels and combustion: Introduction to fuels; properties of fuel oil, coal & gas; storage; handling & preparation of fuels; principles of combustion, combustion of oil, coal & gas; draft system

#### **UNIT X**

Boilers: Boiler specification, Indian boiler regulation, system components, types, combustion in boilers, performance terms, analysis of losses, feed water treatment, blow down, energy conservation opportunities

#### **UNIT XI**

Steam system: Properties of steam, assessment of steam distribution losses, steam leakage, steam trapping, condensate and flash steam recovery system, opportunities for energy savings

#### **UNIT XII**

Waste heat recovery: Classification, advantages and application, commercially viable waste heat recovery: devices, saving potential

#### **UNIT XIII**

Other utilities & services: Lighting, CIP system, waste water/drainage, water treatment, dust removal, fire protection and maintenance system

#### **PRACTICAL**

1. Study on energy basic, types, forms, terms and measuring instruments used in food plant utilities.
2. Study on plant's electrical power supply system, billing and load estimation.
3. Motors and variable speed drives specification, selection, performance terms & definitions.
4. Study on compressed air system components and performance terms & definitions.
5. Study of refrigeration & HVAC system components, performance terms & definitions and load estimation of a plant.
6. Study of fans and blowers, types, specification, performance terms & definitions.
7. Pumps types, specification, selection, performance terms & definitions.
8. Study on plant lighting system and their components.
9. Study on DG system their specification and selection.
10. Study on combustion of oil, gas & coal.
11. Study on fuel substitution.
12. Study on boiler performance terms and assessment.
13. Study on cost of steam
14. Study on waste heat recovery devices

[Recuperates, Regenerators, Heat wheel, Heat pipes, Economizers, Heat exchanger (Shell and tube, PHE, run around coil exchanger, direct contact HX), Waste heat recovery boilers, Heat pumps and Thermocompressor].

15. Study on CIP' system components.
16. Study on fire control operations and use of fire extinguisher.
17. Study of water treatment plant.
18. Study of effluent treatment plant.

### **SUGGESTED READING**

1. Energy Efficiency and Management in Food Processing Facilities, by Lijun Wang. Published by CRC Press, 2008
2. Energy-saving Techniques for the Food Industry by M. E. Casper. Published by Noyes Data Corp., 1977
3. Chilton's Food Engineering. Published by Chilton Co., 1979
4. A Survey of Water Use in the Food Industry by W. E. Whitman, S. D. Holdsworth. Published by British Food Manufacturing Industries Research Association.

### **BVFPS405P: EDUCATIONAL EXCURSION**

#### **BVFPS501T&P: ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT**

##### **UNIT-I**

**Instructions for the examiner:** The examiner will set nine questions in all. All questions will carry equal marks. Q. No. 1 which will be objective/short answer type covering the entire syllabus, will be compulsory. The remaining questions will be set section wise with questions 4 from each section. Each question should be divided into parts & the distribution of marks be indicated part wise

##### **UNIT-II**

**Instructions for the candidates:** The candidates will be required to attempt Q. No. 1 & four others selecting 2 questions from each section. As far as possible the question will be of short answer type.

##### **UNIT-III**

**Entrepreneurship:** Definition of Entrepreneur, Internal and External Factors, Functions of an Entrepreneur, Entrepreneurial motivation and Barriers, Classification of Entrepreneurship, Theory of Entrepreneurship, Concept of Entrepreneurship, Development of entrepreneurship; Culture, stages in entrepreneurial process

##### **UNIT-IV**

**Creativity and Entrepreneurial Plan:** Idea Generation, Screening and Project Identification, Creative Performance, Feasibility Analysis: Economic, Marketing, Financial and Technical; Project Planning: Evaluation, Monitoring and Control segmentation. Creative Problem Solving: Brainstorming, Synectics, Value Analysis, Innovation.

##### **UNIT-V**

**Institutional support for new food ventures:** Supporting Organizations; Incentives and facilities; Financial Institutions and Small scale Industries, Govt. Policies for SSIs.

##### **UNIT-VI**

**Managerial aspects of small Business:** Principles of Management (Definition, Function of management viz planning, Organisms, coordination, and control Operational Aspects of Production. Basic principal of financial management. Marketing techniques. Personnel and Inventory Management. Importance of communication in business

##### **UNIT-VII**

**Production management:** plant location and layout, production planning and control. marketing challenges and approaches for new products and services.. Agricultural sector and food processing industry problems and opportunities, Standard related to food industry

##### **UNIT-VIII**

**Legal Aspects of small Business:** Elementary Knowledge income tax, sales tax, excise rules, factory act and payment of wages act.

## **PRACTICALS**

1. Overview of present status of food industries in India
2. Overview of management databases
3. Market Survey, Consumer survey to identify new products
4. Layout for different types of food industries.
5. Methods for economic analysis and profitability analysis of food plant
6. Data collection of materials and processes.
7. To study the essential elements of TQM.

## **SUGGESTED READING**

- 1 Holt (1990) Entrepreneurship, New Venture Creation, Prentice-Hall
- 2 Dollinger M J (1999) Entrepreneurship, Prentice-Hall
3. Singh B.P., Management Concepts & Practices, Dhanpat Rai & sons, Nai Sarak, Delhi.
4. Naidu NVR and Krishna Rao T (2009). Management and Entrepreneurship, I.K. International Pvt. Ltd.
5. Dwivedi R.S. Management – An Integrated Approach, National Publishing Co., Delhi.

## **BVFP502T&P: DOCUMENTATION IN FOOD PROCESSING**

### **THEORY**

#### **UNIT-I**

Introduction to documentation in food industry, documentation and inspection of raw material in food industry.  
Methods of documentation for raw material to finished product.

#### **UNIT-II**

Familiarization with the application of computer in some common food industries : milk plant & fruits vegetable plants, starting from the receiving of raw material up to the storage & dispatch of finished product. Statistical analysis in food industry- application of mean, median and standard deviation in food industry.

#### **UNIT-III**

Introduction and implementation of ERP, application of ERP in food industry, Essential guidelines of ERP in food processing industries.

#### **UNIT-IV**

Documentation of finished product detail - name of the product, batch number, time of packing, date of manufacture, date of expiry, other label detail, primary, secondary and tertiary packing material for finished product, storage conditions.

## **PRACTICALS**

1. Problem solving using spread sheet and word.
2. Use of statistical package for analysis of data
3. Application of ERP demonstrated with suitable food product.
4. Familiarization with software related to food industry.
5. Visit to industries and Knowledge of computer application in food industry.
6. Actual presentation of report in seminar.
7. Documentation of any food product along with relevant labeling.

## **SUGGESTED READING**

1. K.T.Patel and N.P Chotai, Apr-jun, 2011, Documentation and record: Harmonized GMP requirement, v(3).
2. Tufan Koc, 7 May 2007, The impact of ISO 9000 quality management system on manufacturing, Vol.186(1):207-213,
3. Inka Heidi Vilpola, 20 feb 2008, page 47-76, A Method for improving ERP implementation success by the principle and process of user centred design.
4. A Rockley, 1987, Proceedings of the 34th International Technical, Online documentation: from proposal to finished product
5. Axel Röder, Bernd Tibken 16 March 2006, Pages 1010–1029, A methodology for modeling inter-company supply chains and for evaluating a method of integrated product and process documentation, Volume 169, Issue 3, , Pages 1010–1029.

## **BVFPS503T&P: FOOD INDUSTRY WASTE AND BYPRODUCT MANAGEMENT**

### **THEORY**

#### **UNIT-I**

Introduction : Sources of waste and pollutants, Classification and characterization of Solid, Liquid and Gaseous wastes, such as wastes from fruit and vegetable and treatment of solid wastes from agro wastes. India -nature of different waste - Waste utilization from rice mill- Thermal and biotechnological use rice husk-cement preparation and different thermal application - utilization of rice bran-stabilization-defatted bran utilization.

#### **UNIT-II**

Utilization of Fruit and Vegetable Wastes: Types Of Waste And Waste Generation in Different Food Processing Industries: Concept, scope and importance of waste management and effluent treatment Temperature, pH, Oxygen Demands (BOD, COD), Measurement of levels of Pollution such as COD, BOD, TOD, fat, oil and grease content, metal content, forms of phosphorus and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues. Processes for waste utilization from fruit and vegetable industries - Distillation for production of alcohol - oil extraction from waste - waste management in sugar mills - citric acid production from fruit waste, extraction of active ingredients from fruit waste.

#### **UNIT-III**

Fish, Meat and Poultry And Tuber Crops Waste Utilization: Fish Industry by products and Waste utilization-meat and poultry waste recycling. Waste from tuber crops - effluent safe disposal- effluent treatment plant - waste recycling plant - feasibility report for food industries using food waste and by products.

#### **UNIT-IV**

By-Products Utilization of Wheat and Pulse Mill: By products of wheat milling- germs and bran - by products of pulses milling - husk, germs and broken. Coconut processing - by-product utilization - fuel briquette.

#### **UNIT-V**

Biodegradability : Concept of biodegradability, Criteria of Pollution, Physical Chemical and Biological properties, Soluble, suspended and volatile solids. Ammonia Nitrogen and Biological indicator. BOD Dilution test and mathematical model for BOD curve. Typical Case Studies: Characterization and treatment of liquid wastes from Dairy, Slaughter house etc. Process of anaerobic bio-methanation, Conventional aerobic process, Aerated lagoon, Strategies for utilization of Biomass residues after fruit/food processing. Animal and community waste. Landfill and composting. Environmental protection act and specifications for effluent of different food industries, waste Utilization, Effluent treatment, Pre-treatment of waste : sedimentation, coagulation, flocculation and floatation, Secondary treatments: Biological oxidation-trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons, Tertiary treatments: Advanced waste water treatment process-sand, coal and activated carbon filters, phosphorus, sulphur, nitrogen and heavy metals removal.

### **PRACTICAL**



1. Waste characterization : Temperature, pH, thermal conductivity, solids content, turbidity, BOD, COD, estimation of break point chlorination, ammonia removal from waste, effect of lime treatment on waste water in respects of BOD, COD, solids content, phosphate content, demonstration of waste utilization in various industries.
2. Identification of useful products from food and agricultural waste
3. Extraction of leaf proteins
4. Alcohol production from molasses
5. Extraction of banana fiber
6. Use of crop residues for the production of cellulose
7. Use of mango kernels for starch manufacture
8. Pectin from organic waste
9. Rice bran utilization for edible grade oil extraction
10. Extraction of volatile oils from organic waste
11. By-Products utilization of poultry, fish, meat milk, cereals, pulses and seed wastes from agro processing industries.
12. Estimation of Water portability and acceptable parameters
13. Characterization of industrial effluents for pH, TS, TDS, TSS, alkalinity and hardness parameters.
14. Evaluation of population potential of waste materials as Biochemical Oxygen Demand (BOD).
15. Determination of chemical oxygen demand (COD) in various effluents.
16. Water treatment using microbes

#### **SUGGESTED READINGS:**

1. Green and Krammer, Food Processing Work Management ; CBS Publication
2. Mariett NG, Principles of Food Sanitation; CBS Publication
3. Lawrence K.Wang, Yung-Tse Hung Howard H.Lo, Waste Treatment in the Food Processing Industry; Constantin Yapijakis : CRC Taylor and Francis group, Boca Raton London, New York
4. Metcalf and Eddy, Waste Water Engineering Treatment Disposal and Reuse; Tata McGrawHill Book company NY
5. GN Pandey and GC Carney, Environmental Engineering; Tata McGraw Hill Pub Co Ltd. New Delhi.

#### **BVFPS504T: INDUSTRIAL SAFETY AND HAZARDS**

##### **UNIT-I**

Origin of process hazards, Laws Codes, Standards, Case Histories, Properties of Chemicals, and Health hazards of industrial substances.

##### **UNIT-II**

Toxicology :Toxic materials and their properties, effect of dose and exposure time, relationship and predictive models for response, Threshold value and its definitions, material safety data sheets, industrial hygiene evaluation.

##### **UNIT-III**

Fire & explosion: Fire and explosion hazards, causes of fire and preventive methods. Flammability characteristics of chemical, fire and explosion hazard, ration of process plant.

##### **UNIT-IV**

Propagation of fire and effect of environmental factors, ventilation, dispersion, purifying and sprinkling, safety and relief valves.

##### **UNIT-V**

Other Energy Hazards: Electrical hazards, noise hazard, radiation hazard in process operations, hazards communication to employees, plant management and maintenance to reduce energy hazards.

#### **SUGGESTED READING**

1. Crawl D.A. And Louver J.A.,2001 "Chemical Process Safety Fundamentals With Applications" Prentice Hall

2. Wentz, C.A, 2001 . "Safety Health And Environmental Protection," Mcgraw Hill
3. Smith,B.D,2001 "Design Of Equilibrium State Process, "Mcgraw Hill.
4. Sanjoy Banerjee. 2002. Industrial Hazards and Plant Safety by Amazon Publisher.

## **BVFPS505P: IN-PLANT TRAINING IN PRODUCT PLANT**

### **BVFPS601T: FOOD BUSINESS MANAGEMENT**

#### **UNIT I**

Business Management: introduction, theories and functions, food industry management, marketing management and human resource development, personal management. Sectors in food industry and scale of operations in India.

#### **UNIT II**

Human Resource Management: Study the basics about HR and related policies and capacity mapping approaches for better management.

#### **UNIT III**

Consumer behavior towards food consumption, Consumer Surveys by various Institutes and Agencies, various journals on consumer behavior and market research, internet based data search.

#### **UNIT IV**

International trade: basics, classical theory, theory of absolute advantage, theory of comparative modern theory, free trade- protection, methods of protection, quotas, bounties, exchange control, devaluation, commercial treaties, terms of trade, balance of payments, Exim policy, foreign exchange, mechanics of foreign exchange, GATT, WTO, role of WTO. International trade in agriculture. World trade agreements related with food business, export trends and prospects of food products in India.

#### **UNIT V**

World consumption of Food: patterns and types of food consumption across the globe. Ethnic food habits of different regions. Govet. Institutions related to international ad trade; APEDA, Tea board, spice board, wine board, MoFPI etc. management of export import organization, regristration, documentation, export import logistics, case studies. Export and import policies relevant to horticultural sector.

### **SUGGESTING READING**

1. Chhabra TN & Suria RK. 2001. Management Process and Perspectives. Kitab Mahal.
2. Jhingan ML. 2005. International Economics. 5th Ed. Virnda Publ.
3. Kotler P. 2000. Marketing Management. Prentice Hall.
4. Reddy SS, Ram PR, Sastry TVN & Bhavani ID. 2004. Agricultural Economics. Oxford & IBH.

### **BVFPS602T&P: FOOD PLANT LAYOUT & DESIGN**

#### **THEORY**

#### **UNIT I**

Introduction: Definition, Basic concepts of plant layout and design with special reference to food process industries. Application of HACCP concept, ISO, FPO & MPO requirements in food plant layout and design.

#### **UNIT II**

Plant Location: Influence of location on plant layout, location factors, location theory and models, Economic plant size, types of manufacturing processes like continuous, repetitive and intermittent processes.

### **UNIT III**

Plant Layout: Preparation of a Plant Layout, Plant Layout problem, importance, objectives, classical types of layouts. Evaluation of layout. Advantages of good layout

### **UNIT IV**

Plant Building: Considerations in building design, type of factory buildings, choice of building construction, material for floors, foundation, walls, doors, windows, drains etc, ventilation, fly control, mold prevention and illumination in food processing industries.

### **UNIT V**

Plant layout & Equipment Layout: Plant layout and design of bakery and biscuit industries; fruits and vegetables processing industries including beverages; milk and milk products; meat, poultry and fish processing industries.

### **PRACTICAL**

1. Preparation of project report
2. Preparation of feasibility report Layout of food storage wares and godowns
3. Visit to food storage wares and godowns
4. Layout and design of cold storage
5. Visit to cold storage plant
6. Layout of preprocessing house
7. Layout of milk and milk product plant
8. Visit of milk processing plant Layout and design of bakery and related product plant
9. Visit to bakery unit
10. Layout and design of fruit processing plant
11. Layout and design of vegetable processing plant
12. Visit to fruit and vegetable processing plant Design and layout of multiproduct and composite food plant
13. Waste treatment and management of food plant

### **SUGGESTING READING**

1. John Holah, H. L. M. Lelieveld, (2011), "Hygienic Design of Food Factories", Elsevier Publication.
2. J. Peter Clark, (2008), "Practical Design, Construction and Operation of Food Facilities", Academic Press Publishers.
3. Zacharias B. Maroulis, George D. Saravacos, (2007), "Food Plant Economics", CRC Press Publishers.
4. Antonio Lopez-Gomez, Gustavo V. Barbosa-Canovas, (2005), "Food Plant Design", CRC Press Publishers.

## **BVFPS603T&P: FOOD PACKAGING TECHNOLOGY**

### **THEORY**

#### **UNIT-I**

Packaging Machineries, Systems and Regulations, Introduction to Food Packaging: History, Definitions, Importance and scope functions of packaging, package components.

#### **UNIT-II**

Packaging Materials and Properties: Manufacturing process, types, properties, advantages and disadvantages. Primary Packaging Materials. Paper and paper based packaging materials, Plastic as packaging materials: Brief history, processing, classification, mechanical, optical and barrier properties like WVTR, GTR, additives in plastics.

#### **UNIT-III**

Aluminium foil. Metal packaging materials. Manufacture of tin plate, TFS, fabrication, corrosion and remedial measures. Glass packaging materials: Composition, structure, properties, manufacture, design and closure. Plastic collapsible tube. Composite container. Secondary Packaging Material: Folding carton. Transport packaging materials- corrugated fiber board boxes, wooden boxes. Ancillary Packaging Materials: Printing inks, varnishes, lacquers and adhesives. Factors responsible for the selection of Packaging materials for fresh and processed food products.

#### **UNIT-IV**

Packaging requirements of different types of foods : fruits and vegetables, meat, fish, poultry, dairy products, edible oils and spice products, bakery products, confectioneries, Instant foods, extruded foods, snack foods, alcoholic and non alcoholic carbonated beverages, compatibility and estimation of shelf life.

#### **UNIT-V**

Packaging Machineries, Systems and Regulations: Packaging Machineries: Bottling, canning, capping, labeling, form- fill sealing, strapping, cartonning machineries. Packaging Systems: Vacuum and gas packaging, aseptic packaging, retort packaging, CAP and MAP, Intelligent/Smart/Active packaging systems and their food applications, active packaging, shrink packaging, lined cartonning system. Packaging Standards and Regulations: Laws, regulations, specifications and quality control, recycling of plastic packaging materials: Collection, separation and disposal.

#### **UNIT-VI**

Labelling requirements, methods of coding and regulation and standards of labelling of food packages

#### **PRACTICALS**

1. Familiarization of different types of packaging materials.
2. Paper: Thickness, Grammage, weight, and water absorption capacity, Determination of wax weight, Determination of continuity of wax coating weight, grease resistance.
3. Plastics: Identification of different types of plastic packaging materials, thickness, density, Tensile strength and elongation, dart impact, WVTR, GTR, Migration tests on plastics,
4. Metals: Determination of tin coating weight, headspace analysis of trace elements (Pb, Cr, Fe), lacquer coating, Can seaming.
5. Glass ; Study on various defects in glass containers, To perform non-destructive tests for glass containers,
6. Transport package: Corrugated fibre board boxes: Determination of bursting/strength properties, compression strength, Cobb value, edge crush test, transport worthiness tests.
7. Estimation of shelf life of packaged food.
8. To perform vacuum packaging of food sample and carry out its storage study.
9. To perform modified atmospheric packaging of food sample and carry out its storage study.
10. To determine grease resistance of packaging materials.
11. Determination of water vapour transmission rate of various packaging materials.
12. To find out the porosity of tin plate.
13. To see the chemical resistance of packaging material.
14. Puncture resistance of corrugated boxes.
15. Visit to various industries, dealing with food packaging materials like / paper, board and metal cans.
16. Visit to packaging institute
17. Tetra packing
18. Labeling of packing

#### **SUGGESTED READINGS**

1. Jung H. Han. Innovations in Food Packaging. Elsevier Science Ltd.
2. Gordon L. Robertson. Food Packaging: Principles and Practice. CRC press

3. Dong Sun Lee, Kit L. Yam , Luciano Piergiovanni. Food Packaging Science and Technology. CRC press
4. Raija Ahvenainen. Novel Food Packaging Techniques. Woodhead Publishing
5. M. L. Rooney. Active Food Packaging. Blackie Academic & Professional
6. Aaron L. Brody, E. P. Strupinsky, Lauri R. Kline. Active Packaging for Food Applications. Taylor & Francis
7. Charles L. Wilson. Intelligent and Active Packaging for Fruits and Vegetables. Taylor & Francis.
8. Aaron L. Brody, PhD, Hong Zhuang, PhD, Jung H. Han. Modified Atmosphere Packaging for Fresh-Cut Fruits and Vegetables. John Wiley & Sons.

#### **BVFPS604P: PROJECT**

Students have to prepare a business plan/entrepreneurship for production of any food product on the basis of their choice/interest. The submitted report will cover specialized processing from procurement of raw material to processing, including packaging and storage, organizing resources and utilities, selling of the product, maintaining accounts and documents.

#### **Evaluation criteria:**

1. Preparation of Business Plan: i. Selection of product to be manufactured, ii. Innovativeness, iii. Creativity, iv. Realistic plan, v .Overall project report and project presentation
2. Organizing the Production: i Organization of resources, ii Organizing Utility, iii Time management
3. Production and Sales: i. Regularity in production, ii. Product quality, iii. Positioning of product in market, iv. Adhering to rules and regulations,
4. Sales: i. Sales performance, ii. Sales volumes, iii. Profit generated including C/B ratio, and pay back period, etc.
5. Documentation and Reports: i. Book keeping, ii. People Management, iii. Preparation of manual, iv. Preparation of final report
6. Oral Examination:i. Presentation, ii. Oral performance

#### **BVFPS605P: SEMINAR**

Students have to give any presentation of any topic related to Food Processing

#### **BVFPS606P: COMPREHENSIVE VIVA-VOCE**

## General Syllabus

(Examination will be at end of each academic year, will be conducted by Vidyasagar University)

### Nutrition

#### PART- I (1<sup>st</sup> year)

#### Paper - I

#### Unit – 01 Marks: 50 Biophysical, Biochemical principles and Biochemistry of Nutrients

##### 1.1 Biophysical and Biochemical principles

(a) Basic process and biological importances of diffusion, osmosis, Surface tension, ultra filtration, dialysis, Brownian movement,

absorption. (b) Colloids : Definition, types, properties, biological importance. (c) Normal Solution, Dielectric constant – importance in nutrition. d) Acids, Bases, Buffers, pH, Indicators. Biological importance of pH and Buffers. Buffers in pH regulation, pH determination by indicators. (e) Enzymes: Enzymes as catalyst, classification of enzymes, co-enzymes, co-factors. Mechanism of enzyme activity. (f) Calorimetry, Refrigeration and Isotope in nutrition.

##### 1.2 Biochemistry of Nutrients

(a) Carbohydrates: Classification, isomerism-stereoisomerism, optical isomerism, anomerism, mutarotation, properties of monosaccharides, amino sugars, deoxy sugars, sialic acid. Functions of carbohydrates in body. (b) Proteins: Proteins and amino acids. Classification of amino acids. Properties of proteins, classification of proteins. Elementary idea of protein structure. Essential and non-essential amino acids. Functions of proteins in the body. Protein quality- Biological value of protein, net protein utilization (NPU), Protein efficiency ratio (PER). (c) Fats: Classification of lipids. Properties of fats. Classification of fatty acids. Essential fatty acids. Function offats in the body. Plasma lipoproteins - LDL, VLDL, HDL, Triglycerides. (d) Vitamins: Fat and water-soluble vitamins - source, daily requirement, functions and deficiency symptoms, Hyper vitaminosis, provitamin and anti-vitamin, vitamin as co-enzyme. (e) Minerals: Major and minor minerals. Sources, functions and deficiency symptoms of calcium, iron, sodium, potassium, iodine, zinc, copper, cobalt, manganese, magnesium. (f) Water: Function of water. Deficiency of water.

(g) Dietary fiber: classification, sources, and nutritional significance. (h) Antioxidant system and nutraceuticals

#### Unit – 02 Marks 50 Human Nutrition

**2.1 Basic Nutrition** (a) Concept and definition of terms Nutrition, Malnutrition and Health. Brief history of Nutritional Science. Scope of nutrition. (b) Body composition and its changes in different phases of life. (c) Minimum nutritional requirements and recommended dietary allowance. Reference man and reference woman. (d) Energy in Human Nutrition: Energy and its unit. Energy balance. Energy requirement of the body. Basal Metabolic Rate (BMR) - Factors affecting measurement of BMR. Specific dynamic action (SDA). RQ. Calorific & physiological fuel value of food. Determination of energy in food. (e) Energy and other nutritional requirement of adult male and female engaged in different types of work (sedentary, moderate, heavy).

**2.2 Growth and Nutrition** (a) Growth and development: Physical growth and development in different phases of life-embryonic, infancy, school children, adolescents. Growth spurt in puberty, pubertal changes. Use of growth charts and standards. (b) Nutrition during infancy - Breast feeding and its advantages and disadvantages. Colostrums and its importance in feeding, Formula feeding. Supplementary foods. Digestive disturbance of infants. (c) Nutritional requirements of toddlers, pre-school children, school going children and adolescents.

**2.3 Diet** (a) Balance diet (b) Food groups: Cereals, pulses, milk and meat products, fruits and vegetables, fats and sugars. Food composition table. (c) The exchange list system (d) Basic principles follows for preparation of diet. (e) Formulation of diet chart of low and high cost for adult male and female. (f) Diet in infancy, pre-school and school going children and adolescent. (g) Principles and steps in planning menu. (h) Vegetarian diet : different vegetarian diet and limiting nutrients. (i) Socio - cultural and regional food habits in different age groups.

**2.4 Community Nutrition** (a) Concept of community, types of community, factors affecting health of community. (b) Malnutrition: Types, causes and preventive measures. (c) Concept of surveillance system: International, national, regional agencies and organization. (d) Nutritional intervention programmes to combat malnutrition- Vit.-A & animea prophylaxis programme, iodine deficiency disorders control programme, balwadi programme. Mid-day meal & ICDS programme, public distribution system. (e) Importance of dietitian in community.

#### **Framing of questions and distribution of marks in each unit of theoretical question papers:**

1. Five short answer type questions are to be answered from eight questions of 2 marks each (10 marks).

2. Four semi long answer type questions are to be answered from six questions of 5 marks each (20 marks).
3. One long answer type question is to be answered from two questions of 15 marks each which will be subdivided into two components: 8 marks and 7 marks.

## PART-II (2<sup>nd</sup> year)

### **Paper - II Full Marks - 100**

#### **Unit - 03 Marks: 50 Physiological Aspect of Nutrition**

**3.1 Animal cell and tissue** (a) Cytoarchitecture of eucaryotic cell and description of different component with function (cell membrane and cell organelles). (b) Structure and functions of different types of tissues i.e., epithelial, connective, nervous and muscular tissue with special emphasis on blood and bone.

**3.2 Basic idea of the functions of different system of human body** (a) Cardiovascular system, respiratory system, excretory system, musculoskeletal system, nervous system, digestive system, endocrine and reproductive system.

**3.3 Digestive system** (a) Parts of digestive tract, structure of mouth, esophagus, stomach, small intestine, large intestine and their functions. Macro and micro histological structures of stomach and intestine. (b) Digestive glands-their structures with special emphasis on liver and pancreas. (c) Composition of different digestive juices and their functions. (d) Movements of digestive tract- their functions. (e) Gastro-intestinal hormones-sources, nature and functions. (f) Circulation in gastro-intestinal tract, with special reference to entero-hepatic circulation of blood and lymph.

**3.4 Digestion** (a) Digestion of carbohydrates (b) Digestion of proteins in general with special reference to digestion of some specific food items like egg, meat and milk. (c) Digestion of fat.

**3.5 Absorption** (a) Absorption of monosaccharides. (b) Absorption of amino acids. (c) Absorption of fatty acids and cholesterol.

(d) Absorption of mineral like calcium, iron, sodium, iodine and vitamins. (e) Water absorption. (f) Role of hormones on absorption of nutrients.

**3.6 Metabolism** (a) General idea about catabolism and anabolism. (b) Nitrogen balance, factors affecting nitrogen balance. (c) Protein metabolism: Primary idea about protein synthesis, deamination, transamination and transmethylation, ornithine cycle. Amino acid requirements, importance of essential amino acids. (d) Carbohydrate metabolism: Glycolysis, TCA cycle, glycogenolysis, glycogenesis, neoglucogenesis, and pentose phosphate pathway. Blood sugar level, hormonal controls of carbohydrate metabolism with special reference to blood sugar level. (e) Fat metabolism: Importance of essential fatty acids. Idea about saturated and unsaturated fatty acid (PUPA). Oxidation of fatty acids. Primary idea about fatty acid synthesis, ketone bodies, ketogenesis, hormonal control of fat metabolism. (f) Interrelationship of protein, carbohydrate and fat metabolism and their interconversion, interaction of hormones and vitamins. (g) Water metabolism with special reference to water balance, its hormonal control, electrolyte balance -  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Cl}^-$ ,  $\text{PO}_4^{3-}$ .

#### **Unit – 04 Marks 50 Food, Nutrition and Health**

**4.1 Food Commodities and Food Hygiene** (a) Basic food commodities: Rice, wheat and their products. Bakery products, pulses and their products, milk and milk products, poultry, beverages, food adjuncts, convenience food, fast food, genetically modified food. (b) Interaction among food, nutrition and health. (c) Food hygiene: Milk hygiene, meat hygiene, food and vegetable hygiene. (d) Food borne diseases and their prevention

**4.2 Food toxicants** (a) Different types of food toxicants - Natural and artificial. (b) Food additives, food fortification and food adulteration. (c) Prevention of food adulteration act-1954, food laws, consumer's protection rights. (d) Food standards.

**4.3 Food processing and food preservation** (a) Different methods of cooking food with their advantages and disadvantages. (b) Effects of cooking on nutrients and its management. (c) Types of food preservation: Home preservation and commercial preservation, advantages and disadvantages. (d) Preservation of fish, meat, egg and milled (e) Losses of food and nutrients in food processing.

**4.4 Nutritional education and health care** (a) Necessity of health and nutritional education at different levels of formal education starting from school to university. (b) Nutritional education and health care. (c) Child health care, immunization programme, growth monitoring programme and national nutrition policy. (d) Common

nutritional diseases among infants and children. (e) Basic idea about community health, national and international health programmes.

**4.5 Nutrition and Infection** (a) Infection, a cause of malnutrition and vice-versa. (b) Nutrition and immunity during childhood and in adult.

**Framing of questions and distribution of marks in each unit of theoretical question papers:**

1. Five short answer type questions are to be answered from eight questions of 2 marks each (10 marks).
2. Four semi long answer type questions are to be answered from six questions of 5 marks each (20 marks).
3. One long answer type question is to be answered from two questions of 15 marks each which will be subdivided into two components: 8 marks and 7 marks.

**Paper -III (Practical) Full Marks - 100**

**Unit - 05 Marks: 50 Qualitative detection of nutrients and adulterants**

- 5.1 General qualitative tests for carbohydrates, reducing and non-reducing sugars, monosaccharides, aldoses and ketoses, disaccharides and polysaccharides.
- 5.2 Qualitative tests for simple proteins and derived proteins.
- 5.3 Qualitative tests for bile salts. .
- 5.4 Qualitative tests for fats, glycerol, cholesterol.
- 5.5 Qualitative tests for detection of calcium, phosphorus, iron in food stuffs.
- 5.6 Sequential test for detection of an unknown nutrients (only from above mentioned nutrients).
- 5.7 Qualitative tests for detection of saccharine, mentanil yellow, kessari flour, banaspati in different food stuffs and starch in milk.
- 5.8 Laboratory note book.
- 5.9 Viva - voce.

**Distribution of marks in the question paper of Unit - 05**

1. Identification of two unknown nutrients (as mentioned in Unit 05) by sequential biochemical tests with a confirmatory test.  $10 \times 2 = 20$
2. Identification of anyone nutrient (as mentioned in Unit-05) which will be selected by the candidate by lottery 5
3. Identification of any two-food adulterants by biochemical test.  $5 \times 2 = 10$
4. Laboratory note book. 5
5. Viva – voce 10

**Total - 50**

**Unit - 06 Marks: 50 Quantitative Aspects of Nutrients**

- 6.1 Titration of acids and bases.
- 6.2 Estimation of haemoglobin by Sahli's hemoglobinometer.
- 6.3 Quantification of glucose, fructose, lactose in a sample by Benedict's quantitative reagent.
- 6.4 Computation of energy requirement of an individual per day on the basis of BMR and physical activity.
- 6.5 Assessment of nutritional status by anthropometric methods height, weight, BMI, circumference - chest, upper arm, waist, hip & BSA.
- 6.6 Preparation of low-cost and middle-cost school tiffin (ingredients are to be supplied by the examination centre).
- 6.7 Laboratory note book.
- 6.8 Viva-voce.

**Distribution of marks in the question paper of Unit - 06**

1. Estimation of anyone nutrient mentioned in 6.1 and 6.2 5
2. Estimation of anyone nutrient mentioned in 6.3. 15
3. One question from 6.4 10
4. Anyone question from 6.5 and 6.6 5
5. Laboratory note book 5
6. Viva – Voce 10

**Total 50**



## **PART-III (3<sup>rd</sup> year)**

### **Paper-IV Full Marks: 100**

#### **Unit – 07 Marks 70 Applied Nutrition**

##### **7.1 Nutrition in specific physiological state**

**(a) Nutrition in Pregnancy and Lactation** (i) Nutritional demands of pregnancy. (ii) Food selection in pregnancy. (iii) Complication of pregnancy due to diet. (iv) Diet following delivery. (v) Nutritional demand during lactation. (vi) Basic concept and methods of oral feeding, tube feeding, potential nutrition and intravenous feeding.

**(b) Geriatric Nutrition** (i) Nutrition of aged individual. (ii) Food habits and requirements of older people. (iii) Dietary modifications needed in aged. (iv) Planning meals for older people. (v) Importance of anti-oxidative nutrients for the prevention of aging.

**(c) Nutrition of Athletes** (i) Nutritional requirements of an athlete. (ii) Dietary management in different sports and athletes.

(iii) Meal planning of an athlete with special demand of female athlete.

##### **7.2 Causative nutritional factors in diseases**

(a) Nutritional factors involved in cardio-vascular disease, diabetes, obesity, cancer and gout.

(b) Causative nutritional factors for endemic goiter, rickets, osteomalacia, anorexia nervosa.

##### **7.3 Diet therapy in specific pathophysiological conditions**

(a) Hospital diets- liquid, clear fluid, soft & normal diets. (b) Diet therapy in diabetes mellitus and obesity. (c) Dietary management in cardiovascular disease like atherosclerosis, hyperlipidemia, hypertension. (d) Diet therapy in peptic ulcer, gastritis, diarrhea, colitis, constipation, flatulence and jaundice. (e) Diet during febrile condition, infection, surgical condition, nephritis, and nutritional anemia. (f) Therapeutic uses of dietary fibers with special reference to chronic constipation, diverticular disease, irritable bone syndrome, obesity and diabetes, possible adverse effects of dietary fibers.

##### **7.4 Rehydration therapy**

(a) Elementary idea about rehydration. (b) Conditions for rehydration. (c) Different types of rehydration therapy with special emphasis on ORS - its types and importance. (d) Age dependent ORS quantity for rehydration therapy.

##### **7.5 Antioxidative nutrients: 5 Lectures**

(a) Preliminary idea about oxidative stress. (b) Elementary idea about antioxidative nutrients (c) Food items containing antioxidative nutrients.

##### **7.6 Diet survey and Nutritional assessment of the community**

(a) Different methods used in diet survey - their merits and demerits. (b) Importance of diet survey in community. (c) Methodology followed for the assessment of nutritional status of the community with their merits and demerits. (d) Nutritional anthropometry

#### **Framing of questions and distribution of marks in the question paper-IV, Unit-07 :**

1. Eight short answer type questions are to be answered from fourteen questions of 2 marks each (16 marks).
2. Five semi long answer type questions are to be answered from eight questions of 5 marks each (25 marks).
3. Two long answer type questions are to be answered from four questions of 11 marks each (22 marks).

#### **Paper - IV (Practical)**

##### **Unit - 08 Total Marks - 30**

8.1 Preparation of ORS solution. ORS bicarbonate and ORS citrate.

8.2 Measurement of systolic and diastolic pressure by sphygmomanometer.

8.3 Normal diet chart preparation for adult male & female pregnant lactating mother.

8.4 Preparation of therapeutic diet chart - menu planning for diabetes mellitus, obesity, hypertension, peptic ulcer.

8.5 Field based excursion report on diet survey of a family by questioner method. Clinical signs of malnutrition are to be included in the report.

8.6 Laboratory note book

8.7 Viva - voce

##### **Distribution of marks in question paper of Unit - 08**

1. Anyone question from 8.1 & 8.2 07
2. Preparation of menu for anyone therapeutic diet (to be selected by lottery from 8.3 & 8.4) 08

3. Field based excursion report 05
  4. Laboratory note book 05
  5. Viva – voce 05
- Total - 30**

**ECONOMICS (GENERAL)  
PART - I**

**Paper I (100 marks): Economic Theory -I (Microeconomics) & Indian Economy-I (University Examination-90 & Internal Assessment in College-10) Paper-I, 1st Half: Economic Theory -I (Microeconomics)**

**Module 1**

**Basic problems in an economy:**

Man-Nature and Man-Man interaction, Macro Economics, Circular flow of income and expenditure, Micro vs. Macro Economics.

**Module 2**

**Theories of consumer behavior and Theory of demand:** Utility theory, Indifference curve theory and the law of demand; Elasticity of demand

**Module 3**

**Theories of producer behavior and Theory of supply:** Price line and Equilibrium production, Supply curve and the elasticity of supply

**Module 4**

**Theories of production and cost:** Production function, average and marginal products; Returns to factor and returns to scale; Cost of production, average and marginal cost, fixed and variable costs, short run and long run costs.

**Module 5**

**Market morphology:**

Features of perfect competition, Price and output determination under perfect competition, Shifts in demand and supply and changes in price and output; Types and features of imperfectly competitive markets, Price and output determination under monopoly and discriminating monopoly

**Module 6**

**Theories of distribution:**

Theories of determination of wage, interest, rent and profit

**Paper- I, 2nd Half: Indian Economy –I**

**Module 1**

Features of underdevelopment of the Indian economy

**Module 2**

National income of India: Trends and Structure

**Module 3**

Population in India: Population growth and Population policy, Poverty inequality and Unemployment

**Module 4**

India's agriculture: Growth and productivity, Technology and institutions in agriculture

**Module 5**

Industries in India: Industrialization pattern, Growth and policy

**Recommended Books (1<sup>st</sup> Half):**

1. Samuelson, P. A. and W. D. Nordhaus, *Economics*, McGraw Hill Book Company, Singapore.
2. Stonier, A. W. and D. C. Hague, *A Text Book of Economic Theory*, Longman Group, London.
3. Mukherjee, D., *Essentials of Micro and Macro Economics*, New Central Book Agency, Kolkata.
4. Dwivedi D.N., *Microeconomics- Theory and Applications*, Pearson Education
5. Case, Fair and Oster, *Principles of Economics*, Pearson
6. Ramesh Chandra Das, *Microeconomics- Theory and Practice*, Kunal Books

**Recommended Books (2nd Half):**

1. Dutt, R. and K. P. M. Sundaram, *Indian Economy*, S.Chand
2. Agarwal, *Indian Economics*, NEWAGE INTERNATIONAL P. LTD. (MUMBAI)
3. Prakash B.A.(ed.) *The Indian Economy since 1991, Economic Reforms and Performance*, Pearson Education India
4. Misra and Puri, *Indian Economy*, Himalaya Publishing House

## PART - II

### **Paper II (100 marks) Economic Theory-II (Macroeconomics) & Indian Economy II (University Examination-90 & Internal Assessment in College-10)**

#### **Paper II, 1st Half: Economic Theory-II (Macroeconomics)**

##### **Module 1**

##### **Theories of national income determination:**

Circular flow of factors and products and of income and expenditure; Distinction between national product and national income, gross and net national income; Simple Keynesian theory of income determination; Consumption function and the multiplier

##### **Module 2**

**Money and banking:** Definition and functions of money; Quantity theory of money; Functions of commercial banks-credit creation; Functions of central bank-credit control; Types and causes of inflation-Anti-inflationary policies

##### **Module 3**

##### **Government finance:**

Direct and indirect tax; Proportional and progressive tax; Public debt

##### **Module 4**

##### **International trade:**

Absolute and comparative advantages as the bases of trade; Gains from trade; Arguments for free trade and protection

#### **Recommended Books (1st Half):**

1. Samuelson, P. A. and W. D. Nordhaus, *Economics*, McGraw Hill Book Company.
2. Richard Lipsey and Alec Chrystal, *Economics*, OUP.
3. Stonier, A. W. and D. C. Hague, *A Text Book of Economic Theory*, Longman Group, London.
4. Mukherjee, D., *Essentials of Micro and Macro Economics*, New Central Book Agency, Kolkata.
5. Case, Fair and Oster, *Principles of Economics*, Pearson.
6. John Sloman, *Economics*, Pearson.

#### **Paper -II 2nd Half: Indian Economy II**

##### **Module 1**

Money and Banking in India

##### **Module 2**

India's public finance

##### **Module 3**

India's foreign trade: Trend and pattern of exports and imports, exchange rate and balance of payments

##### **Module 4**

Indian Planning

##### **Module 5**

Decentralised Planning and Local Governance in India

#### **Recommended Books (2nd Half):**

1. Dutt, R. and K. P. M. Sundaram, *Indian Economy*, S. Chand.
2. Agarwal, A. N., *Indian Economy*, New Age International Pub. (P) Limited.
3. Prakash B.A. (ed.) *The Indian Economy since 1991, Economic Reforms and Performance*
4. Misra and Puri, *Indian Economy*, Himalaya Publishing House.

**Paper III (100 marks) Development Economics  
(University Examination-90 & Internal Assessment in College-10)**

**Paper III, 1st Half: Development Economics-I (F.M. 50)**

**Module 1**

Economic growth vs. economic development, Indicators of economic development, Concept of Human Development Index.

**Module 2**

Theories of economic development, Stages of economic development and economic growth

**Module 3**

Development Strategies: Low level equilibrium Trap and big push theory, Balance vs. Unbalanced Growth.

**Module 4**

Complementary role of agriculture and industry, Role of technology in agricultural and industrial development.

**Module 5**

Domestic capital formation: Sources and problems, Incentives for saving and investment

**Paper III, 2nd Half: Development Economics -II ( F.M. 50)**

**Module 1**

Foreign investment: Different forms, Role of foreign investment in economic development

**Module 2**

Role of IMF and World Bank in economic development of developing countries.

**Module 3**

International trade and economic development

**Module 4**

Comparative Development Experience: China and India

**Module 5**

Environment and Development

**Recommended Books:**

1. Gill, R. T., *Economic Development- Past and Present*, Prentice Hall.
2. Salvatore, D. and E. Dowling, *Development Economics*, Schaum's Outline Series in Economics, McGraw Hill, New York
3. Todaro, M. P. & *Economic Development / Pearson*.
4. Gerald M. Meier, James E. Rauch, *Leading Issues in Economic Development*, Oxford University Press
5. Yanrui Wu, *Understanding Economic Growth in China and India: A Comparative Study of Selected Issues*, World Scientific Pub Co Inc (January 13, 2013)

**PART - III**

**Paper IV (100 marks)**

Rural Economics, Elementary Statistics and Methodology of

**Paper IV 1st**

Project in Economics & Field Survey based Project Work

**Half (50 marks)**

Rural Economics (25), Elementary Statistics (20) and Methodology of Project in Economics (05)

**(University Examination-90 & Internal Assessment in College-10)**

**Module 1**

Features of the rural economy, Economics of Agriculture and Allied activities, Rural Industrialization, Rural Infrastructure and Rural Credit

**Module 2**

Rural development programmes in India, Decentralized planning and Local government

**Module 3**

Collection and presentation of data

**Module 4**

Calculation of mean, variance and correlation

**Module 5**

Definition and type of project, Steps in the Preparation of a project

**Recommended Books:**

1. Singh Katar, *Rural Development, Principles, Policies and Management*.
2. Maheswari, S., *Rural Development*.
3. Mondal and Mondal, *Rural Development: Theory and Experience*.
4. Sharma, Prasad and Satyanarayana, *Research Methods in Social Sciences*, Sterling Publishers Pvt. Ltd., New Delhi.
5. Das, N. G., *Statistical Methods, Vol. I*.
6. Nagar and Das: *Basic Statistics*, OUP.

**Paper IV 2nd**

**Half (50 marks) : Project Work**

**Field Survey based Project Work (50Marks):** Project paper (40 marks);  
Viva-voce (10 marks)

**Project**

- Title & Objective of the study.
- Questionnaire Designing.
- Sample selection and data collection.
- Data compilation & interpretation using statistical tools.
- Writing the report.