

**MODEL III-**  
**(B.Sc. Food Science & Quality Control) under Choice**  
**Based Credit System**

# CONTENTS

<b>Sl.NO:</b>	<b>TOPIC</b>	<b>PAGE NO</b>
1.	Board of Studies	3-4
2.	Acknowledgement	5
3.	Introduction	8
4.	Syllabus – Core and Complementary	10-77

Prepared by BOS and Faculty of

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## **ACKNOWLEDGEMENT**

The course in Model III –B.Sc. Food Science and Quality Control has been designed keeping in mind the latest technological advances in the food processing industries and the need for complete professionals adept in all areas of the vast science of food. The course aims at training students not just academically but also in the areas that develop communication skills, soft skills and overall ability. The course is also designed to give a further thrust on developing in students a desirable attitude for self employment.

I express profound gratitude to the honorable Vice Chancellor, Pro Vice-Chancellor, Registrar, members of the syndicate and academic council for their cooperation and guidance for the completion of the syllabus.

I express my heartfelt thanks to all members of the University- academic section as well as the supporting staff members.

I place on record my whole hearted gratitude to the members of the faculty of Food Science and Quality Control for their untiring efforts.

I take this opportunity to thank all the members on the Expert Committee for their untiring efforts and support for the preparation of the syllabus . I gratefully take this opportunity to thank all the members for their valuable contributions in drafting the syllabus of B.Sc. Food Science and Quality Control.

## **NEED AND SCOPE OF FOOD SCIENCE & QUALITY CONTROL**

With liberalization of Indian economy, all-round industrial growth has been witnessed in all sectors with improvement in social and economic conditions of our people. This has created demand for more and better quality foods. With advancement in production technology, high yield levels will lead to large amount of marketable surplus of food grains and crop residues, demanding appropriate handling, processing, preservation, storage, marketing and utilization.

The development of processing industries to preserve the perishable agricultural produce will not only improve economic and nutritional status of our population but it may help in employment generation in rural as well as urban areas of the country. This can be achieved by linking production, and post harvest technology in synergistic way.

At present the export from agro-sector represents about 16% of total Indian exports. The primary export commodities are cereals, fruits, vegetables and their processed products, and marine products but fast growing specialty products have also penetrated in foreign markets. Considering the contribution of these products in Indian export, it is necessary to have appropriate technology for handling and processing of agricultural produce.

The importance of Food Science and Quality Control lies in the fact that it has capability to provide food to our population through scientific conservations, eliminating avoidable losses and making available more balanced and nutritious food. High value products from low grade material can be produced by innovative and appropriate processing and packaging technologies and also from by-products and residue waste using integrated approach. Thus modernization of post harvest operations and agro-processing industries through innovative and appropriate technology has a vital role to play in national economy in general and rural economy in particular. Considering the above aspects, the role of food technologist does not stop at farm level but it continues till the harvested crops and animal products are processed, preserved and further modified into useful and nutritious products, until it utilized by the consumer. So, the post-harvest handling and processing need to be attended on priority basis at national and international level. Moreover, with development of processing industries, it is quite likely that the demand for food scientists and technologists will increase in the next few decades. Hence, specializations offered at graduate level need to be strengthened considering occupational needs as well as demands of the food industries.

The field of food quality assurance has evolved substantially over the past decade, and certain key developments have become widely accepted. These include Quality Systems (e.g., ISO ) and HACCP. Consequently, it has become essential for undergraduate Food Science and Quality Control students preparing for careers in the food industry to have some basic training in these systems as part of the curriculum in their university or college programs. The B.Sc. programme integrates the latest principles, practices, and terminology of food safety systems with those of quality management systems to provide an understanding of a single food quality management system. Modules define industry terminology, review the differences and components of food quality and food safety, explain quality programs and quality systems, and thoroughly examine Good Manufacturing Practices and HACCP. Designed primarily as an undergraduate-level programme, it combines the fundamentals of food science and quality management courses in its curriculum.

Food Science is basically an interdisciplinary programme involving chemistry, microbiology and quality assurance. Hence, basic knowledge of these three disciplines becomes mandatory if student wishes to pursue career in this discipline. In order to develop strong and need based programme,

core courses in above disciplines should be there for developing Food Science and Quality Control discipline for effective preservation, processing and utilization of perishable agricultural produce ensuring its quality.

In addition, the programme offers industrial training in the first, second and third year giving students an opportunity to familiarize the food industrial unit operations while learning.

### **3. Introduction**

This practical and informative course provides participants with foundational knowledge related to all aspects of food science presented by world renowned experts.

This course is designed for any one working in food industry or in the field of food science in order to increase their knowledge in food chemistry, food processing, sensory science, food safety, food packaging and functional foods and Nutraceutical.

This course is designed to give a five day overview of the most relevant aspects of food science typically covered over our three year under graduate programme.

Food Science can be defined as the application of basic sciences and engineering to study the basic and fundamental physical, chemical and biochemical nature of foods and the principles of food processing.

As such food science is a broad discipline which contains within it much specialization such as in food microbiology, food engineering and food chemistry.

Food Technology is the science of processing and packaging of food items. Fruits, vegetables, sea foods, meats, cooked foods, snacks, confectionaries, beverages, juices, canned juices and fruits all come under the preview of food technology.

## **Aim & Objectives**

- 1.** To train the students to be competent working professionals in the food industry, in the production of quality food by imparting better nutritional, sanitation & hygiene concepts.
- 2.** To encourage students to the entrepreneurs and develop the capacity for setting up small scale enterprises with respect to food within the country.
- 3.** To organize functions for creating awareness about the importance of safe processed nutritious food.
- 4.** To provide diagnostic analysis of food products.

## Consolidated Scheme for All Semesters in the Format

SEM	Title with Course Code	Course Category	Hours Per Week	Credit	Marks	
					Intl	Extl
<b>I</b>	Common- English	Common	5	4	20	80
	Complementary-Chemistry	Complementary	4	2	20	80
	Complementary- Zoology	Complementary	4	2	20	80
	Complementary- Mathematics	Complementary (optional)	4	3	20	80
	Core- Basic Nutrition- FS1CRT01	Core	3	3	20	80
	Core- Basic Food Chemistry-FS1CRT02	Core	3	3	20	80
	Core- -Methodology in the Discipline of Food Science - FS1CRT03	Core	4	3	20	80
<b>II</b>	Common- English	Common	5	4	20	80
	Complementary- Chemistry	Complementary	4	2	20	80
	Complementary- Zoology	Complementary	4	2	20	80
	Complementary- Mathematics	Complementary (optional)	4	3	20	80
	Core- Food Commodities- FS2CRT04	Core	3	3	20	80
	Core- Food Preservation- FS2CRT05	Core	3	3	20	80
	Core- Food Microbiology, Sanitation and Hygiene - FS2CRT06	Core	4	3	20	80
	Core- (OJT)Industrial Training-FS2OJP07	Core		2		100
<b>III</b>	Complementary-Chemistry	Complementary	4	3	20	80
	Complementary-Zoology	Complementary	4	3	20	80
	Complementary- Mathematics	Complementary (optional)	4	4	20	80
	Core-Processing Technology of	Core	5	3	20	80

	AnimalsFoods-FS3CRT08					
	Core-Sensory Evaluation-FS3CRT09	Core	5	3	20	80
	Core-Food Packaging Materials & Testing-FS3CRT10	Core	5	3	20	80
<b>IV</b>	Complementary-Chemistry	Complementary	4	3	20	80
	Complementary- Zoology	Complementary	4	3	20	80
	Complementary-Mathematics	Complementary (optional)	4	4	20	80
	Core- Processing Technology of Plant foods-FS4CRT11	Core	5	3	20	80
	Core- Analytical Instrumentation-FS4CRT12	Core	5	4	20	80
	Core- Food Safety & Quality Assurance-FS4CRT13	Core	5	4	20	80
	Core (OJT)-Industrial Training-FS4OJP14			2		100
<b>V</b>	Core- Food Analysis (Theory)-FS5CRT15	Core	2	4	20	80
	Core-Food Toxicology-FS5CRT16	Core	2	4	20	80
	Core- Environmental studies and Human Rights-FS5CRT17	Core	4	4	20	80
	Open Course -FS5OP18, FS5OP19, FS5OP20	Core	4	3	20	80
<b>VI</b>	Core- Entrepreneurship Development & Management in food Industry-FS6CRT24	Core	3	4	20	80
	Core- Food Adulteration & Testing-FS6CRT25	Core	3	4	20	80
	Choice Based -FS6CBT26, FS6CBT27, FS6CBT28	Core	4	4	20	80
	Core- Project/Dissertation-FS6DSP32	Core	2	3		100

## Consolidated Scheme for Practical's

SL.No	SEMESTER	COURSE TITLE	HOURS PER WEEK	CREDIT
1.	I & II	Practical - Complementary- Chemistry	2	2
2.	I & II	Practical - Complementary- Zoology	2	2
3.	III & IV	Practical- Complementary- Chemistry	2	2
4.	III & IV	Practical- Complementary- Zoology	2	2
5.	V & VI	Practical-Core- Basic Microbiology FS5CRP21 & Advanced Food Microbiology- FS6CRP29	5	2+2=4
6.	V & VI	Practical-Core- Food Analysis & Adulteration testing -Practical I & Food Analysis FS5CRP22 & Adulteration testing -Practical II –FS6CRP30	4	2+2=4
7.	V & VI	Practical-Core- Food Chemistry Practical FS5CRP23 & Advanced Food Chemistry Practical- FS6CRP31	4	2+2=4

**List of Open Course Papers available for Fifth Semester for Other Departments**

<b>No</b>	<b>Title of course</b>	<b>Exam duration (hours)</b>	<b>Credit per course</b>	<b>Contact hours per week</b>
1	FS5OP18-Food Facts and Principles	4	3	4
2	FS5OP19-Human Health and Nutrition	4	3	4
3	FS5OP20- Human Health and Nutrition	4	3	4

**List of Choice Based Core Course Papers available for Sixth Semester**

<b>No</b>	<b>Title of course</b>	<b>Exam duration (hours)</b>	<b>Credit per course</b>	<b>Contact hours per week</b>
1	FS6CBT26-Coconut & Beverage Technology	4	4	5
2	FS6CBT-27-Basic Food Engineering	4	4	5
3	FS6CBT28-Introduction To Food Engineering	4	4	5

## **6. SYLLABUS – CORE COURSE**

## SEMESTER I

### FS1CRT01- BASIC NUTRITION

**Credits-3**

**72 hrs**

#### **OBJECTIVES:-**

To enable the students to

1. Understand the relationship between nutrition and human well being
2. Know and understand the functions, importance of all nutrients for different age group and special group.

#### UNIT- 1

12 hrs

- **Introduction to Nutrition** – General Introduction, Definitions of Balanced diet, Nutrition, Health, Malnutrition, Food, Nutrients, Functions of Food , Basic Food Groups.
- Inter Relationship between Nutrition and Health, Malnourishment- definition, types etiological factors and remedial measures.

#### UNIT- II

14 hrs

- **Water and Its Use in the Body**- Distribution, Requirements, Sources, Water Balance, Unit of Measurement, Deficiency and Toxicity

#### UNIT- III

14 hrs

**Proximate Principles** – Carbohydrates, Proteins & fats

- Introduction
- Classification
- Sources
- Functions
- Deficiency & toxicity
- Unit of measurement
- RDA

#### UNIT- IV

16 hrs

**Vitamins & Minerals**

- Introduction

- Classification ( Fat Soluble and Water Soluble, Minerals ( Ca, P, Fe, I, Na, K, Zn, Cu, Ni, Pb)
- Sources
- Functions
- Deficiency & toxicity
- Unit of measurement
- RDA

UNIT –V

16 hrs

**Energy-** Introduction, Calorific value of foods, determination of calorific value, BMR,SDA, sources, deficiency, PEM, Requirements, RDA, Unit of measurement

### **REFERENCES**

1. Mudambi, S. R., Rajagopal M. V., Fundamentals of food and Nutritions, 2<sup>nd</sup> edition, Wiley Eastern Ltd, New Delhi 1990.
2. Swaminathan, M., Hand book of Food & Nutrition, Bappco Ltd, Bangalore, 1978.
3. Srilakshmi, B, Nutrition Science, New age international (P) Ltd publishers, New Delhi, 2006.
4. Swaminathan, M. Essential of food and Nutrition, Vol.I. Bangalore Printing and Publishing Co. Ltd Bangalore.
5. Begum, R. A text book of foods, Nutrition and Dietetics. Second revised edition, Sterling Publishers(P) Ltd, New Delhi, 1991.

## SEMESTER I

### FS1CRT02- BASIC FOOD CHEMISTRY

**Credits – 3**

**72 hrs**

#### **OBJECTIVES:**

To enable the students to:

- Acquire knowledge on the macro and micro constituents of the food
- Know the structure and chemical characteristics of constituents of food

#### **UNIT I – INTRODUCTION TO FOOD CHEMISTRY**

**14 hrs**

- Introduction to Food Chemistry
- Water (Structure of water and ice, Physical constants of water, Types of water, Water activity)
- Composition of Food- Carbohydrates, Proteins, Lipids, Vitamins & Minerals

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

**16hrs**

- **CLASSIFICATION, STRUCTURE, PROPERTIES AND REACTIONS OF CARBOHYDRATES**

Monosaccharide

Classification., Optical Activity D-and L-forms. Muta-Rotation. Straight and Ring structure of glucose, fructose and galactose.

Oligosaccharides

Classification.Reducing & Non-reducing sugar. Glycosidic bonds. Structure of sucrose, maltose, iso- maltose & lactose .Inversion of sucrose.

Polysaccharides

Classification. Structure of starch, cellulose, glycogen, pectin, hyaluronic acid. Difference between amylose & amylopectin .Gelatinization of starch. Theories of gel formation .

Chemical Reactions of Carbohydrates

Reactions involving glycosidic-OH group.Reactions involving alcoholic-OH group. Reactions involving both glycosidic & alcoholic-OH group. Oxidation reactions.

Browning reactions - Enzymatic & Non-enzymatic browning.

#### **UNIT III- PROTEINS & ENZYMES**

**16 hrs**

- Classification of amino acid- structure, essential and non essential amino acids, zwitter ion, isoelectric point, amphoteric property, Peptide bond. biological roles of protein.

- Classification of protein according to shape; classification of protein according to composition and solubility Structure of protein, chemical bonds involved in protein structure
- Physical-chemical properties of proteins; colour and taste, shape of size, molecular weight, colloidal nature, amphoteric nature, ion bonding capacity, solubility, optical activity, precipitation with antibodies.
- Denaturation-agents causing denaturation, changes occurring during denaturation
- Chemical reaction-hydrolysis, Reactions involving COOH group, Reactions involving NH<sub>2</sub> group, Reactions involving R groups or side chain.
- **ENZYMES** -Introduction, classification of enzyme,enzyme kinetics, enzyme activity, factors affecting enzyme activity
- Enzyme inhibitors- reversible (Competitive & Noncompetitive), irreversible
- Enzyme activators; regulation of enzyme activity- zymogens inactivation, covalent modification and feedback inhibition
- Enzymes used in food industry

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

**14 hrs**

- Classification of lipids according to chemical composition, fatty acids; saturated and unsaturated fatty acids. Fatty acids-essential fatty acids structure, chemical reactions of lipids.
- Physical properties - melting point, polymorphism, softening point, slipping point, specific gravity, refractive index, smoke flash and fire points, turbidity points,
- Chemical properties- RM, P,K values Saponification value, iodine value, acid value
- Rancidity: Hydrolytic and oxidative rancidity; mechanism of auto oxidation of fat; reversion
- Antioxidants- natural and synthetic
- Technology of edible fats and oils; hardening of fat hydrogenation and inter esterification
- Emulsion and emulsifiers.

#### **UNIT V- FOOD PIGMENTS**

**12 hrs**

Introduction, classification, types of food pigments- chlorophyll, carotenoids, anthocyanins, flavanoids.

#### **REFERENCES**

1. Fundamentals of Biochemistry J L Jain 4th Edition 1990 S.Chand &Company, New Delhi
2. Aurand, L.W. and Woods, A.E. 1973. Food Chemistry. AVI, Westport.
3. Birch, G.G., Cameron, A.G. and Spencer, M. 1986. Food Science,3rd Ed. Pergamon Press, New York

4. Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. Marcel Dekker, New York.
5. Meyer, L.H. 1973. Food Chemistry. East-West Press Pvt. Ltd., New Delhi.

## SEMESTER I

### FS1CRT03- METHODOLOGY IN THE DISCIPLINE OF FOOD SCIENCE

**Credits : 3**

**72 Hrs**

#### **UNIT I- Introduction to Food Science**

**15 hrs**

- What is Food science and Quality Control?
- Early history of food science, its developments
- Preparation of a career in food science
- Activities of food scientists
- Components of a food industry
- Allied industries

#### **UNIT II. Innovations**

**15 hrs**

- Importance of new products and product technology
- New applications of membranes in food processing
- Cross flow membrane technology
- Next generation products
- Competitive behaviour

#### **UNIT III. Types of Research**

**10 Hrs**

- Introduction to research
- Research design
- Sampling
- Measurement and scaling techniques
- Importance in the field of Food Science

#### **UNIT IV. Experimentation in Science**

**18 Hrs**

- Hypothesis, Formulation of Hypotheses- Deductive model and Inductive model
- Design of an experiment: experimentation, observation, data collection, interpretation and deduction
- Making observations: direct, indirect controlled and uncontrolled, human and machine observations
- Scientific instruments used in food science

## **UNIT V. Data Handling and Ethics in Science**

**14hrs**

- Documentation of experiments, nature and types of data
- Significance of statistical tools in data presentation
- Data presentations- graphs, tables, histograms and pi diagrams
- Statistical testing of hypotheses, null hypotheses, significance tests, Correlation

### **References:**

- Kothari, C.R. (2004). *Research methodology-methods and techniques*. (2<sup>nd</sup> ed.). New Delhi, India: New Age International (P) Ltd.
- Singh, Y.K. (2006). *Fundamental of research methodology and statistics*. New Delhi, India: New Age International (P) Ltd.

# **SEMESTER-II**

## SEMESTER II

### FS2CRT04- FOOD COMMODITIES

Credits – 3

72 hrs

#### OBJECTIVES

1. To understand the basic commodities both raw and processed in food industries and various aspects of their production and distribution.
2. To discuss the qualities and standards of available commodities and their suitability for different purposes

#### **UNIT I- PERISHABLE FOOD COMMODITIES**

**12 hrs**

- Milk, Meat, Fish, Egg and Poultry
- Introduction, composition, types, processing, products, uses in Indian Cookery

#### **UNIT –II- SEMI PERISHABLE FOOD COMMODITIES**

**16 hrs**

- Fruits and Vegetable, Fats and Oils
- Introduction, composition, types, processing, products, uses in Indian Cookery

#### **UNIT –III- NON PERISHABLE FOOD COMMODITIES**

**16 hrs**

- Cereals, Pulses, Legumes, Oil seeds and Spices
- Introduction, composition, types, processing, products, uses in Indian Cookery

#### **UNIT IV- TYPES OF FOODS**

**14 hrs**

Nutraceuticals, Probiotics, Prebiotics, GM Foods, Organic Foods, Traditional Foods, Fabricated Foods, Junk Foods, Fast Foods, Convenience Foods, RTS, and RTE

#### **UNIT V- SUGAR AND CONFECTIONARY**

**14 hrs**

- Different types of sugar (sugar, Jaggery, honey, syrup),
- Manufacture, selection, storage and use as preservative

## **REFERENCES**

1. Srilakshmi, B.. Food Science (3<sup>rd</sup> edition), New Age International (P) Limited Publishers, New Delhi, 2003.
2. National Institute of Industrial Research Board, Hand Book on SPICES Asia Pacific Business press Inc. New Delhi.
3. Potter, N.N. Food Science (5<sup>th</sup> edition), CBS publishers and Distributors, New Delhi, 1995.
4. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles., New Age International Publishers., New Delhi., 2004.

## **SEMESTER II**

### **FS2CRT05-FOOD PRESERVATION**

**Credits – 3**

**72 hrs**

#### **Objectives**

To enable the students to

- 1) Acquire knowledge on different preservation techniques used to enhance the shelf span of food product.

#### **UNIT-I FOOD PRESERVATION**

**12 hrs**

- Introduction, Importance, principle and Types

#### **UNIT-II HIGH AND LOW TEMPERATURES PRESERVATION**

**14 hrs**

- Pasteurization
- Sterilization
- Canning
- Freezing
- Refrigeration

#### **UNIT – III MOISTURE REMOVAL PRESERVATION TECHNIQUE**

**16 hrs**

- Concentration
- Drying
- Dehydration
- Freeze Drying
- Dehydro freezing

#### **UNIT IV- ELECTRIC CURRENT & PRESERVATIVES**

**16 hrs**

- Ohmic Heating
- Pulsed Electric Field

- High Pressure Processing (HPP)
- Class- Class I and Class II
- Its role
- Permitted Preservatives and Levels
- Preparation of Jam, Jelly, Marmalade, Preserves, candy, glazed crystallized fruit, sauces, chutney, Pickles.

**UNIT V- FERMENTATION, IRRADIATION, COMBINATION AND PICKLING  
TECHNIQUES**

**14 hrs**

- Types of Fermentation
- Fermented Foods
- Properties of irradiation
- Microwave heating

**REFERENCES**

1. Subalakshmi, G and Udipi, S.A. Food processing and preservation; New Age International Publishers, New Delhi, 2001.
2. Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003.
3. Potter, N.N. and Hotchkiss J. H. Food Science.CBS publishers and distributors. 1996.
4. Srivastava, R.PO and Kumar, S. Fruit and vegetable preservation, International Book distribution Company, Lucknow, 1994.
5. MC.Williams, M and Paine, H. Modern Food preservation. Surjeet Publications, Delhi, 1984.
6. Cruess, W.V. Commercial Fruits and Vegetable Products, Anees Offset press, New Delhi, 1997

## SEMESTER II

### FS2CRT06- FOOD MICROBIOLOGY, SANITATION AND HYGIENE

Credits – 3

72 hrs

#### OBJECTIVES

To help the students to:

- a) Acquire an elementary knowledge about micro organisms.
- b) Develop an understanding of industry and in maintenance of health.

#### **UNIT I-INTRODUCTION TO MICROBIOLOGY**

12 hrs

- Characteristics and morphology of bacteria, fungi, virus, algae and protozoa
- Introduction to microscope
- Culture Medias, types and Culture techniques
- Microbial Growth curve
- Factors affecting microbial growth
- Beneficial microbes in food industry- SCP, Fermentation,Enzymes

#### **UNIT II- FOOD BORNE ILLNESS AND DISEASES ASSOCIATED WITH MICROORGANISMS**

14 hrs

- Definition, Classification (Food infections and intoxication)
- Food hazard- definition, types
- Food poisoning- types, prevention and control
- Diseases- neurolathyrisms, Botulism, aflatoxin, ergotism, staphylococcal intoxication, salmonellosis etc

#### **UNIT III- SPOILAGE AND CONTAMINATION OF DIFFERENT FOODS**

16 hrs

- Cereal and cereal products
- Sugar and sugar products
- Fruits and vegetable products
- Meat and meat products
- Fish and Fish products

- Egg and poultry
- Milk and Milk Products
- Canned Foods

#### **UNIT IV- CLEANING METHODS & TECHNIQUES**

**16 hrs**

- CIP
- COP
- Cleaning equipments & Sanitizers
- Sterilization & Disinfection
- Use of detergents, heat, chemicals
- Cleaning compounds

#### **UNIT V- CONTROL OF INFESTATION**

**14 hrs**

- Rodent Control
- Insect Control
- Pest Control
- Uses of Pesticides

#### **References:**

1. Frazier, W.C. Food Micro biology . 4<sup>th</sup> edition. Mc Graw Hill. Newyork.
2. Pelzar, H.J. and Rober, D. Microbiology 5<sup>th</sup> edition Mc Graw Hill. Newyork
3. Banwart, G.T. Basic Food Microbiology. CBS Publishers, New Delhi.
4. Narayanan, L.M., Mani,L., Microbiology.Saras Publications, Nagercoil.
5. Bryan,F.L., Diseases transmitted by foods. Munich Publishers, Atlanda.
6. Jacob.M, Safe food handling, a training guide for Manager, WHO, Geneva, MARRIOTT.N.G (1989)

**INDUSTRIAL  
TRAINING  
(ONE MONTH)-  
FS20JP07**

# SEMESTER III

**SEMESTER III**  
**FS3CRT08-PROCESSING TECHNOLOGY OF ANIMAL FOODS**

Credits – 3

72 hrs

**Objectives:**

1. To enable the students to understand the importance and methods of post processing Technology of Animal foods.

**UNIT I- INTRODUCTION TO POST HARVEST TECHNOLOGY** **12 hrs**

- Introduction, Definition, Primary and secondary processing, Importance.
- 

**UNIT II- PROCESSING TECHNOLOGY OF MILK AND MILK PRODUCTS** **16 hrs**

- Milk- Definition, composition, method of manufacture, use
- Butter- Definition, composition, method of manufacture, use
- Butter Oil- Definition, composition, method of manufacture, use
- Ice cream- Definition, composition, method of manufacture, use
- Cheese- Definition, composition, method of manufacture, use
- Condensed milk- Definition, composition, method of manufacture, use
- Dried Milk- Definition, composition, method of manufacture, use
- Yoghurt- Definition, composition, method of manufacture, use
- Indian Dairy Products- Kheer, Khoa, Rabri, Kulfi, Dahi, Shrikdhand, Paneer, Channa, Ghee.

**UNIT III- PROCESSING TECHNOLOGY OF EGG** **14 hrs**

- Changes during storage, processing , functions of egg in cookery
- Egg Quality ,Egg Grading
- Egg products

**UNIT IV- PROCESSING TECHNOLOGY OF MEAT AND POULTRY** **16 hrs**

- **Meat**- types methods of slaughter, Antimortem inspection
- Post mortem changes in meat
- Tenderizing of meat
- Grading of Meat,
- Processing of meat
- Sausage, Salami, Bacon, Ham
- **Poultry**
- Classification, processing

**UNIT V- PROCESSING TECHNOLOGY OF FISH** **14 hrs**

- Types of sea foods

- Fish processing
- Fish products

**REFERENCES:**

1. Kent, J.A. Riegels Handbook of Industrial Chemistry, 7th edition. Van Nostrand Reinhold Company, New York. 2003.
2. Dubey, R.C. A Textbook of Biotechnology. S.Chand & Company Limited, New Delhi. 2000.
3. Prescott and Proctor B.E. Food Technology. MC Graw Hill Book Co. New York 1997.
4. Potter, N. N., Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.

**SEMESTER III**  
**FS3CRT09-SENSORY EVALUATION**

Credits – 3

72 hrs

**OBJECTIVES**

To enable the students

- To understand different aspects of sensory science and its application.
- To be able to use sensory evaluation as an analytical tool.

**UNIT I –INTRODUCTION TO SENSORY EVALUATION AND QUALITY**

**ATTRIBUTES**

12 hrs

- Definition and importance of sensory evaluation
- Quality attributes –appearance, flavor, texture and additional quality factors

**UNIT II- PRACTICAL REQUIREMENTS AND GENERAL TESTING CONDITIONS**

14 hrs

- Testing area ,testing set up ,lighting, testing schedule, preparation of samples, sample coding ,evaluation card preparation, Trained & untrained panel members

**UNIT III- SENSORY ASSESSMENT OF FOOD QUALITY**

16 hrs

**1. TASTE ( GUSTATION)**

- Introduction , importance of gustation,
- Taste sense to mouth, tongue
- Chemical dimensions of basic tastes- sweet, bitter, sour, salt and umami.
- Taste enhancers, perception of taste
- Taste measurement- E-tongue

**2. ODOUR AND FLAVOR ( OLFACTION)**

- Introduction and importance of odour and flavor
- Smelling techniques- Vonskramlk Test
- E- Nose and theories of olfaction.

**3. COLOR**

- Introduction and importance of color
- Dimensions of color, perception of color

**4. TEXTURE**

- Introduction, definition and importance
- Texture classification
- Texture measurement

**5. OTHER SENSES**

- Temperature sensation, pain sensation, touche sensation, kinesthetic sensations, and sound sensations etc.

#### **UNIT –IV SENSORY TESTING OF FOODS**

**16 hrs**

- Threshold tests,
- Descriptive test
- Discriminative tests,
- Ranking tests,
- Hedonic tests,
- Acceptance and preference tests,
- Scoring tests
- Sensitivity tests

#### **UNIT- V DATA ANALYSIS**

**14 hrs**

- Importance of data analysis, tests of significance ,null hypothesis ,mean, median, variance, standard deviation, t-test ,chi-square test

#### **REFERENCE**

1. Jellinek, G., Sensory Evaluation of Food-Theory and Practice., Elis Horwood Ltd.,England.,1985.
2. Srilakshmi,B., Food Science., New Age International (P) Limited., New Delhi.,2005.
3. Manay,S., Shadaksharaswamy,M., Food Facts and Principles, New Age International (P) L imited., New Delhi., 2008.

## SEMESTER III

### ES3CRT10-FOOD PACKAGING MATERIALS AND TESTING

Credits – 3

72 hrs

#### **OBJECTIVES**

##### **To enable students**

- (i) To be familiar with different methods and materials used for packaging.
- (ii) To understand the technology behind packaging.
- (iii) To understand interaction of food with packaging & to do shelf life testing.

#### **UNIT – I INTRODUCTION TO FOOD PACKAGING**

12 hrs

- Definition, functions and requirements for effective packaging.

#### **UNIT II- CLASSIFICATION OF PACKAGING**

14 hrs

- Primary, secondary and tertiary packaging.
- Flexible, rigid and Semi- rigid packaging.

#### **UNIT -III MATERIALS FOR FOOD PACKAGING, TYPES, USES, MERITS DRAWBACKS.**

16 hrs

- Paper, Glass, Tin, Aluminum, Plastic, Boxes, Jars, Cans, Bottles

##### **Interaction of packages with foods**

- Tin can corrosion
- Global migration of plastics

#### **UNIT IV- MODERN CONCEPTS OF PACKAGING TECHNOLOGY.**

16 hrs

- Aseptic packaging
- Form Fill Seal packaging
- Edible Films
- **Vacuum, Controlled atmospheric Packaging, Retort Pouches, Active & intelligent packaging systems.**
- Easy - Open End, Boil in- bags, Closures.

## **UNIT V- QUALITY TESTING OF PACKAGING MATERIALS**

**14 hrs**

- Physical test for tin and plastic
- Testing of glass containers
- Physical and chemical test for plastics

### **SHELF LIFE TESTING OF DIFFERENT PACKAGED FOODS.**

Tin, Plastic, Oxygen interactions, moisture interchanges and aroma permeability

#### **REFERENCES:-**

1. Sacharow, S., Griffin, R.C. Food Packaging. AVI Publishing Company, West Port, Connecticut. 2000.
2. Davis, E.G. Evaluation of tin & plastic containers for foods. CBS Publishers, New Delhi. 2004.
3. Cruess, W.V. Commercial Fruit & Vegetable Products. Allied Scientific Publishers, Delhi. 2003.
4. Potter, N. N., Hotchkiss, J. H. Food Science . CBS Publishers, New Delhi. 2000.
5. Raj, G .D. Encyclopaedia of Food Science, Vol 2. Anmol Publications PVT Ltd, New Delhi.

# **SEMESTER IV**

## SEMESTER IV

### FS4CRT11-PROCESSING TECHNOLOGY OF PLANT FOODS

Credits – 3

72 hrs

**OBJECTIVE:**

- To enable students to understand the importance and to gain knowledge in the processing of plant foods

#### **UNIT I-PROCESSING TECHNOLOGY OF CEREAL AND CEREAL PRODUCTS**

**16 hrs**

- Wheat- composition, milling process, products- baked food products
- Rice- parboiling, milling, products & by products
- Maize- milling
- Oats- milling

#### **UNIT II- PROCESSING TECHNOLOGY OF PULSES, LEGUMES AND OILSEEDS**

**12 hrs**

- Processing- milling- importance pulses- processed soya
- Oil seeds- extraction

#### **UNIT III- PROCESSING TECHNOLOGY OF FRUITS & VEGETABLES**

**16 hrs**

- Tomato- sauce, ketchup, puree
- Mango- pickles, concentrates, pulp, bar, candies, Jam, essences, canned mango pulp
- Tapioca- Syrup, dextrose, syrup solids, flour
- Jackfruit- value added jackfruit products- canned jackfruit, nectar, chips,
- Apple- apple cider, candy, jam, jelly, Juice, pulp, concentrate
- Pineapple- canned pineapple, natural pineapple pulp, juice, fresh pineapple, frozen pineapple juice concentrate, sulphated pineapple ,RTS- pineapple juice
- Potato- chips, French fries, flour, starch, dried potato slices, dehydrated potato products

#### **UNIT IV- PROCESSING TECHNOLOGY OF SPICES & EXTRACTS**

**14 hrs**

- Introduction – classification- processing- uses- oleoresins & spice oils.

#### **UNIT V- PROCESSING TECHNOLOGY OF MISCELLANEOUS FOOD PRODUCTS**

**14 hrs**

- Tea , coffee, - Introduction, processing
- Alcoholic beverages- Introduction (beer, wine, brandy, whisky, rum, gin, vodka)
- Soft drinks- introduction
- Cocoa- processing, products
- Sugar- manufacture, forms of sugar, by products of sugarcane

- Jaggery
- Honey

#### REFERENCES:

1. Kent, J.A. Riegels Handbook of Industrial Chemistry, 7th edition. Van Nostrand Reinhold Company, New York. 2003.
2. Dubey, R.C. A Textbook of Biotechnology. S.Chand & Company Limited, New Delhi. 2000.
3. Prescott and Proctor B.E. Food Technology. MC Graw hill Book Co. New York 1997.
4. Potter, N. N, Hotchkiss, J. H. Food Science . CBS Publishers, New Delhi. 2000.

**SEMESTER IV**  
**FS4CRT12-ANALYTICAL INSTRUMENTATION**

Credits- 4

72 hrs

**Objectives:**

In order to enable students:

- To be familiar with different methods of investigation used in the analysis of foods and biochemical assay.
- To gain knowledge about different instruments used in food analysis.
- To know the principles and applications of different techniques used in food and nutrition research.

**UNIT I - BASIC PRINCIPLES OF CHROMATOGRAPHY**

**12 hrs**

- Adsorption
- Partition
- Affinity
- Size exclusion

**UNIT II- TYPES OF CHROMATOGRAPHY**

**16 hrs**

(Introduction, general principles, procedure,)

Paper Chromatography, thin layer chromatography, column chromatography

**UNIT III- HPLC & GC**

**16 hrs**

Introduction, principle of separation, procedure, components, types of detectors, column hardware & applications

**UNIT IV- SPECTROPHOTOMETRY**

**14 hrs**

- Introduction, basic principles,
- UV –Visible spectroscopy
- Fluorimetry
- Atomic absorption spectroscopy

**UNIT V- ELECTROPHORETIC, ENZYMATIC & RADIO TRACER TECHNIQUE**

**14 hrs**

- Introduction, basic principles, types, procedure & applications of the following:
- SDS PAGE
- Agaros gel
- Native gel
- Radio Immuno Assay
- Scintillation counting(Solid, Liquid, gas)
- Elisa
- Application of enzymes in food industry

## REFERENCES:

1. Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston , London.2004.
2. Mahindru,S.N. Food additives. Characteristics, detection and estimation. Tata Mc Graw-Hill Publishing Company Limited, New Delhi.2000.
3. Pearson, D. The Chemical Analysis of Foods. Churchill Livingstone, New York,2002

## SEMESTER IV

### FS4CRT13-FOOD SAFETY AND QUALITY ASSURANCE

**Credits- 4**

**72 hrs**

**OBJECTIVES:**

- To provide a basic understanding of quality concepts and practice in food companies.
- To provide approaches to the planning and organization of a quality control system.
- To provide a basic acquaintance with standards and specifications

**UNIT 1- INTRODUCTION TO FOOD SAFETY**

**16 hrs**

- Definition, types of hazard-physical, chemical and biological, factors affecting Food Safety.

**Quality Control Concepts as applied to the food industry**

- General Concepts of quality control and quality control
- Major quality control functions

**UNIT II- QUALITY ASSURANCE- TOTAL QUALITY CONTROL AND STATISTICAL QUALITY CONTROL**

**14 hrs**

- Definition of Quality Assurance, Difference between QA and QC
- Definition of TQC, its nature, approaches and role of management
- Definition of SQC, determining the need for SQC,
- Definition –control chart, uses process control.

**UNIT III- STANDARDS AND SPECIFICATIONS**

**12 hrs**

- Voluntary and Compulsory standards
- Packaging and labeling standards
- ISO and HACCP
- FSSAI

**UNIT IV- QUALITY IMPROVEMENT TECHNIQUES**

**14 hrs**

- Quality Improvement Plans(QIP)
- Quality Control Circles( QCC)
- Total quality management (TQM)

**UNIT V- EXTERNAL QUALITY CONTROL ACTIVITIES**

**16 hrs**

- Inspection- Preshipment inspection and inspection at the port of destination
- Certification and quality marks

- National Standard Bodies
- Testing Laboratories.

## **REFERENCES :**

- Philip,A.C. Reconceptualizing quality. New Age International Publishers,Banglore. 2001.
- Bhatia,R. and Ichhpujan,R.L. Quality assurance in Microbiology. CBS Publishers and Distributors, New Delhi. 2004.
- Kher, C.P. Quality control for the food industry. ITC Publishers, Geneva. 2000.

**INDUSTRIAL  
TRAINING  
(ONE MONTH)-  
FS4OJP14**

# **SEMESTER V**

**SEMESTER V**  
**FS5CRT15-FOOD ANALYSIS (THEORY)**

**Credit – 4**

**72 hrs**

**OBJECTIVES**

To enable the students

- to understand different sampling techniques employed in chemical analysis of foods.
- to learn various chemical methods of food analysis.
- to do the proximate analysis.

**UNIT I- INTRODUCTION TO FOOD ANALYSIS**

**14 hrs**

- Introduction to food analysis
- Sampling, Population, Proximate Principles
- Importance of sampling
- Sampling technique
- Types of sampling
- Sampling Plan
- Preparation of samples
- Problems in sampling

**UNIT II- PHYSICAL METHODS OF FOOD ANALYSIS**

**12 hrs**

- Food Rheology
- Viscosity
- Surface Tension
- Refractometry
- Polarimetry
- Freezing point
- Specific gravity

**UNIT III- ANALYSIS OF FOODS**

**16 hrs**

- **MOISTURE ANALYSIS**- Oven drying method, Distillation method, Karl-Fischer Titration Method, San Pan Technique
- **ASH ANALYSIS**- Dry, Wet, Low temperature, Plasma Ashing, Soluble and Insoluble Ash in Water, Ash insoluble in acid
- **TOTAL CARBOHYDRATE ANALYSIS**- Lane and Eynon's Metho, Nelson-Somogyi method, Alkaline ferric cyanide method, Phenol-sulphuric acid method, Starch Analysis.

- **FIBRE ANALYSIS:** - Crude Fibre analysis, Dietary Fibre Analysis by AOAC method
- **PROTEIN ANALYSIS-** Kjeldahl Method, Biuret Method, Lowry Method, BCA Method, Barford's Method, Ninhydrin Method, Amino acid Analysis.
- **FAT ANALYSIS:** Continuous solvent extraction method, Semi continuous solvent extraction method, Discontinuous extraction method, Non-solvent wet extraction method, Instrumental methods, Refractive index, melting point, SFI, Cold Test, Cloud point, Smoke point, Flash and Fire point, Iodine Value, Saponification Value, Acid Value, Peroxide Value, TBA Test, Schaal Oven test.

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

**16 hrs**

- Vitamin A by Carr-Price method, HPLC
- Vitamin C- Ascorbic acid dichloroindophenol method
- Vitamin D- Line test

#### **UNIT V- MINERAL ANALYSIS**

**14 hrs**

- Mineral Analysis- Calcium- Gravimetric, EDTA and redox titration
- Iron – Redox titration
- Phosphorous- colorimetry

#### **REFERENCE**

1. Kalia, M. Food Analysis and Quality Control. Kalyani Publishers, New Delhi. 2002.
2. Winton, A.L and Winton, K.B. Techniques of food analysis. Allied Scientific Publishers, New Delhi. 1999.
3. Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London. 2003.
4. Connell, J.J. Control of fish quality. Blackwell Scientific Publications, Cambridge

## SEMESTER V

### FS5CRT16-FOOD TOXICOLOGY

**Credit – 4**

**72 hrs**

**OBJECTIVES:**

- to make students aware of the toxicity in foods
- to assess the safety of food
- to familiar with the techniques used in food evaluation.

**UNIT I- INTRODUCTION TO TOXICOLOGY**

**12 hrs**

Definition- Toxicology- importance- scope – basic divisions- Goals- Basic concept of Toxicology

**UNIT II- NATURALLY OCCURRING TOXICANTS IN VARIOUS FOODS**

**14 hrs**

Toxicants in Plant foods- Seafood toxins- Antivitamins- Radioactive metals in foods- Toxic minerals- other inorganic compounds occur in Food & Water

**UNIT – III TOXICANTS OF PUBLIC HEALTH HAZARD**

**16 hrs**

Chemical contaminants- pesticide residues- types of pesticides- automobile emissions( CO, SO<sub>2</sub>, NO), Hydrocarbons- photochemical products- heavy metals(Mercury, Arsenic, Lead, Cadmium, Aluminium, Tin), Food additives- types- health hazards- radioactive substances-kinds of radiators- sources of radiations- biological effect of radiations

**UNIT IV- XENOBIOTICS & CARCINOGENS**

**16 hrs**

Absorption, Assimilation, utilization and excretion of xenobiotics- Biotransformation- Phase I and Phase II-Types- Mechanism of chemical carcinogens-mutagens and Teratogens

**UNIT V- SUBSTANCES INTENTIONALLY ADDED TO FOODS**

**14 hrs**

Antioxidants- colors-stabilizers –GM Foods and their safety

**REFERENCES:**

- B.Jacob, Chemical analysis of food and food products by Morris, 3<sup>rd</sup> edtn,
- Nutritional and Toxicological aspects of food processing ed. Walker and E.Quattrucci Tayloss and Francis New York 1980

## SEMESTER V

### FS5CRT17-ENVIRONMENTAL STUDIES AND HUMAN RIGHTS

**Credit – 4**

**72 hrs**

#### **Module I**

##### **Unit 1 : Multidisciplinary nature of environmental studies**

Definition, scope and importance

**(2 hrs)**

Need for public awareness.

##### **Unit 2 : Natural Resources :**

Renewable and non-renewable resources : Natural resources and associated problems.

a) **Forest resources** : Use and over-exploitation, deforestation, case studies.

Timber extraction, mining, dams and their effects on forest and tribal people.

b) **Water resources** : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) **Mineral resources** : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) **Food resources** : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) **Energy resources**: Growing energy needs, renewable and non renewable energy sources,

use of alternate energy sources, Case studies.

f) **Land resources**: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

- Role of individual in conservation of natural resources.

- Equitable use of resources for sustainable life styles.

**( 10 hrs)**

##### **Unit 3: Ecosystems**

- Concept of an ecosystem

- Structure and function of an ecosystem

- Producers, consumers and decomposers

- Energy flow in the ecosystem

- Ecological succession

- Food chains, food webs and ecological pyramids.

- Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem

**( 6 hrs)**

#### **Module II**

##### **Unit 1: Biodiversity and its conservation**

- Introduction

- Biogeographical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
- Endangered and endemic species of India

( 8 hrs)

## **Unit 2: Environmental Pollution**

Definition

Causes, effects and control measures of: -

- a. Air pollution
  - b. Water pollution
  - c. Soil pollution
  - d. Marine pollution
  - e. Noise pollution
  - f. Thermal pollution
  - g. Nuclear hazards
- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
  - Role of an individual in prevention of pollution
  - Pollution case studies
  - Disaster management: floods, earthquake, cyclone and landslides.

(8 hrs)

## **Unit 3: Social Issues and the Environment**

- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people: its problems and concerns, Case studies
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust, Case studies
- Consumerism and waste products
- Environment Protection Act
- Air ( Prevention and Control of Pollution) Act
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness

(10 hrs)

## Module III

### UNIT I : Waste Management in Food Industries 10 Hrs

- Classification and characterization of food industrial wastes from fruit and vegetable processing industry, beverage industry, fish, meat and poultry industry, sugar industry and dairy industry; Waste disposal methods –physical, chemical and biological;

### Module – IV

### Unit I: Treatment Methods of Liquid & Solid Wastes

10hrs

- Treatment methods for liquid wastes from food process industries; Design of activated sludge process, Rotating biological contactors, Trickling filters
- Treatment methods of solid wastes: Biological composting, drying and incineration; Design of solid waste management system: Landfill digester,

### Module – V

**Unit 1- Human Rights**– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

**Unit-2 Human Rights and United Nations** – contributions, main human rights related organs - UNESCO, UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights.

**Human Rights in India** – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

**Unit-3 Environment and Human Rights** - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment

**Conservation of natural resources and human rights:** Reports, Case studies and policy formulation. Conservation issues of western ghats- mention Gadgil committee report, Kasthuriengan report. Over exploitation of ground water resources, marine fisheries, sand mining etc.

(8 Hrs)

### Internal:

### Field study

- Visit to a local area to document environmental grassland/ hill /mountain
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc
- Study of simple ecosystem-pond, river, hill slopes, etc

(Field work Equal to 5 lecture hours)

## REFERENCES

1. Bharucha Erach, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013 (TB)
2. Clark.R.S., Marine Pollution, Clarendon Press Oxford (Ref)
3. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001 Environmental Encyclopedia, Jaico Publ. House. Mumbai. 1196p .(Ref)
4. De A.K.Environmental Chemistry, Wiley Eastern Ltd.(Ref)
5. Down to Earth, Centre for Science and Environment (Ref)
6. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140pb (Ref)
7. Jadhav.H & Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p (Ref)
8. Mckinney, M.L & Schok.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p (Ref)
9. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
- 10.Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p (Ref)
- 11.Rao.M.N & Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p (Ref)
- 12.Rajagopalan. R, Environmental Studies from crisis and cure, Oxford University Press, Published: 2016 (TB)
- 13.Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut (Ref)
- 14.Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (Ref)
- 15.Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (Ref)
- 16.Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (Ref)
17. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p (Ref)
- 18.(M) Magazine (R) Reference (TB) Textbook

## **Human Rights**

- 1.** Amartya Sen, The Idea Justice, New Delhi: Penguin Books, 2009.
- 2.** Chatrath, K. J.S., (ed.), Education for Human Rights and Democracy (Shimla: Indian Institute of Advanced Studies, 1998)
- 3.** Law Relating to Human Rights, Asia Law House,2001.
- 4.** Shireesh Pal Singh, Human Rights Education in 21<sup>st</sup> Century, Discovery Publishing House Pvt.Ltd, New Delhi,
- 5.** S.K.Khanna, Children And The Human Rights, Common Wealth Publishers,1998. 2011.
- 6.** Sudhir Kapoor, Human Rights in 21<sup>st</sup> Century,Mangal Deep Publications, Jaipur,2001.
- 7.** United Nations Development Programme, Human Development Report 2004: Cultural Liberty in Today's Diverse World, New Delhi: Oxford University Press, 2004.

# **OPEN COURSE**

## **FS5OPT18 -SEMESTER V**

### **FOOD FACTS AND PRINCIPLES**

**Credit: 3**

**72 Hrs**

**Objectives:**

#### **UNIT 1 : INTRODUCTION AND CLASSIFICATION OF FOODS**

**16 Hrs**

- definition-.Functions, Food groups, Food guide
- Classification:
  - a. Natural
  - b. Organic
  - c. Functional
  - d. Probiotic
  - e. Prebiotic
  - f. Fabricated
  - g. Functional
  - h. Space
  - i. Health
  - j. Nutritional
  - k.convenience
  - l. l.fast foods

#### **UNIT II- METHODS OF PRESERVATION**

**14 Hrs**

- low temperature
- high temperature
- use of preservatives
- dehydration
- irradiation

#### **UNIT III- FOOD ADULTERATION**

**14 Hrs**

- definition
- types
- intentional
- incidental
- methods of detection

#### **UNIT IV: PREPARATION OF VARIETY OF FOODS**

**14 Hrs**

- jam
- jellies

- marmalades
- purees
- sauces
- pickles

**UNIT V: FOOD PACKAGING:**

**14 Hrs**

- . Definition
- Functions and requirements for effective packaging
- Classification of packaging
- Materials for food packaging
- Modern concepts of food packaging technology

**References:**

1. Giridhar Lal, G.S, Siddappa and G.L Tandon, Preservation of fruits and vegetables, Indian council of agricultural Research, New Delhi
2. N.Shakunthala manay and M.Shadhakaraswamy, Food Facts and Principles, New Age international Publishers

**SEMESTER V (ST.GEORGE'S COLLEGE)**  
**FS5OPT19- HUMAN HEALTH AND NUTRITION**

**CREDITS – 3**

**72 hrs**

**Unit 1- Basic concept of food, nutrition and health**

**12 hrs**

Concept of nutrition, classification, nutrients- fat, protein, carbohydrates, vitamins, minerals, and trace elements. Dietary fibre, nutritional profile of principle foods- cereals, pulses, milk and milk products, egg, fish, poultry and spices. Nutritional requirements – concept of energy, energy requirement, protein quality, balanced diet at different ages and nutritional needs during life cycle ( infants to old age ) including physiological conditions like pregnancy and lactation. Functions of food, components of food – functions and sources. Food group and concept of balanced diet, socio – economic aspect of nutrition and health status in India. Nutrigenomics, Functional foods, food safety and quality.

**Unit 2 – Nutritional agencies**

**16hrs**

Nutritional programmes related to nutrition- Vitamin A deficiency programme, National Iodine Deficiency Disorder Programme, Mid- day meal programme, Integrated Child Development Scheme (ICDS ). National and international agencies working towards food and nutrition- NIPCCD,CARE, FAO, NIN, CFTRI. Assessment of nutritional status.

**Unit 3- Food additives**

**10 hrs**

Food additives- definition & types, colours, preservatives. Food adulteration, household level food preservation and storage. Food labelling.

**Unit 4 – Food processing**

**10 hrs**

Methods of cooking, healthy cooking practices, food hygiene, potable water- methods of purification. Food and water borne infections.

**Unit 5- Major nutritional deficiency diseases**

**24 hrs**

Protein energy malnutrition, Vitamin A deficiency, Iron deficiency, Iodine deficiency- Causes, symptoms, prevention and any government programme in related. Life style diseases- BP, diabetics, obesity- causes and prevention through life style modification. Social health problems- smoking, alcoholism, drugs and AIDS. Diseases related to mineral deficiency.

**REFERENCES**

1. Mudambi, S. R., Rajagopal M. V., Fundamentals of food and Nutritions, 2<sup>nd</sup> edition, Wiley Eastern Ltd, New Delhi 1990.
2. Swaminathan, M., Hand book of Food & Nutrition, Bappco Ltd, Bangalore, 1978.
3. Srilakshmi, B, Nutrition Science, New age international (P) Ltd publishers, New Delhi, 2006

FS5OPT20 HUMAN HEALTH AND NUTRITION

**CREDITS – 3**

**72 hrs**

**Unit 1- Basic concept of food, nutrition and health**

**12 hrs**

Concept of nutrition, classification, nutrients- fat, protein, carbohydrates, vitamins, minerals, and trace elements. Dietary fibre, nutritional profile of principle foods- cereals, pulses, milk and milk products, egg, fish, poultry and spices. Nutritional requirements – concept of energy, energy requirement, protein quality, balanced diet at different ages and nutritional needs during life cycle ( infants to old age ) including physiological conditions like pregnancy and lactation. Functions of food, components of food – functions and sources. Food group and concept of balanced diet, socio – economic aspect of nutrition and health status in India. Nutrigenomics, Functional foods, food safety and quality.

**Unit 2 – Nutritional Programmes**

**16hrs**

Nutritional programmes related to nutrition- Vitamin A deficiency programme, National Iodine Deficiency Disorder Programme, Mid- day meal programme, Integrated Child Development Scheme (ICDS ). National and international agencies working towards food and nutrition- NIPCCD,CARE, FAO, NIN, CFTRI. Assessment of nutritional status.

**Unit 3- Food additives**

**10 hrs**

Food additives- definition & types, colours, preservatives. Food adulteration, household level food preservation and storage. Food labelling.

**Unit 4 – Food processing**

**10 hrs**

Methods of cooking, healthy cooking practices, food hygiene, potable water- methods of purification. Food and water borne infections.

**Unit 5- Major nutritional deficiency diseases**

**24 hrs**

Protein energy malnutrition, Vitamin A deficiency, Iron deficiency, Iodine deficiency- Causes, symptoms, prevention and any government programme in related. Life style diseases- BP, diabetics, obesity- causes and prevention through life style modification. Social health problems- smoking, alcoholism, drugs and AIDS. Diseases related to mineral deficiency.

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1. Mudambi, S. R., Rajagopal M. V., Fundamentals of food and Nutritions, 2<sup>nd</sup> edition, Wiley Eastern Ltd, New Delhi 1990.
2. Swaminathan, M., Hand book of Food & Nutrition, Bappco Ltd, Bangalore, 1978.
3. Srilakshmi, B, Nutrition Science, New age international (P) Ltd publishers, New Delhi, 2006.

**- SEMESTER V**  
**FS5CRP21- BASIC MICROBIOLOGY PRACTICALS**

Credit – 2

72hrs

**OBJECTIVES:**

- To study the different laboratory equipments in the lab
  - To understand the preparation of media
  - To get thorough with various staining techniques, isolation and enumeration of microbes
1. Study of compound microscope
  2. Working and handling of common microbiological laboratory equipments and materials
  3. Preparation of microscopic examination
  4. Monochrome staining
  5. Differential staining
  6. Capsule staining
  7. Spore staining
  8. Microscopic examination of living organisms- hanging drop mount method for the demonstration of bacterial motility
  9. Negative staining of bacteria
  10. Isolation, Enumeration and Characteristics of microorganisms

**References:**

Dubey,R.C and Maheshwari, D.K. Practical microbiology. S.Chand & Company Ltd, Ram Nagar 200

**SEMESTER V**  
**FS5CRP22- FOOD ANALYSIS AND ADULTERATION TESTING**  
**PRACTICALS-I**

**Credits-2**

**72hrs**

1. **INTRODUCTION TO LABORATORY EQUIPMENTS AND APPARATUS**

2. **ANALYSIS OF MILK**

- Milk Solids,
- Ash
- Fat
- Protein
- Lactose
- Acidity

**Qualitative test**

- MBRT Test
- Starch
- Sucrose
- Urea
- Formalin

3. **ANALYSIS OF SQUASH:**

- Total solids
- Ash
- Water insoluble ash, Water soluble ash, Alkalinity water soluble Ash
- Acidity
- Total Sugar
- Soluble solids(Refractive index)
- Qualitative tests- potassium metabisulphite, sodium benzoate

4. **ANALYSIS OF CONDENSED MILK**

- Total Solids
- Fat
- Acidity
- Estimation of lactose and estimation of sucrose
- Qualitative tests- sucrose, starch

5. **ANALYSIS OF VINEGAR**

- Total solids
- Acidity

- Specific gravity
- Qualitative tests

6. **ANALYSIS OF HONEY**

- Moisture
- Estimation of reducing sugar
- Acidity
- Specific gravity
- Qualitative tests- Aniline chloride and Added glucose

7. **ANALYSIS OF WINE**

- Specific gravity
- Suspended solids
- Dissolved solids
- Total solids
- Total acidity

8. **ANALYSIS OF SPICES**

- Moisture
- Alcoholic extract
- Ash
- Acid insoluble ash
- Volatile Oil

9. **ANALYSIS OF TOMATO KETCHUP**

- Moisture
- Ash
- TSS
- Acidity

10. **DETECTION OF ADULTERATION IN VARIOUS FOODS**

- |                  |           |
|------------------|-----------|
| • Milk           | • Vinegar |
| • Condensed milk | • Wine    |
| • Honey          | • Spices  |
| • Squash         | • Ketchup |

## SEMESTER V

### ES5CRP23- FOOD CHEMISTRY PRACTICALS

**Credit – 2**

**72 hrs**

1. Estimation of Starch
2. Estimation of Crude fibre
3. Estimation of sugar by Phenol Sulphuric acid method
4. Estimation of sugar by Munson & Walker's method
5. Estimation of sugar by Lane & Eynon's method
6. Water Hardness
7. Paper Chromatography
8. Saponification Value of oils/fats
9. Acid value of oils/fats
10. Estimation of ascorbic acid

# **SEMESTER VI**

**SEMESTER VI**  
**FS6CRT24-ENTREPRENEURSHIP DEVELOPMENT & MANAGEMENT IN FOOD**  
**INDUSTRY**

**Credits - 4** **72 hrs**

**UNIT I**

Entrepreneurship: Definition, characteristics and traits, difference between entrepreneur, intrapreneur and manager, types of entrepreneurs, role of entrepreneurs in economic development 12 hrs

**UNIT II**

**Project formulation-** various approaches principles of product selection and development techno-economic feasibility of the project, structure of project report  
14 hrs

**UNIT III**

Role of Government in promoting Entrepreneurship

- Incentives, subsidies and grants
- Agencies and their role - DIC, SISI, EDII, NIESBUD, NEDB

14 hrs

**UNIT IV**

**Management-** Characteristics, Objectives, Principles, Challenges, Importance, Levels of management, Food industry and Management  
16 hrs

**UNIT V**

**Product Development** - need for new products, stages in product development, factors to be considered for it, Pricing and distribution of new product -kinds of pricing, sales promotion techniques  
16 hrs

**REFERENCES**

- Gupta,C.P. Entrepreneurship Development in India. Sultan Chand & sons, New Delhi
- Abraham, M.M.Entrepreneurship Development & Management, Prakash Publications, Changanacherry, 2000.

**SEMESTER VI**  
**FS6CRT25-FOOD ADULTERATION & TESTING**

**Credit – 4**

**72 hrs**

**OBJECTIVES:**

- To enable students to familiarize about the testing methods for adulteration.
- To test for adulteration in food samples.

**UNIT I- FOOD ADULTERATION**

**12 hrs**

- Definition, Classification,
- Health hazards caused by various adulterants
- Critical levels of metals in various foods.

**UNIT II- COMPOSITION AND QUALITY CRITERIA FOR PLANT FOODS 16 hrs**

- Oils and Fats
- Spices and condiments
- Food grains
- Fruits & Vegetables
- Beverages- Alcoholic & Non Alcoholic

**UNIT III- COMPOSITION AND QUALITY CRITERIA FOR ANIMAL FOODS 14 hrs**

- Milk and Milk Products
- Flesh Foods
- Egg

**UNIT IV- COMPOSITION & QUALITY CRITERIA FOR SUGAR & PRESERVES & TIN FOODS 14 hrs**

- Sugar and Sugar products
- Preserves
- Tin Foods

**UNIT V- FOOD ADDITIVES**

**16 hrs**

- Introduction
- Classification- Antioxidants, Preservatives, Emulsifiers, Stabilizers, sweeteners, thickening agents, chelating agents, curing agents, leavening agents, anti caking agents, coloring agents, flavoring agents.

**REFERENCES:**

- Handbook of Analysis; QC for Fruits & Vegetable Products
- E.M.Master; Standard Methods for examination of Dairy Products
- Jacob; Chemical methods of Food Analysis

# **CHOICE BASED**

**SEMESTER VI**  
**FS6CBT 26 -COCONUT & BEVERAGE TECHNOLOGY**

**Credit: 4**

**72 Hrs**

Objectives

- To enable the study to get an up to date knowledge about fermented foods and beverages

**UNIT I Introduction to Coconut Technology**

**12 Hrs**

- Harvesting & storage of coconut & coconut water
- Copra- Introduction, Grades, Copra Drying, Quality Copra
- Coconut oil- Introduction, Properties, Uses, Extraction Methods,
- Quality Standard methods Of Refining, Virgin Coconut Oil

**UNIT II Coconut products and its processing**

**14 Hrs**

- Coconut Toffee
- Dehydrated Sweet Coconut
- Coconut Baked Custard
- Coconut Chips
- Preserved Coconut Milk
- Coconut Cream
- Coconut Jam
- Coconut Honey
- Coconut Cheese
- Spray Dried Coconut Milk Powder
- Dessicated coconut

**UNIT III Processing Technology of Fruit beverages**

**16 Hrs**

- FRUIT JUICE
- FRUIT DRINK
- FRUIT SQUASH
- FRUIT CORDIAL
- FRUIT JUICE CONCENTRATE

**UNIT IV**

**14 Hrs**

Processing Technology of Carbonated beverages

## **UNIT V**

**16 Hrs**

### **Processing Technology of Alcoholic beverages**

- WINE
- BEER
- DISTILLED SPIRITS- VODKA, GIN, WHISKY, BRANDY, RUM

### **References:**

1. Srilakshmi, Food Science. New Age International Publishers, New Delhi,2003
2. Potter,N.N,Hotchmiss, J.H. Food Science, CBS Publishers, New Delhi,2002

**SEMESTER VI**  
**FS6CBT27- BASIC FOOD ENGINEERING**

**Credit 4** **(72 Hrs)**

**UNIT I: DIMENSIONS, QUANTITIES AND UNITS** **10 Hrs**

- a. Dimensions and units
  
- b. Basic physical quantities: velocity and speed, acceleration, force and momentum, weight, pressure. Work and energy, power.

**UNIT II: FLUID FLOW IN FOOD PROCESSING**

**16 Hrs**

- a. Fundamentals of fluid flow
  
- b. Properties of fluids, density, viscosity, Handling system for Newtonian liquids – Continuity equation, Reynolds number, Entrance region and fully developed flow, Velocity profile.
  
- c. Measurement of fluid flow, Pitot tube.

**UNIT III: HEAT TRANSFER IN FOOD PROCESSING**

**16 Hrs**

- a. Principles of heat transfer, heat exchangers.
  
- b. Thermal properties of food, specific heat, thermal conductivity, thermal diffusivity
  
- c. Modes of heat transfer: conduction, convection, and radiation
  
- d. Conductive heat transfer in rectangular slab

**UNIT IV: UNIT OPERATIONS**

**16Hrs**

- a. Separation processes: centrifugation, filtration, solvent extraction
  
- b. Mechanical operations: mixing of liquid and solid food materials, size reduction of liquid and solid food materials, Extrusion
  
- c. Membrane separation: electro dialysis system, reverse osmosis, ultra filtration.

**UNIT V: FREEZING AND DRYING**

**14 Hrs**

- a. Refrigeration: selection of refrigerant, components of a refrigeration system, advantages and disadvantages.

- b. Freezing: principles, types of freezing, theories of freezing, Merits and demerits of freezing.
- c. Drying: Theories of drying, types of driers, Merits and demerits of freezing of drying.
- d. Evaporation: Types of evaporators.

**REFERENCE:**

1. Introduction to food engineering, 4 th edition, R. Paulsingh & Dennis .R. Heldman, Elsevier publications.
2. **Singh, R.P., 2004, Introduction to Food Engineering 3rd edition. Academic Press, London.**

**SEMESTER VI**  
**FS6CBT28- INTRODUCTION TO FOOD ENGINEERING**

Credit – 4

72 hrs

**OBJECTIVES:**

- To provide an understanding of basics in food engineering

**UNIT I- INTRODUCTION**

**10 hrs**

Dimensions – Primary and Secondary

Engineering Units – Base units, Derived units and supplementary units

System – State of a system, extensive and intensive properties

Density – Solid, Particle and Bulk density

Concentration, Temperature, Pressure, Enthalpy, Power and area

Phase diagram of water

**UNIT II – THERMODYNAMICS AND EQUILIBRIUM**

**13 hrs**

Conservation of mass- conservation of mass for an open system and a closed system

Thermodynamics – laws of thermodynamics

Equation of state and Perfect Gas Law

Energy – potential and kinetic energy

Energy balance for a closed system and an open system, total energy balance

**UNIT III – FLUID FLOW IN FOOD PROCESSING**

**17 hrs**

Liquid Transport Systems – Pipes and Pumps

PUMPS- Definition, classification, positive displacement and centrifugal pumps, factors affecting choice of a pump

Properties of liquids - Density, Pressure, Surface tension and Viscosity.

Newtonian and non Newtonian fluids, laminar and turbulent fluid, The Continuity equation,

Reynold's number

Energy equation for steady flow of fluids – pressure, kinetic energy, potential energy, frictional loss, power requirements of a pump

**UNIT IV – ENERGY IN FOOD PROCESSES**

**17 hrs**

Generation of steam – Steam Generation System, Steam Tables, Steam Utilization

Fuel utilization- Systems, Mass And Energy Balance Analysis, Burner Efficiency

Electric Power Utilization – Electric Terms and Units, Ohm's Law, Electric Circuits, Electric Motors, Electric Controls and Lighting

**UNIT V – HEAT TRANSFER IN FOOD PROCESSING**

**15 hrs**

Thermal properties of food – Specific Heat, Thermal Conductivity, Thermal Diffusivity

Modes of Heat Transfer – Conductive, Convective, Radiative

Steady state heat transfer, Application of steady state heat transfer

Fourier's law

Role of insulation in reducing heat loss from process equipment

### **REFERENCES**

- Dincer, I. Heat Transfer Food Cooling Applications. Taylor and Francis Publishers, USA. 1997.
- Heldman, D.R. and Lund, D.B. Handbook of Food Engineering 2<sup>nd</sup> edition. CRC press, Newyork, 2007.
- Singh, R.P. Introduction to Food Engineering 3<sup>rd</sup> edition. Academic Press, London. 2004.

**SEMESTER VI**  
**FS6CRP29-ADVANCED FOOD MICROBIOLOGY PRACTICALS**

**Credits – 2**

**72 hrs**

**Objectives:**

- To study the standard plate count method
  - To identify microorganisms based on their enzymatic activity
  - To evaluate micro flora of various food samples
  - To assess sanitary quality of water
1. Composition, preparation and sterilization of media, nutrient agar, PDA agar, McKonkey Agar, EMB Agar
  2. Isolation of Pure Colonies
    - Preparation of media and sterilization,
    - Pour plate and Streak Plate Methods
  3. Microbiology of Milk
    - a) Quantitative analysis of milk by SPC(standard Plate Count Method)
    - b) Enzymatic test of milk by MBRT(Methylene Blue Reductase Test)
    - c) Determination of phosphatase activity of milk
    - d) Detection of mastitis through milk test
    - e) Detection of calcium and phosphorous in milk
  4. Microbiological Analysis of Meat and Fish and Egg
  5. Microbiology of Sauce
  6. Microbiology of Bread (Yeast & mold)
  7. Microbiology of fruits and vegetables
  8. Microbiology of Air, Water and Soil
  9. SWAB test
  10. Biochemical Testing
    - a) Triple sugar iron agar test
      - b) Indole Production Test
      - c) Methyl Red Test
      - d) Vogues Proskauer Test
      - e) Citrate Utilization Test

**SEMESTER VI**  
**ES6CRP30-FOOD ANALYSIS AND ADULTERATION TESTING**  
**PRACTICALS- II**

**Credit – 2**

**72hrs**

**1. ANALYSIS OF JAM**

- Determination of Soluble Solids
- Insoluble Solids
- Totals Solids
- Acidity
- Pectin Content
- Total Sugar

**2. ANALYSIS OF TEA**

- Moisture
- Ash
- Water soluble Ash
- Alkalinity of water Soluble Ash
- Total extractives
- Stalks in Tea
- Tannin

**3. ANALYSIS OF COFFEE**

- Moisture
- Ash
- Water-soluble ash
- Alkalinity of soluble ash
- Caffeine extractives
- Chicory
- Qualitative tests for chicory

**4. ANALYSIS OF WHEAT FLOUR**

- Moisture
- Ash
- Gluten
- Crude fibre
- Maltose figure
- Acidity
- Acid insoluble ash
- Sedimentation value

**5. ANALYSIS OF BUTTER**

- Moisture
- Curd and salt
- Fat analysis
- Total titratable acidity
- Qualitative tests- added color, vanaspathi and added starch

**6. ANALYSIS OF COCOA POWDER**

- Moisture
- Ash
- Bulk Density
- Fat
- Crude fibre

**7. ANALYSIS OF MILK POWDER**

- Moisture
- Ash
- Alkalinity of ash
- Acidity
- Fat
- Lactose
- Bulk density

**8. ANALYSIS OF JELLY**

- Determination of Soluble solids
- Insoluble solids
- Total solids
- Total sugar
- Acidity
- Pectin

**9. DETECTION OF ADULTERATION IN VARIOUS FOODS**

- Jam
- Tea
- Coffee
- Wheat Flour
- Butter
- Milk powder
- Jelly
- Cocoa powder

## **10. SENSORY ANALYSIS OF FOODS**

- DIFFERENCE TESTS
  - Paired
  - Compared
  - Duo-trio
  - Triangle
- RATING TEST
  - Ranking test
  - Two sample test
  - Multiple sample test
- NUMERICAL SCORING TEST – Composite scoring test

## **SEMESTER VI**

### **FS6CRP31-ADVANCED FOOD**

#### **CHEMISTRY PRACTICALS**

**Credits- 2**

**72 hrs**

1. Estimation of Chlorophyll
2. Estimation of SO<sub>2</sub>
3. Estimation of sucrose by  
Willstatter's method
4. Peroxide value of fats/oils
5. Estimation of protein by Lowry  
method
6. Estimation of Iodine value
7. Estimation of free fatty acids
8. Estimation of protein by Sorenson's  
Formol titration
9. Enzyme standardization-  
Determination of amylase activity
10. Estimation of Protein by Biuret  
method

**PROJECT  
/DISSERTAT  
ION-  
FS6DSP32**