

DEPARTMENT OF Chemistry  
**M.Sc. Food Chemistry and Food processing**  
**P.G. PROGRAMME**  
**SYLLABUS**

Effective from the Academic Year 2016-2017



**Loyola College (Autonomous)**  
**Chennai- 600 034**



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**RESTRUCTURING-2016 (2016-17 batch ONWARDS)  
PG - Arts / Science / Commerce / Social Work**

Part	Semester 1	Semester 2	Summer Vacation	Summer 3	Summer 4	Total Hours
Major Core (MC)	30(20 C)	24(20 C)	--	20(15 C)	30(24 C)	104(79 C)
Elective Subject (ES)	--	4(3 C)	--	4(3 C)	--	8(6 C)
Inter - Disciplinary (ID)	--	--	--	6(5 C)	--	6(5 C)
Self study Paper (SSP)				Outside class hours(2C)		(2 C)
Summer Training Program (STP)	--	--	3 to 4 weeks (1 C)	--	--	(1 C)
Life Skills Training (LST)	--	2h + 2h# (2 C)	--	--	--	2+2# (2 C)
Extension Activities	LEAP	LEAP(3 C)	--	--	--	(3 C)
Total Hours (Total Credits)	30 (20 C)	30+2# (23+5 C)	-(1 C)	30 (23+2 C)	30 (24 C)	120+2# (90+6+2*)C

Note: A theory paper shall have 5 to 6 contact hours and a practical session shall have 3 to 5 contact hours.



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## New formats of the subject code from the 2016 Regulation

Subject codes are 10 characters long:

1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	7 <sup>th</sup>	8 <sup>th</sup>	9 <sup>th</sup>	10 <sup>th</sup>
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- 1st & 2nd digits – last two digits of regulation year in YY format (If 2016, it will be 16).
- 3rd alphabet: U – UG / P – PG / M – M.Phil. / D – Ph.D.
- 4th & 5th alphabets: department wise program code (example – MT / CO / HT.....)
- 6th digit: Semester for UG/ PG / M.Phil. and year for Ph.D.
- 7th & 8th alphabet: Category of paper or group of category of papers (GE/RL/OL/HE/OR/AL /ES/SK/MS/CM/CC/ .....)
- 8th & 9th digits: subject number range (01 to 99).

For example,

### Example 1:16UCH1MC01

16 – Admitted in 2016  
U – UG student  
CH – Chemistry Student  
1 – 1st Semester subject  
MC01 – Major paper

### Example 2:16PCO2ID01

16 – Admitted in 2016  
P – PG student  
CO – Commerce Student  
2 – 2nd Semester subject  
ID01 – Inter disciplinary paper

- For subjects which are carried forward from one regulation to the next, the first two digits representing the regulation alone will change.
- Subjects which are not carried forward from one regulation to the next, will not appear in the new regulation.
- For new subjects which need to be added to a regulation, a new subject code must be created in continuation of the last created code under that type/category.
- Subject codes which are identical (except for the first two digits which represent the regulation year) are treated as equivalent for the purpose of syllabus / question paper setting / conducting examination / etc.



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**M.Sc FOOD CHEMISTRY & FOOD PROCESSING -  
RESTRUCTURED TEMPLATE**

<b>Sl. No</b>	<b>Sub. Code</b>	<b>Title of the paper</b>
1	16PFP1MC01	FOOD CHEMISTRY - I
2	16PFP1MC02	INTRODUCTION TO FOOD PROCESSING
3	16PFP1MC03	FOOD MICROBIOLOGY
4	16PFP1MC04	TECHNIQUES IN FOOD ANALYSIS
5	16PFP1MC05	FOOD ANALYSIS LAB – I
6	16PFP1MC06	FOOD MICROBIOLOGY LAB
7	16PFP2MC01	FOOD CHEMISTRY – II
8	16PFP2MC02	HUMAN NUTRITION & BIOCHEMISTRY
9	16PFP2MC03	RES. METHODOLOGY & BIOSTATISTICS
10	16PFP2MC04	BIOCHEMISTRY LAB
11	16PFP2MC05	FOOD ANALYSIS LAB – II
12	16PFP2ES01	FUNCTIONAL FOODS AND NUTRACEUTICALS
13	16PFP2ES02	MANAGEMENT OF LIFESTYLE DISEASES



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14	16PHE2FC01	LIFE SKILLS TRAINING
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15	16PFP3MC01	DAIRY & BEVERAGE PROCESSING
16	16PFP3MC02	LIVESTOCK PROCESSING
17	16PFP3MC03	PLANT PRODUCT PROCESSING
18	16PFP3MC04	FOOD ANALYSIS LAB - III
19	16PFP3ES01	SUSTAINABLE FOOD MANAGEMENT
20	16PFP3ES02	ENTREPRENEURS FOR FOOD INDUSTRIES
21	16PFP3TP01	SUMMER TRAINING PROGRAMME
22	16PFP3ID01	FOOD BIOTECHNOLOGY
23	16PFP4MC01	FOOD SAFETY, LAWS & REGULATIONS
24	16PFP4MC02	FOOD PROCESSING LAB - I
25	16PFP4MC03	FOOD PROCESSING LAB - II
26	16PFP4PJ01	PROJECT AND VIVA VOICE



**16FP1MC01 FOOD CHEMISTRY I**  
**CHEMISTRY OF MACRONUTRIENTS**

<b>SEMESTER I</b>	<b>CREDITS 4</b>
<b>CATEGORY MC(T)</b>	<b>NO.OF HOURS/ WEEK 5</b>

**Objectives:**

- i. To provide students with the knowledge about organic molecules present in food.
- ii. To familiarize the students with the underlying chemical concepts behind the functionality of food components and their stereochemical properties.
- iii. To provide an understanding of the effects of chemical interactions and changes in the food components during food handling, production, processing and storage.

**Unit I: Water and Ice: (15 hours)**

- Physical and Chemical properties of water: free, bound & entrapped water.
- Solute effects on water : glass transitions and molecular mobility in foods,
- Water activity ( $a_w$ ): Principles, measurements and effects - relationship to relative vapour pressure (RVP) and food stability.
- Kinetic Principles: Key concepts underlying molecular mobility in food.
- Ice in presence of solutes. Solute solvent – ion- dipole, dipole-dipole and induced dipole interactions- macroscopic level. Technological aspects of Ice-freezing, over drying, vacuum freeze drying- lyophilisation.

**(Hours for introduction: 2 - Content handling: 11 - revision: 2)**

**Unit II: Carbohydrates: (15 hours)**

- Monosaccharides: Chirality, isomerisation, Oxidation



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and reduction reactions, Maillard Browning and related





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reactions – Generation of heterocyclic compounds in foods.

- Oligosaccharides: Hydrolytic reactions and their applications in the food industry.
- Polysaccharides: Solubility; gums and hydrocolloids; viscosity and stability of food gels; Indigestible polysaccharides - xanthan gums, carageenan, alginates, pectin, gum arabic and their food applications.
  - Digestible polysaccharides: Starch, amylase and amylopectin; overview of general properties of some starch granules.gelatinisation. Uses of modified and unmodified starch. Celluloses- CMC and MCC, its applications in food industry.

**(Hours for introduction: 2 - Content handling: 11 - revision : 2)**

**Unit III: Proteins:**

**(15 hours)**

- Proteins: Structural hierarchy of proteins- primary, secondary, tertiary and quaternary structures. Forces involved in the stability of protein structure – steric strain, hydrogen bond, electrostatic interactions, hydrophobic interactions, disulphide bonds, conformational stability and adoptability of proteins.
- Amino acids: Physicochemical properties of amino acids. Peptide and synthesis of peptides using amino acids – glycine, alanine, lysine, cysteine, glutamic acid and arginine. Isoelectric point.
- Emulsifying properties: methods, emulsifying activity effects, protein loads, capacity and stability of emulsions, factors influencing emulsification, foaming properties, flavor binding.
- Reactions of proteins in food: reactions with lipids, sulphites, chemical and enzymatic modifications of proteins- alkylation, acylation, phosphorylation, sulphitolysis, enzymatic hydrolysis, plastein reaction.

**(Hours for introduction: 2 - Content handling: 11 - revision : 2)**



**Unit IV: Enzymes: (15 hours)**

- Introduction to Enzymes: Nomenclature, classification, typical concentrations and factors influencing concentrations of enzymes in food, chemical nature of enzymes; Catalysis - enzyme kinetics; Steady state rate kinetics and reaction order.
- Enzyme cofactors: Features of cofactor, coenzymes, prosthetic group, significance of metalloenzymes in Food Chemistry, enzyme inactivation and control, reversible inhibitors, competitive and uncompetitive inhibition Irreversible inhibitors.
- Food modification: Role of endogenous enzymes in food quality, color, lipoxygenase, chlorophyllase, texture- pectic enzymes; flavor and aroma changes, nutritional quality in food.
- Enzymes as processing aids: production of sweeteners, in modifying lipids, in milk and dairy products. Baking for the removal of unwanted constituents, brewing for control of microorganisms.
- Latest trends in enzymes and food management.

**(Hours for introduction: 2 - Content handling :11 - revision : 2)**

**Unit V: Lipids: (15 hours)**

- Introduction to lipids: Nomenclature, Physical properties: melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point, Chemical properties: Reichert meissel value, Polanski value, iodine value, peroxide value, saponification value.
- Effect of frying on fats, Changes in fats and oils-rancidity, lipolysis, flavor reversion Auto-oxidation and its prevention, Fat Mimetics
- Antioxidants: Effectiveness and mechanism of action; Synergism – characteristics of commonly used



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antioxidants. Thermal non-oxidable and oxidable reactions of saturated fats.

- Quality of fats: Test for assessing the quality of saturated fats and frying oils. Control measures, effects of ionizing radiation on fats. Determination of melting points, saponification value, R.M. and Polanski values.
- Rate of changes in macronutrients with relation to temperature, relative humidity both during production and storage.

**(Hours for introduction: 2 - Content handling:11 - revision : 2)**

**Books for study:**

1. Owen R Fennema's (2008) Food Chemistry 4th Edition, CRC Press Publishers.
2. Vaclavik, V. A. and Christian E. W. (2003). "Essentials of Food Science". 2nd Edition, Kluwer Academic, Springer,
3. Belitz.H.D,Grosch .W and Schieberle.P ( 2009) Food Chemistry 4<sup>th</sup> Edition, Spinger

**Books for References:**

1. James K Edward, (Eds.) (2011),.Water quality and treatment, Handbook on drinking water, Sixth edition. Mc graw Hill Publishers.
2. De Man, John M. "Principles of Food Chemistry". 3rd Edition, Springer, 1999.
3. Cheung.C.K .Peter and M.M.Bhavbhuti (Eds) (2015) " Handbook of Food chemistry" Springer-Verlag Berlin Heidelberg Publisher.
4. Hui.Y.H. (Ed) (2006) "Handbook of Food Science, Technology and Engineering" CRC Press.



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**16FP1MC02 INTRODUCTION TO FOOD PROCESSING**

<b>SEMESTER I</b>	<b>CREDITS 4</b>
<b>CATEGORY MC(T)</b>	<b>NO.OF HOURS/ WEEK 5</b>

**Objectives:**

- i. To understand the history and evolution of food processing.
- ii. To gain knowledge on the various food preservative techniques.
- iii. To understand the concept of new product development.

**Unit 1 - Introduction to Food processing and preservation:  
20 hours**

- Scope of food processing in India; principles of food processing and preservation; types of food preservation and industrial applications.
- Unit operations in food processing: and effluent Size reduction, fluid-solid separation, filtration, membrane separation, drying and crystallization.
- **Thermodynamics in food:** Significance of  $\Delta H$ ,  $\Delta S$  &  $\Delta G$ . Coupled reactions in biological systems. Significance of  $E_o$  (SRP); Kirchoff's equation for the calculation of equilibrium constant; Types of dispersion- Effects on reaction rate, surface phenomenon. Surface Tension gradients, Van der Waals attraction. Electric double layer, DLVO theory – Liquid dispersions, sedimentary aggregation kinetics, reversibility of aggregation, Gels- food gels, plastic fats, Mixed gels.
- **Kinetics to shelf life modeling** – Chemical changes during processing and storage. Food quality function; Order of reaction. Temperature effects – Arrhenius approach- Simple shelf-life plot approach; General aspects of quality loss and shelf life test.

**(Hours for introduction: 2 - content handling: 16 -  
revision: 2)**



**Unit 2 - Preservative techniques: Low temperature/High temperature 20 hours**

- Processing and preservation by heat - fundamentals of thermo bacteriology - blanching, pasteurization, sterilization and UHT processing, retorting –RTE foods, extrusion, cooking, baking,
- Processing and preservation by low temperature- Freezing curve, changes occurring during freezing, effect of freezing, chilling on microorganisms, types of freezing i.e. slow freezing, IQF ,chilling and freezing equipment,thawing, changes during thawing and its effect on food.
- Processing and preservation by drying, mechanism and theory of drying, drying curve concentration and evaporation- freeze drying - types of dryers and their suitability for different food products.
- Challenges in Ethnic Food Preservation techniques

**(Hours for introduction: 3 - content handling : 12 - revision : 5)**

**Unit 3 - Non thermal methods of processing and Hurdle technology: 10 hours**

- Processing and preservation by non-thermal methods – curing, fermentation, pickling, emulsions, microbial interactions, chemical preservatives.Novel methods: irradiation, high pressure, pulsed electric field, dielectric heating, microwave heating, ultra sonication.
- Use and application of enzymes, microorganisms and types of food additives in processing and preservation of foods
- Hurdle technology.

**(Hours for introduction:1- content handling : 8 - revision : 1)**



#### **Unit 4 - Introduction to New Product Development:15 hours**

- New food product - Definition – Concept, need and general characteristics of new food product; Classes of New Food products; Technological innovation and food choice models, factors affecting food product development, causes of product failure/ success
- Characteristics of the product: Product Life cycle .Generation of Food product Ideas -Sources of new product ideas- Phases in Food Product Development-
- Consumer research: Financial review Development - Production - Consumer trials -Test market. Concept testing methodology, Design of proto type - testing - quality standards - marketing research-Organizing for new product development - Concepts of research and development Creativity; Criteria for screening - Constraints.
- Standardization of product formulation and product design: Process design, Scale - up and in - process specifications, Requirement for product authorization and product specification -Market and sensory testing - Product launch and commercialization of the product – Start up ventures

**(Hours for introduction: 1 - content handling: 13 - revision: 1)**

#### **Unit 5 - Introduction to Packaging and packaging methods: 10 hours**

- Packaging: Definition, Functions, Significance, Classification and types - Packaging materials - types, various uses, merits & drawbacks; Packaging systems and methods: Vacuum and gas flush packaging, CAP and MAP, Aseptic and retort packaging, box in box; Modern concepts of packaging technology.
- Quality testing of packaging materials- Criteria for



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selection of proper packaging based on the required



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shelf life: Transportation hazards - Shelf life testing of different packaged foods - Oxygen interactions, moisture interchanges and aroma permeability.

- Packaging aesthetic and graphic design; Food labelling, Coding and marking including bar coding; Safety aspects of packaging materials: sources of toxic materials - Interaction of packages with foods - Global migration of plastics - tin can corrosion
- Environmental Issues: recycling and waste disposal.

**(Hours for introduction: 1 content handling : 7  
revision : 2)**

**Books for study:**

1. Brody Aaron. L, Lord and John B (Eds)( 2000), Developing new food products for a changing market place (2nd edition) - Economic Publishing Co. Inc, Lancaster.
2. Zeuthen Peter and Bogh-Sorenson Leif (Eds)(2003) “Food Preservation Techniques” Woodhead Publishing Ltd CRC Press.
3. Robertson, G.L.(2006). Food Packaging: Principles and Practice(2nd ed.), Taylor & Francis

**Books for references:**

1. Earle Mary, Earle Richard and Anderson Allen (2001) “Food Product Development” CRC Press.
2. Potter, Norman N., Hotchkiss, Joseph H., (1998) Food Science, 5<sup>th</sup> Edition, Springer science media, New York.
3. Jun Soojin and Irudayaraj Joseph. M., (2009) “Food Processing Operations Modelling Design and Analysis”, 2<sup>nd</sup> edition, CRC Press.





**16FPF1MC03 FOOD MICROBIOLOGY**

<b>SEMESTER I</b>	<b>CREDITS 4</b>
<b>CATEGORY MC(T)</b>	<b>NO.OF HOURS/ WEEK 5</b>

**Objectives:**

- i. To enable the students to develop knowledge in the basic area of Food Microbiology.
- i. To impart knowledge on the types of micro-organisms associated with food, their role in food spoilage, food borne infections and beneficial uses of microbes.
- ii. To familiarize the students with the methods employed for detection in food.

**Unit 1 – Introduction to Food Microbiology : 15 hours**

- Microbes of importance in the food industry-Indicator organisms: sources of micro organisms and its introduction into the food chain. Future challenges in control of microbes in the food chain.
- Intrinsic and Extrinsic parameters of foods that affect microbial growth- growth curve.
- Water: microbial contamination through water - Control of microorganisms in water, Chlorination, UV radiation -Standards for potable water -Sewage and waste water treatment.
- Use of microbes in food biowars, food pure cultures, microbes in relation to food sanitation.

**(Hours for introduction : 3 -  
content handling : 9 - revision: 3)**

**Unit 2- General mechanism of microbial spoilage of foods :  
20 hours**

- Food biodeterioration- types of bio deterioration - characterization of SSO; CSI, MSL
- Interactions between food-spoiling bacteria- antagonism, symbiosis, Quorum sensing:



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Types of food spoilage reactions and control of spoilage of foods.

- Contamination and spoilage of cereal, pulses and their processed products.
- Contamination and spoilage of Vegetables, fruits and their products.
- Contamination and spoilage of Flesh foods, Eggs and poultry, Milk and milk products.
- Significance of psychrophilic organisms in cold stored and frozen foods.
- Industrial examples of microbial contamination in dairy , poultry , meat and vegetable processing.

**(Hours for introduction : 2 - content handling : 13 - revision : 5)**

**Unit 3- Role of microbes in food borne illness: 13 hours**

- Food Infection and intoxication- epidemiology, laboratory diagnosis and identification.
- Food borne pathogens - bacteria -Gram Negative and Gram positive food borne pathogens: Salmonella, Coliforms, E. coli, Shigella, Vibrio cholerae, Staphylococcus aureus; Clostridium botulinum; Listeria monocytogenes, Campylobacter.
- Food borne viruses, helminthes, nematodes and protozoa.
- Mycotoxins, Algal and Shell fish poisoning.
- Emerging pathogens.

**(Hours for introduction: 2 - content handling: 8 - revision: 3)**

**Unit 4: Fermentation and industrial microbiology:15 hours**

- Fermentation biochemistry –Classification, Importance and safety of fermented foods.



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- Microbes of importance in food fermentations-role and classification of starter bacteria, culture collection centers-natural and controlled fermentation.
- Role of microorganisms in production of Fermented milk, meat and vegetable based foods and fermented beverages- Traditional fermented foods- Primary and secondary microbial metabolites of importance in the food industry.
- Probiotics, prebiotics and synbiotics.
- Mushroom cultivation and Single cell protein.

**(Hours for introduction: 2 - content handling: 9 - revision: 4)**

**Unit 5: Modern instrumental methods of microbial analysis and shelf life prediction: 12 hours**

- Principles of impedance and conductance methods.
- Methods based on bioluminescence measurement-Spiral plate techniques.
- Enzyme Immuno assay techniques – ELISA.
- Rapid and automated microbial methods-Use of rapid kits, microbiological reference criterion of foods, measurement of uncertainty in microbiological testing.
- Shelf life prediction and modeling.

**(Hours for introduction: 2 - content handling: 7 - revision: 3)**

**Books for study:**

1. Bibek Ray and Arun Bhunia, (2014). Fundamentals of Food Microbiology, 5<sup>th</sup> Edition, CRC press.
2. James M. Jay, Martin J. Loessner and David A Golden, (2005). Modern Food Microbiology, 7<sup>th</sup> Edition, Springer Science Media Inc.



3. Frazier W.C. and West off D.C, (2008). Food Microbiology, 4<sup>th</sup> Edition, Tata McGraw-Hill Publishing Co, New Delhi.

**Books for reference:**

1. Adams, M.R and M.O. Moss (2008). Food Microbiology, 3<sup>d</sup> edition New Age International Pvt Ltd Publishers.

2. Vijaya Ramesh (2007). Food Microbiology, 2<sup>nd</sup> edition, MJP Publishers.

3. Wilson.L.Charles(2008) Microbial Food Contamination , 2<sup>nd</sup> edition, CRC Press.

**16PFPMC04 TECHNIQUES IN FOOD ANALYSIS**

<b>SEMESTER I</b>	<b>CREDITS 4</b>
<b>CATEGORY MC(T)</b>	<b>NO.OF HOURS/ WEEK 5</b>

**Objectives:**

- i. To introduce the students to various analytical concepts in food analysis.
- ii. To provide a broad spectrum idea of the principle and elementary ideas involved in various instrumental techniques and their applications in food industries.

**Unit I: Introduction to chemical analysis: 15 hours**

- Accuracy, Precision, Absolute and relative errors, methods of minimizing errors. Normal error curve and its importance. Methods of expressing concentration of solution- Normality, Molarity, Molality, ppm, ppb, W/W, W/V, V/V.
- General principles and applications of titrimetric, gravimetric and colorimetric methods employed in food analysis.

**(Hours for introduction: 2 - Content handling: 11 - revision: 2)**



**Unit II: Spectroscopic Techniques: 15 hours**

- Principle, elementary idea and applications of the following spectroscopic techniques in food analysis: UV-Visible spectroscopy, Atomic absorption spectroscopy, spectrofluorimeter, IR and Raman. NMR, Inductively coupled plasma spectrometry (ICP).

**(Hours for introduction: 2 - Content handling:11 - revision : 2)**

**Unit III: Chromatographic Techniques: 15 hours**

- Principle, elementary idea and applications of the following chromatographic techniques in food analysis: Distribution coefficient: solid liquid, liquid liquid, and gas chromatography- theory of chromatography- Normal and reverse phase chromatography-gel permeation- ion exchange and affinity chromatography, HPLC-instrumentation.

**(Hours for introduction: 2 - Content handling:11 - revision : 2)**

**Unit IV: Separation Techniques: 15 hours**

- Principle, elementary idea and applications of the following separation techniques in food analysis: Gel filtration, membrane filtration, electrophoresis, sedimentation, ultrafiltration and ultracentrifugation, solid phase extraction, supercritical fluid extraction, isoelectric focusing, isotopic techniques, manometric techniques.

**(Hours for introduction: 2 - Content handling:11 - revision : 2)**

**Unit V: Electrochemical Techniques: 15 hours**

- Principle, instrumentation and applications of the following electrochemical techniques in food analysis: Types of electrochemical apparatus- Preparation of Buffer solutions-pH meter, Potentiometer, and



conductivity meters – Measuring Electrode potentials-  
Redox titrations.

**(Hours for introduction: 2 - Content handling:11 -  
revision : 2)**

**Books for Study:**

1. Skoog, D.A. et al., “Principles of Instrumental Analysis”. 6<sup>th</sup> Edition, Thomson/Brooks/Cole, 2007.
2. Willard, Hobart H. et al., “Instrumental Methods of Analysis”.7<sup>th</sup> Edition, CBS Publishers,2008.

**Books for References :**

1. Braun, R.D. “Introduction to Instrumental Analysis”. Pharma Book syndicate Hyderabad, 2006.
2. Suzanne Neilson (ed), (2010)“Food analysis” 4<sup>th</sup> edition, Springer publishers.

<b>16PFP1MC05 FOOD ANALYSIS LAB-I SEMESTER</b>	<b>I</b>
<b>CREDITS</b>	<b>2</b>
<b>CATEGORY MC(L)</b>	<b>NO.OF HOURS/ WEEK 5</b>

**Objectives:**

- i. To enable students to develop skill in qualitative analysis and to develop preparative skills in organic preparations from food samples.
- ii. To better understand the presence of possible adulterants and food contaminants.
- iii. To inculcate skills in analysis of phytochemicals in food.
  1. Separation of organic preservatives (benzoic acid and sorbic acid) from food.
  2. Qualitative estimation of synthetic colours in biscuits and cakes.
  3. Qualitative estimation of cocoa powder from chocolates.
  4. Qualitative estimation of oxalic acid in solvent extracted sesame flour.



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5. Qualitative estimation of hydrocyanic acid from beans.



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6. Qualitative estimation of non-fat milk solids in milk bread.
7. Qualitative quick test for detection of adulterants in milk and milk products.
8. Qualitative determination of rancidity of fats, tests for adulterants in oils and fats.
9. Qualitative estimation for the presence of Salicylic acid a non-permitted preservative in foods.
10. Qualitative estimation for the presence of saccharine in confectionery items and traditional Indian sweets.
11. Tests for the presence of metanil yellow a non-permitted coal tar colour in beverages, ice cream and sweets.
12. Qualitative estimation for the presence of phytochemicals in a few food sources.
13. Qualitative estimation of heavy metals in a few foods – raw and processed foods.
14. Detection of foreign particles in food.
15. Separation of components from food sources, adulterants and food poisons
  - a. Thin layer chromatography
  - b. Paper chromatography
  - c. Column chromatography.

**Books for references:**

1. Tests for some adulterants in food – Instruction manual part II, 2012. Food safety and standards Authority of India (FSSAI)
2. FSSAI lab manual 8, 2012. Methods for analysis of foods - Test for food additives.
3. FSSAI lab manual 8, 2012. Methods for analysis of foods.
4. Russel N.J and Goul Khuwer G.W (Ed) 2003 Food preservatives, Academic /plenum publishers, New York





<b>16FPF1MC06 FOOD MICROBIOLOGY LAB</b>	
<b>SEMESTER I</b>	<b>CREDITS 2</b>
<b>CATEGORY MC(L)</b>	<b>NO.OF HOURS/ WEEK 5</b>

**Objectives:**

- I. To enable the students to understand different methods of sterilization ,staining and isolation techniques.
- II. To impart various microbiological techniques for enumerating microorganisms and pathogens associated with food.
- III. To inculcate knowledge on environmental hygiene.

**EXPERIMENTS:**

1. A. Introduction to tools in microbiology and lab practices.  
B. Methods of sterilization and Microscopy.
2. Preparation of different types of culture media (complex, differential and selective)
3. Enumeration of microorganism- Sampling and serial dilution - Total count, Yeast and mold count in food products (Pour plate method), Detection of E.coli, Salmonella, and Staphylococcus in food samples.
4. Isolation and preservation of microorganisms Streak plate method, slants and stabs.
5. Staining techniques: Preparation of smears, simple staining and Gram's stain.
6. Fungal examination –Lacto phenol cotton blue staining.
7. Bacteriological Analysis of Water - Most probable number (MPN) method.



IS 10500: 2012/ IS 1622:1981.

8. Microbiological examination of milk- Dye reduction test.
9. Tests for establishing sensitivity to chemicals, antibiotics, chemotherapeutants, and minimal inhibitory concentrations.
10. Environmental hygiene Assessment of surface sanitation by swab/rinse method, equipment swabs - Assessment of personal hygiene, enumeration of aerial micro flora.
11. Validation techniques for disinfectants and detergents.
12. Demonstration of Rapid and automated microbial method.

**Books for study:**

1. FSSAI manual of methods for analysis of foods- Microbiological testing(2012.)
2. Harrigan, W.F. (2011). Laboratory Methods in Food Microbiology, 3<sup>rd</sup> Edition, Academic Press.
3. IS 10500 : (2012) – Drinking water specifications.
4. IS 1622: (1981) – Method of sampling and microbiological examination of water.
5. Murugalatha .N. (2012). Microbiological techniques. 1st edition, MJP Publishers.
6. Rajan S. and Christy R.(2010). Experimental procedures in Life sciences. Anjanaa Book House.



**16PFP2MC01 FOOD CHEMISTRY II CHEMISTRY  
OF MICRO NUTRIENTS AND FOOD ADDITIVES**

**SEMESTER II CREDITS 4**  
**CATEGORY MC(T) NO.OF HOURS/ WEEK 5**

**Objectives:**

- i. To enable students to understand the importance of additives in food industry.
- ii. To familiarize students chemical and functional properties of micronutrients in food.

**Unit I: Vitamins and Minerals:**

**10 hours**

- Introduction: Classification; an overview of stability and toxicity; sources of micronutrients in foods – Restoration, fortification, enrichment, nitrification
- Fat soluble vitamins: Vitamin- A and provitamin- A, vitamin D and E- stability and mechanism of degradation
- Water soluble vitamins: Vitamins B and C – stability and degradation mechanism.
- Major and Minor mineral constituents in food – Essential metals as nutrients, solubility of minerals. Acid- base theory; Lowry- Bronsted and Lewis theory; Chelate effect.
- Chemical and functional properties of minerals in food- calcium, phosphate, iron, nickel and copper.

**(Hours for introduction : 2 - content handling : 7 - revision : 1)**

**Unit II: Preservatives and antioxidants:**

**20 hours**

- An introduction: Food additives in foods; regulations and monitoring agencies; Toxicological evaluation of additives; interaction of additives with food ingredients. GRAS ingredients based on Codex ingredients.



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- Preservatives-Definition, classification and function in food processing and preservation. natural preservatives; chemical preservatives; acidulants – organic acids and esters; sulphur dioxide and its salts; nitrites; antibiotics; surface preservation; Permitted preservatives in foods .
- Antioxidants- natural and chemical antioxidants; mechanism of antioxidant function; primary and secondary antioxidants; selection and application of antioxidants in foods; permitted antioxidants in foods; sequestrants; role of Vitamin C – Vitamin E – tocopherols - lipoic acid–evaluation of antioxidant effectiveness.

**(Hours for introduction: 5 - content handling : 12 - revision : 3)**

**Unit III: Food Colours: 15 hours**

- Natural and synthetic colours; difference between dyes and colours; applications of colours – limits in food industry ; Pigments in animals and plants tissues; color change on processing - pigment stability on packaging.
- Chlorophyll - influence of pH on processing; technology of color preservation - enzymic - metallo complex formation; carotenoids-occurrence-distribution.
- Betalains–structure–stability-effects of pH heat and light.
- Extraction of carotenes, lycopene, chlorophyll and curcumin.
- Calculation of required limits of colours in processed food.

**(Hours for introduction : 2 - content handling : 10 - revision : 3)**



**Unit IV: Food Flavours:**

**10 hours**

- Taste: structural basis-sweet, bitter and sour taste models
- Flavoring agents – concept of flavors in foods; natural flavors; nature identical flavors; artificial flavoring substances
- Flavour enhancers–astringency-pungency-vegetable and spice flavors-allium, cruciferae-mushroom.
- Odour: theory and sense of odour - flavours from shikimic acid pathway-pear, banana, apple, eugenol, vanillin. Volatile terpenoids - noot ketone, geraniol, nerol,  $\pm$  carvone, flavour from lactic acid; ethanol fermentation – diacetyl.
- Biosynthesis of Food flavours -Fish food flavours; Biosynthesis of tomato flavor; thermally induced flavors Biosynthesis of tomato flavour.

**(Hours for introduction : 1 - content handling : 7 - revision : 2)**

**Unit V: Emulsifiers, Stabilizers, Flour Improvers and Sweeteners**

**20 hours**

- Emulsifiers and stabilizers - Definition; properties; HLB value; function of emulsifiers and stabilizers in foods; permitted emulsifiers and stabilizers used in foods; polyols – physical and chemical properties of polyols, application in food industry, permitted polyols in foods.
- Flour improvers: Dough -Leavening agents - starters and cultures-nutritional needs of yeast; activity analysis of yeast and gas retention. Batters- gas productive and retention-baked product; Anticaking agents-pH control.
- Natural and artificial sweeteners: Sweetener index: Non-nutritive-low calorie sweeteners – cyclamate – saccharin – aspartame - alitame acesulfame K-sucralose– polyhydric alcohols as sweeteners. Structure-comparison



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of different sweetness-adverse effects.



- Natural and chemical sweeteners; nutritive and non-nutritive sweeteners; biosweetener –stevia, chemical structure & sweetness; saccharine, acesulfame K, aspartame, sucralose, levulose; restriction on the use of sweeteners in foods; Food acids – their function and application in foods; permitted food acids; nutritive additives; enrichment of foods.

**(Hours for introduction : 5 - content handling : 12 - revision : 3)**

**Books for study:**

1. Titus A. M. Msagati ( 2012) The Chemistry of Food Additives and Preservatives, John Wiley & Sons
2. Jim Smith, Lily Hong-Shum(2011) Food Additives Data Book ,John Wiley & Sons
3. R Wood, L Foster, A Damant, P. Key ( 2004) Analytical Methods for Food Additives, Elsevier

**Books for References:**

1. Chopra, H.K. and P.S. Panesar.(2010) “Food Chemistry”. Narosa, Alpha Science International Ltd.
2. Owen.R.Fennema . (2008) “Food Chemistry” 4th Edition, CRC Press.

**16PFP2MC02 HUMAN NUTRITION AND  
BIOCHEMISTRY**

<b>SEMESTER II</b>	<b>CREDITS 5</b>
<b>CATEGORY MC(T)</b>	<b>NO.OF HOURS/ WEEK 6</b>

**OBJECTIVES:**

- i. To enable the students to understand basic concepts involved in human nutrition and to appreciate the relationship between food and nutrients.



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ii. To sensitize the students to the understanding of the physiological and metabolic functions of nutrients and their contribution to the health of individuals.

iii. To provide the students with the required knowledge of bioenergetic and metabolic processes involved in understanding the role of food molecules in humans.

**UNIT I: AN OVERVIEW OF NUTRITION: 25 hours**

- Background: Food as a source of nutrients, classes of nutrients, concept of food groups, food guide pyramids, principles of balanced diet, dietary recommendations.
- An introduction to the significance of nutrition through various age groups in brief: Infancy, pre-schoolers, school going children, adolescents, pregnant and lactating mothers and geriatric nutrition.
- Significance of normal and therapeutic nutrition in brief.
- Dietary sources, digestion, utilization, recommended intake, deficiency and excess of the following nutrients in brief :Carbohydrates, Lipids, ProteinsFat soluble Vitamins – Vitamin A, D, E and KWater Soluble Vitamins – Thiamin, Riboflavin, Niacin, Pyridoxine, Folate Minerals – Calcium, Iron, Iodine, Fluorine, Zinc
- Nutrition labelling : Misleading claims

**(Hours for introduction : 3 - content handling : 20 - revision : 2)**

**UNIT II : ROLE OF NUTRIENTS IN OUR SYSTEM :**  
**20 hours**

- Evaluation of dietary protein quality, Antinutritional properties, Protein energy malnutrition and Prevention – Kwashiorkor, Marasmus and Marasmic Kwashiorkor, Applied Nutrition Programmes (ANP) globally and nationally.
- Energy measurements, Energy balance: Energy systems:





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utilization of energy by muscle tissue, body weight and



body composition, health implications, and weight control, BMR and BMI calculations, influence of physical exercise on changes in body fat and body composition.

- Determination of energy value of food: direct and indirect calorimetry; basal and resting metabolism; factors influencing, energy requirements – recommendations for different age groups and special conditions – ICMR and FAO.

**(Hours for introduction : 3 - content handling : 14 - revision : 3)**

### **UNIT III: MEMBRANE BIOCHEMISTRY AND BIOENERGETICS: 15 hours**

- Supramolecular architecture: Component of the cell, structure and biochemical functions, membrane structure and functions, transport through biological cell membrane,
- Bioenergetics: concept of free energy, determination of change in free energy from equilibrium constant and reduction potential.
- Biological oxidation: general concept of oxidation and reduction, electron transport chain, oxidative phosphorylation, uncouplers and inhibitors of electron transport chain and oxidative phosphorylation.

**(Hours for introduction : 3 - content handling : 9 - revision : 3)**

### **UNIT IV: NUCLEIC ACIDS AND ITS METABOLISM: 15 hours**

- Nucleic acids: Genetic code, nucleic acids, and structure of DNA and RNA.
- Metabolism of Nucleic acids: Purine biosynthesis and pyrimidine biosynthesis.



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- Molecular Biology concepts: An overview of prokaryotic DNA replication, transcription, and translation.

**(Hours for introduction : 3 - content handling : 9 - revision : 3)**

**UNIT V: METABOLISM OF BIOMOLECULES: 15 hours**

- Metabolism of carbohydrates: Glycolysis, Glycogenesis, Glycogenolysis, HMP shunt, Gluconeogenesis.
- Metabolism of fats: fatty acid biosynthesis and oxidation, cholesterol biosynthesis and lipoproteins metabolism.
- Metabolism of proteins: amino acids oxidation-transamination, deamination, decarboxylation – urea cycle.

**(Hours for introduction : 3 - content handling : 9 - revision : 3)**

**Books for study:**

1. Cox, M.M. and Nelson, David L. Lehninger(2008), “Principles of Biochemistry”. 5th Edition, W.H. Freeman
2. Murray, Robert K. et al ( 2006). “Harper’s Illustrated Biochemistry” 27th Edition. McGraw-Hill.
3. Williams S.R and Schelenker .E (2002)- Essentials of Nutrition and Diet Therapy, Mirror Mosby Publishing Company, 8<sup>th</sup> Ed

**Books for References:**

1. Satyanarayanan, U.(2013) “Biochemistry” , 4<sup>th</sup> Ed , Elsevier Publishers.
2. Kathleen.L.M and Stump.E.S (2007) - Krause’s Food and Nutrition Therapy, Saunders Publishers, 12<sup>th</sup> Ed.



**16PFP2MC03 RESEARCH METHODOLOGY AND  
BIOSTATISTICS**

<b>SEMESTER II</b>	<b>CREDITS 3</b>
<b>CATEGORY MC(T)</b>	<b>NO.OF HOURS/ WEEK 4</b>

**Objectives:**

- i. To inculcate the purpose and importance of research for future development and sustenance
- ii. To know the various indices and abstracts in science and technology as a source of literature survey
- iii. To learn and understand the basic statistics involved in data presentation.
- iv. To know the methodology of writing thesis and journal articles.

**Unit I: Introduction to Research Methodology: 10 hours**

- Research and Research Methodology: Meaning of research; objectives of research; role of research and statistics in food processing discipline; Types of research and its application in food processing; selection and techniques involved in defining a research problem.
- Research Design: Basic concepts concerning testing of hypothesis; important concepts; and principles relating to experimental design.
- Measurement and scaling techniques: Measurement scales; experimental errors; tests of validity; reliability and practicality.

**(Hours for introduction : 1 - content handling : 8 -  
revision : 1)**

**Unit II: Data Collection and Processing: 10 hours**

- Sampling methods: random sampling methods and non-random sampling methods; size of sample; sampling and



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non-sampling errors.



- Collection of data: Methods of collecting primary data; guidelines for constructing primary data; sources of secondary data; advantages; and disadvantages of data collection methods; precautions in the use of secondary data.
- Processing of data: Processing operations – Editing; coding; classification; and tabulation; Representation of data-diagrammatic and graphic presentation.

**(Hours for introduction : 1 - content handling : 8 - revision : 1)**

**Unit III: Descriptive statistics: 15 hours**

- Measures of central tendency - mean; median; quartile; percentile and mode and their relative advantages and disadvantages.
- Measures of dispersion- standard deviation; co-efficient of variation.
- Correlation Analysis - coefficient of correlation and rank correlation.

**(Hours for introduction : 3 - content handling : 9 - revision : 3)**

**Unit IV: Testing of Hypothesis: 15 hours**

- Tests of significance: Tests of significance for large samples and small samples; one-way ANOVA.
- Chi-square test: Conditions for applying chi-square test; degree of freedom.
- Hypothesis: Testing of hypothesis. Levels of significance.
- Risk prone analysis number
- Statistical software tools.

**(Hours for introduction : 3 - content handling : 9 - revision : 3)**



**Unit V: Interpretation and Report Writing: 10 hours**

- Interpretation: Meaning and technique of interpretation; precaution in interpretation.
- Report writing: Significance; steps in writing a report; layout of the research report; mechanics of writing research paper; article; report; thesis proposal and oral presentation.
- FSSAI regulation on statistical reporting and ethics.

**(Hours for introduction : 1 - content handling : 8 - revision : 1)**

**Books for Study :**

1. Kothari C.R(2002) Research Methodology- Methods and Techniques; New Age International; New Delh.

**Books for references :**

1. Gupta; S.P. (2002); Statistical methods; Sultan Chand and Sons; 31st Revised Edition
2. John A. Bower (2013) Statistical Methods for Food Science: Introductory Procedures for the Food Practitioner John Wiley & Sons.

**16PFP2MC04 BIOCHEMISTRY LAB**

<b>SEMESTER II</b>	<b>CREDITS 2</b>
<b>CATEGORY MC(L)</b>	<b>NO.OF HOURS/ WEEK 4</b>

**Objectives:**

- I. To enable the students to develop analytical skill in biochemistry practical.
- II. To understand better the concepts of techniques and appreciate better the applications of Bioorganic chemistry towards chemical, industrial and biological systems

1. Qualitative determination of DNA from food sources
2. Electrophoresis of milk proteins – SDS PAGE
3. Determination of Catalase activity from food source



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(chow chow)





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- i) Effect of optimum pH
  - ii) Effect of optimum temperature
  - iii) Substrate concentration
  - iv) Enzyme concentration
4. Determination of Protease activity from food source(chow-chow)
- i) Effect of optimum pH
  - ii) Effect of optimum temperature
  - iii) Substrate concentration
  - iv) Enzyme concentration
5. Determination of Amylase activity from food source(malted barley)
- i) Effect of optimum pH
  - ii) Effect of optimum temperature
  - iii) Substrate concentration
  - iv) Enzyme concentration
6. Enzyme kinetics of invertase via initial rate determination
7. Determination of casein by Sorenson's formol titration
8. Determination of fruit acids (citric, malic and tartaric acids) by titration and calculation of the sugar / acid ratio.
9. Determination of total amylase activity from sweet potatoes by DNSA method.
10. Determination of diastatic activity of honey

**REFERENCES:**

1. Mark Brandt(2002),Laboratory manual in Biochemistry,third edition,
2. Bruce R.D' Arcy Geoff Hawel (2003) Chemical food analysis- a practical manual, a university of queensland publication.
3. Sambrook and Russell' (2001) Molecular cloning 'A laboratory Manual'volume 2, third edition.
4. David Glick, (2009) 'Methods of Biochemical Analysis'volume 14, John Wiley & Sons,



**16FP2MC05 FOOD ANALYSIS LAB-II**

**SEMESTER II CREDITS 3**

**CATEGORY MC(L) NO.OF HOURS/ WEEK 5**

**Objectives:**

- i. To develop analytical skill in quantitative analysis
- ii. To understand the techniques involved in preparation of standard solutions, standardizations and calculations in the estimation of compounds in food.
  1. Estimation of hardness of water / chlorine - total, temporary and permanent by EDTA method.
  2. Estimation of polyphenols - total anthocyanin / tannins from fruit juices.
  3. Estimation of sugars (reducing and non-reducing) in fruit juices.
  4. Estimation of quaternary ammonium compounds (QAC) in foods.
  5. Estimation of Iodine in Iodised salt
  6. Estimation of ascorbic acid from lime juice.
  7. Estimation of total acidity in various food products.
  8. Estimation of Peroxide Value and Anisidine value in Fats and Oils.
  9. Estimation of Saponification value in fats and oils
  10. Estimation of Iodine number of fats and oils.
  11. Estimation of RM number and free fatty acids in fats.
  12. Estimation of lactose in milk.
  13. Estimation of fat using Soxhlet apparatus.
  14. Analysis of protein using Kjeldhal apparatus.
  15. Determination of soluble and insoluble fibre using fibra plus apparatus.

**Books for References:**

1. Neilson Suzanne S (Ed) (2003)' Food analysis' Plenum Publishing Corporation, U.S.A.
2. S.Ranganna, (1987) Manual of analysis of fruits and vegetable products' central food technological research institute, Mysore, Tata McGraw Hill Publishing



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company Ltd, New Delhi, 1987.



3. S. Sadhasivam and A.Manikam, Biochemical methods (1996), New Age international (p) ltd, publishers and Tamilnadu Agricultural university (Coimbatore), 2<sup>nd</sup> edition

**16PFP2ES01 FUNCTIONAL FOODS AND  
NUTRACEUTICALS**

**SEMESTER II CREDITS 3**  
**CATEGORY ES(T) NO.OF HOURS/ WEEK 4**

**Objectives:**

- i. To understand the basic concepts of functional food and nutraceuticals and their application in day today life.
- ii. To impart the knowledge of the molecular basis of using micronutrients and phytochemicals in prevention of chronic diseases
- iii. Identify major types of health foods and nutraceutical products in the market and evaluate their safety and efficacy.

**Unit I: Introduction to Functional Foods: 12 hours**

- Background: Historical perspective and evolution of health care and functional foods; Definition; relationship of functional foods to health and disease.
- Health claims approved by FDA - Health Claims That Meet Significant Scientific Agreement (SSA); Qualified Health Claims; Structure/Function Claims; Nutrient Content Claims.
- Key nutritive and non-nutritive food components and ingredients with potential health effects. Effect of processing on nutrients in functional foods.

**(Hours for introduction: 2 - content handling : 9 - revision : 1)**

**Unit II: Nutraceuticals as science:**

- Introduction: Definition; classification; scope; and future prospects and regulatory issues; relationship between



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nutraceuticals; food and medicine.



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- Classification of nutraceuticals based on chemical nature; food source; amount of nutraceutical substance and mechanism of action.
  - Identification and extraction of bioactive components from microbes, plant and animal sources.
  - Nutraceuticals in Indian Industry
- (Hours for introduction : 2 - content handling : 9 - revision : 1)**

**Unit III: Properties, structure and function of various nutraceuticals: 12 hours**

- Glucosamine; chondroitin; methylsulfonylmethane; coenzyme q10; melatonin; carnitine; MUFA and PUFA; flaxseed oil; resveratrol; grape seed proanthocyanidin extract; lycopene.
  - Probiotics and prebiotics; lutein; zeaxanthin and astaxanthin; soy isoflavones; tea and creatine as nutraceuticals.
- (Hours for introduction : 2 - content handling : 9 - revision : 1)**

**Unit IV: Therapeutic applications of functional foods and nutraceutical: 12 hours**

- Use of functional foods and nutraceuticals in the treatment of cardiovascular health; cancer prevention; weight management.
  - Use of functional foods and nutraceuticals in the treatment bone health; mental health; respiratory health; oral health.
  - Use of functional foods and nutraceuticals in the treatment women's health and enhancement of sporting performance.
- (Hours for introduction : 2 - content handling : 9 - revision : 1)**



**Unit V: Metabolism, bioavailability and safety of nutraceuticals: 12 hours**

- Metabolism and bioavailability of nutraceuticals; Meta - analyses; and systematic reviews of nutraceutical clinical trials; Safety-presence of trace elements, antinutritional factors, risks of nutraceuticals and interactions of nutraceuticals.
- Interrelationship between nutrigenomics and nutraceuticals.

**(Hours for introduction : 2 - content handling : 9 - revision : 1)**

**Books for Study:**

1. Arnoldi A. (2004) Functional foods, cardiovascular disease and diabetes, Woodhead Publishing Limited and CRC Press LLC.
2. Brian Lockwood, (2007) Nutraceuticals A guide for healthcare professionals, Second edition, Pharmaceutical Press.
3. Johnson I. and Williamson G. ed. (2003) Phytochemical functional foods, CRC Press, Boca Raton Boston New York Washington, DC.

**Books for references:**

1. Shannon Brown (2009) Functional Foods and Beverages in the U.S. 4th Edition May New Orleans, LA.
2. Wildman R.E.C. ed. (2007) Handbook of nutraceuticals and functional foods, Second edition, CRC Press, Boca Raton.



**16PFP2ES02 MANAGEMENT OF LIFESTYLE  
DISEASES**

<b>SEMESTER</b>	<b>II</b>	<b>CREDITS</b>	<b>3</b>
<b>CATEGORY</b>	<b>ES(T)</b>	<b>NO.OF HOURS/ WEEK</b>	<b>4</b>

**OBJECTIVES:**

1. To inculcate the importance of physical, emotional and social well - being and the impact of healthy food in maintaining health and preventing diseases.
2. To create an awareness on the role of food at various stages of life.
3. To impart knowledge on the importance of food in preventing non-communicable diseases.

**Unit I: Introduction to Food, Health and Disease: 10 hours**

- Definition of Health and Disease. Definition; diagnosis and classification of NCDs. Modifiable and Non-modifiable risk factors for NCDs.
- The Nutritional Care Process: Nutritional Assessment; Nutritional diagnosis; Nutritional intervention; Nutritional monitoring and evaluation.
- Effect of food; nutrients and nutritional status on absorption and metabolism of food and drugs.

**(Hours for introduction : 1 - content handling : 8 - revision : 1)**

**Unit II: Role of Food in Pregnancy, Lactation, Infancy and Childhood: 15 hours**

- Pregnancy: Review of major physiological changes during pregnancy; 3 trimesters; importance of BW gain and BMI Nutrition during pregnancy: energy requirements; macro and micro nutrient requirements; some common pregnancy related problems and their effects on nutrient net intake as well as their dietary managements.





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- Lactation: Review of milk production/ejection; factors affecting these processes; human milk composition; major differences between cow's milk and human milk; the impact of certain drugs on lactation.
- Infancy and Childhood: Review of growth and development in infancy; use of growth chart; nutrient needs; assessment of nutrient intake; breastfeeding; types of formulas & formula feeding; enteral/parenteral feeding; failure to thrive; catch-up growth; some common medical problems and their dietary managements.

**(Hours for introduction : 3 - content handling : 9 - revision : 3)**

**Unit III: Role of Food in Adolescence; Adulthood and Elderly: 15 hours**

- Adolescence: Changes in growth and development; hormonal influences; Age at menarche - factors affecting age at menarche; psychological problems; body image; disordered eating behavior; nutritional problems.
- Adult and Elderly: Physiological changes associated with ageing; Changing body composition and techniques for measuring body composition Nutritional requirements and dietary modifications in the diet of the elderly.

**(Hours for introduction : 3 - content handling : 9 - revision : 3)**

**Unit IV: Role of Food in Disease – I 10 hours**

- Dietary management of Gastrointestinal Problems; Renal; Hepatic diseases and Cancer: Prevalence; Etiology; Physiological symptoms and disturbances; diagnosis; complications and management using dietary agents.

**(Hours for introduction : 1 - content handling : 8 -**



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**revision : 1)**



**Unit V: Role of Food in Disease - II**

**10 hours**

- Dietary management of Weight Management; Diabetes Mellitus; Cardiovascular diseases; and Hypertension: Prevalence; Etiology; Physiological symptoms and disturbances; diagnosis; complications and management using dietary agents.

**(Hours for introduction : 1 - content handling :  
8 - revision : 1)**

**Books for study:**

1. Kraus M. V. and L. K. Madan (2010) Food; Nutrition and Therapy; W. B. Saunders Company; London; 12<sup>th</sup> Edition.
2. Robinson; C. H; M. R. Lawlwr; W. L. Chenoweth and A. E. Garwick (2004): Normal and Therapeutic Nutrition; 17th ed; Mac Millan Pub. Co

**Books for References:**

1. Kumar.K (2004) Guide to Prevention of Lifestyle Diseases, Deep and Deep Publications
2. Bharat B. Aggarwal, Sunil Krishnan, Sushovan Guha (2011) Inflammation, Lifestyle and Chronic Diseases: The Silent Link Oxidative Stress and Disease, CRC Press

**16PHE2FC01 LIFE SKILLS TRAINING**

**SEMESTER II**

**CREDITS 2**

**CATEGORY FC(T)**

**NO.OF HOURS/ WEEK 2+2**

**OBJECTIVES OF PG SYLLUBUS**

1. To improve and sustain the primal level of competence and performance of PG students through an advanced training of holistic development of oneself.
2. To empower through various skills and strengthen them to face the future life issues and challenges.



3. To equip them with practical and value based learning of soft skills for a better life in future.

### **INSIDE CLASS HOURS (2 hrs)**

#### **Unit – I: Constructing Identity**

**Self Image** – Understanding self image – shadows down the lane – self acceptance - **Self Knowledge** – Knowing oneself - **Self confidence** – Guilt and grudges - Power of belief – positive thinking– optimizing confidence - **Self development** – perception, attitude and Behavioural change, developing a healthy and balance personality - **Self esteem** – signs - indicators

#### **Unit – II: Capacity Building**

**Motivation** – Definition, types (Intrinsic and Extrinsic), Theories (Maslow’s hierarchical needs, etc), Factors that affect motivation, Challenges to motivation, Strategies to keep motivated, motivational plan. **Time Management Skills**– steps to improve time management, overcoming procrastination, assessing and planning weekly schedule, challenges, goal settings, components of goal settings, consequences of poor time management, control of interruption and distractions.

Communication, public speaking, talents, creativity, learning,

#### **Unit – III: Professional Skills**

**-Leadership development skills** – difference between leader and manager, different styles and their utilities, functions of leadership, application of knowledge, overcoming from obstacles, influential skills and Leadership qualities. **Application skills** – Managing Career and self-direction, Visionary thinking, formulating strategies, shaping strategies,



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building organizations relationships, change management.



Project Management Skills, Independent working skills, Writing skills, Public Speaking, analytical Skills, Neo Research and Development. **Problem solving skills** – Process, approaches and its components, creative problem solving, Tools and techniques, application of SMART analysis and barriers to problem solving.

#### **Unit – IV: Life Coping Skills**

**Life skills** – Personal and reproductive Health, love, sex, marriage and family – family life education – Gender Equity - child bearing and Childrearing practices, Geriatric Care - adjustability **Human Relationship** – formal and informal - peer group – friends – same and other gender - family – Colleagues – community – emotional intelligence - **Stress Coping skills** – Definition of stress, strategies to alleviate stress, problem and emotion focused coping, techniques to reduce stress, stress reaction phases, crisis intervention steps, creating positive affirmations, Signs, Symptoms and Reactions of Stress.

#### **Unit – V: Social Skills**

**Human Rights Education**, Understanding Human Rights, International and national mechanisms, protection and preservation of HRs, Human Rights in the context of new, technological and electronic society, **Peace Education**, Social Harmony in the context of religious fundamentalism and fanaticism, Understanding Peace and Justice, Conflict Resolution Strategies

#### **Reference books**

1. Healing Your Emotional Self: A Powerful Program to Help You Raise Your Self-Esteem, Quiet Your Inner Critic, and Overcome Your Shame by Beverly Engel



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2. Self-knowledge and self-discipline by B.W. Maturin



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3. Motivation: Biological, Psychological, and Environmental (3rd Edition) by Lambert Deckers
4. Getting Things Done: The Art of Stress-Free Productivity by David Allen
5. Managerial Skills in Organizations by Chad T. Lewis
6. Social Intelligence: The New Science of Human Relationships by Daniel Goleman

**OUTSIDE THE CLASS HOURS (2 hrs)**

- Each student will choose either of the above-mentioned modules and is expected to undergo a training/workshop in that module.
- She/he will have to accomplish ten hrs outside the class hours to fulfill the 2 credits.

<b>Competence building</b>	<b>Career Preparatory Training</b>
Power talk	Interview Guidance
Emotional Intelligence	Group Dynamics
Stress management	Leadership skills
Decision Making	Negotiation Skills
Positive image building	Creative writing

**Methodology**

Inputs, ABL model, Documentaries, group activities and Interaction, Special workshop by professionals.

**Evaluation**

There will be end test and a Project for ‘inside the class hours’. Viva Voce will be conducted for the ‘Outside the class hours’.





<b>16PFP3MC01 DAIRY AND BEVERAGE PROCESSING</b>	
<b>SEMESTER III</b>	<b>CREDITS 4</b>
<b>CATEGORY MC(T)</b>	<b>NO.OF HOURS/ WEEK 5</b>

**OBJECTIVES:**

- i. To enable the students to gain knowledge on the properties of milk.
- ii. To impart knowledge on the processing techniques of milk and manufacturing of dairy products.
- iii. To familiarize the students to the varied components of beverage processing.

**Unit 1 - Physio chemical properties of milk : 10 hours**

- Introduction to dairy production, processing and consumption-Dairy scenario in India
- Composition , factors affecting composition and yield of milk
- Physio chemical properties of milk; color, taste, pH and buffering capacity, viscosity, surface tension, freezing, boiling point, thermal and optical properties, redox potential, electrical conductivity, rheological property's

**(Hours for: introduction: 2 - content handling: 6 - revision : 2)**

**Unit 2 - Market milk industry: 15 hours**

- Systems of collection of milk Reception, quality evaluation Platform tests.
- Various stages of processing- Filtration, Clarification, Homogenization, Pasteurization.
- Packaging, storage, transportation and distribution.
- Standardized milk, toned milk, double toned milk,



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recombined milk, sterilized milk, filled milk, flavoured milk, and cream.

**(Hours for: introduction: 2 - content handling: 10 - revision :3)**

**Unit 3 – Processing of Milk products : 20 hours**

- Flow diagram and processing of condensed milk, dehydrated milk, evaporated milk, ice cream
- Fermented milk products – butter, cheese, yoghurt, kefir, acidophilus milk and sour cream
- Indigenous milk products - Present status, method of manufacture of dahi, khoa, burfi, kalakand, gulabjamun, rosogolla, srikhand, chhana, paneer, ghee, lassi.
- By-products from the dairy industry. Cleaning in place- Dairy effluent treatment and disposal.
- Note: Industrial Visit to dairy plants.

**(Hours for: introduction : 3 - content handling : 12 - revision : 5)**

**Unit 4 - Beverage processing: 20 hours**

- Beverage industry in India: Types of beverages and their importance-
- Manufacturing technology for juice-based beverages - synthetic beverages - Tea, coffee, cocoa beverages - Beverages using spices, plant extracts, herbs, nuts, dairy and imitation dairy-based beverages, sports drinks.
- Technology of still, carbonated, low-calorie and dry beverages; role of various ingredients of soft drinks, carbonation of soft drinks.
- Alcoholic beverages- types, manufacture and quality evaluation.

**(Hours for: introduction: 3 - content handling: 13 -**



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revision : 4)



**Unit 5 - Packaged water:**

**10 hours**

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

**(Hours for: introduction : 1 - content handling : 7 - revision :2)**

**Books for study:**

1. David P.Steen & Phillip R.Ashurt,( 2006) Carbonated Soft drinks, Blackwell Publishing Ltd- E book.
2. De Sukumar, (2007) Outlines of Dairy Technology, Oxford University Press.
3. Philip R.Ashurt, (2005).Chemistry and technology of Soft drinks and fruit juices, 2<sup>nd</sup> edition Blackwell Publishing Ltd. E book.

**Books for reference:**

1. Tammy Foster and Purnendu C.Vasavada,(2003) Beverage Quality and safety, 2<sup>nd</sup> edition. CRC Press - E book.
2. Walstra P, J.T.M.Wouters and T.J. Geurts, (2006) Dairy Science Technology, 2nd ed., CRC Press.
3. Spreer Edgar( 2005) Milk and Dairy Product Technology, Marcel Dekker.



<b>16PFP3MC02 LIVESTOCK PROCESSING SEMESTER</b>	<b>III</b>	<b>CREDITS 5</b>
<b>CATEGORY MC(T)</b>	<b>NO.OF HOURS/ WEEK</b>	<b>6</b>

**OBJECTIVES:**

1. To gain knowledge on the composition and nutritive value of foods of animal origin.
2. To understand the importance of processing operations in the manufacture of meat, meat products, poultry, egg and seafoods.
3. To understand the various unit operations in an animal food manufacturing plant.

**UNIT I: INTRODUCTION TO MEAT PROCESSING**

**15 hours**

- Types of meat and its sources; chemical composition and microscopic structure of meat and meat products.
- Unit operations in meat processing: Ante mortem handling; slaughtering of meat: scientific methods of slaughter, Modern abattoirs; slaughter house and its features.  
Stunning techniques – mechanical, electrical, chemical methods; mechanical deboning evisceration; cleaning; inspection, chilling; packaging and storage
- Meat quality evaluation: inspection and grading of meat. Post-mortem changes of meat –Color, flavors, microbiology and spoilage factors of meat and meat products.
- Recent trends in meat processing, Ritual/religious methods of slaughter - Jewish; Halal; Jhatka and Spanish methods.

**(Hours for introduction: 3 - content handling: 9 - revision: 3)**



## **UNIT II: PROCESSED MEAT AND MEAT PRODUCTS**

**20 hours**

- Factors affecting post-mortem changes; properties and shelf-life of meat; meat tenderization and meat quality evaluation – selection criteria and grading.
- Preservation of meat - aging; pickling; smoking. Dried and Cured meat. Canned meat; chilling; frozen meat; Cooked and Refrigerated meat; Sausages; Irradiation and Hurdle concept; methods of stabilization of meat emulsion - meat extension; meat plant sanitation and safety; By-product utilization; safety standards in meat industry - Meat food product order - HACCP-ISO-9000 standards, techno legal aspects related to FSSAI.
- Recall and tracibility

**(Hours for introduction: 3 - content handling : 14 - revision : 3)**

## **UNIT III: FISH PROCESSING:**

**20 hours**

- Types of fish; composition; structure; and spoilage factors of fish; microbiological quality of fresh fish; Post-mortem changes in fish; handling and transportation of fish.
- Bacteriology of fish; Chilling of fish; Freezing and Individual quick freezing.
- Canning and smoking operations; Salting and drying of fish; pickling; radiation processing of fish and fish products.
- Seafood quality Assurance; Advances in fishery by products technology and waste utilization.

**(Hours for introduction: 3 - content handling: 14 - revision: 3)**

## **UNIT IV: POULTRY PROCESSING:**

**20 hours**

- Introduction: Types and characteristics of poultry products; composition; nutritive value,
- Poultry: Classes of poultry meat, classification,



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composition- tenderness, flavor and colour.



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- Unit operations involved in poultry processing; slaughtering of poultry; Ante mortem and post mortem examination of poultry birds - principles of judgment.
- Pre-slaughter care; handling; transport and dressing of a poultry bird; Cuts of poultry bird and Indian Standards of a dressed chicken; inspection and grading.

**(Hours for introduction : 3 - content handling : 14 - revision : 3)**

**UNIT V: EGG PROCESSING: 15 hours**

- Eggs: Formation, structure, composition and nutritive value of egg white and egg yolk; Structure; composition; nutritive value; calculation of nutritive value and functional properties of eggs;
- Egg quality characteristics: Internal Quality - Haugh's unit – Terms indicating defective quality; microbial spoilage of eggs - types of spoilage in eggs - indications - organisms causing spoilage.
- Preservation and maintenance of eggs: Preservation of shell eggs - Egg cleaning – Oil Treatment - Cold storage - Thermo stabilization - Immersion in liquids; egg grading; egg powder processing - preservation of Albumin and yolk - powder production.
- Evaluation of egg quality: Candling, floating in water, and grading of eggs; storage of Eggs; egg Products – Frozen, Pasteurized, Dehydrated, Desugared; egg substitutes.

**(Hours for introduction : 3 - content handling : 9 - revision : 3)**

**Books for Study:**

1. Fidel Toldraj ( 2010) Handbook of Meat Processing, John Wiley & Sons.
2. Owens. M.Casey, Alvarado. Z.Christine and Sams.R. Alan(2010) Poultry Meat Processing, Taylor &





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Francis Group, CRC Press



3. Mead, G.(2004) Poultry Meat Processing and Quality, Woodhead Publishing, England
4. Botana.M.Luis ( 2008) Seafood and Freshwater Toxins, Taylor & Francis Group, CRC Press

**Books for References:**

1. Joseph Kerry, John Kerry and David Ledwood (2002) — Meat Processing, Woodhead Publishing Limited, England ,CRC Press.
2. P.S. Murano (2003) Understanding food science and technology, Thomson Wordsworth Publishers.

<b>16PF3MC03 PLANT PRODUCT PROCESSING</b>			
<b>SEMESTER</b>	<b>III</b>	<b>CREDITS</b>	<b>4</b>
<b>CATEGORY</b>	<b>MC(T)</b>	<b>NO.OF HOURS/ WEEK</b>	<b>5</b>

**Objectives:**

- i. To enable the students to understand the principles and methods involved in the processing of Agricultural and Horticultural foods.
- ii. To impart knowledge on the fundamentals involved in various preservation and storage of Agricultural and Horticultural foods.
- iii. To highlight the importance of value addition in their composition during processing.

**Unit I: Cereals and cereal processing: 15 hours**

- Rice: Classification; physicochemical characteristics and thermal characteristics; Drying; rice milling technology; by-products of rice milling and their utilization; Parboiling of rice- technology and effect on quality characteristics; byproducts of rice milling - Husk; Bran; Broken rice; Curing; Aging of rice; Rice products - Flaked rice; Puffed rice; milling; Shellers; Paddy Separator; Whitener; Polisher; Grader and modern rice mill.



- Wheat: Types and physicochemical characteristics; wheat milling; products; Wheat milling flow sheet; explanation of steps in milling; cleaning Principles of Parboiling of wheat- Methods of Parboiling; Sifters; De-stoners; Roller milling – Break roll and reduction rolls; Sifting and purifying; plan sifters; bran separation; efficiency of milling process; ageing of wheat flour by products from wheat milling and waste utilization and their byproducts.
- Corn and Minor Millets: Corn - Types and nutritive value; dry and wet milling process; Byproducts from corn milling; corn starch; corn syrup; corn flakes; waste utilization; processing of barley; finger millet; oats and sorghum.

**(Hours for introduction: 3 - content handling : 9 - revision : 3)**

**Unit II: Pulse Processing: 15 hours**

- Pulses: Structure and composition; their importance in Indian diet; importance of legumes. Milling and processing of Legumes- Methods of milling of pulses.
- Processing methods- Dhal milling; dehulling losses and effect of dehulling on nutritive value. Fermented and traditional products. Grading methods; cooking quality. Production of protein concentrates and isolates; Antinutritional factors in pulses; and extruded product.

**(Hours for introduction: 3 - content handling: 9 - revision: 3)**

**Unit III: Fruit and vegetable Processing: 15 hours**

- Principles and methods of fruit and vegetable preservation; composition and related quality factors for processing; principles of storage of fruits and vegetables; types of storage: natural; ventilated low temperature storage; CAP and MAP storages.
- Preservation of fruits and vegetables by heat; chemicals; sugar; salt; fermentation; drying etc. Canning of fruits and



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- vegetables; tin cans; glass containers seaming technology; aseptic canning technology.
- Processing of fruit and vegetable products: syrups; cordials and nectars; juice concentrates; pectin and related compounds; jams; jellies; marmalades; preserves; theory of gel formation.
  - Drying and dehydration of fruits and vegetables; problems related to storage of dehydrated products; freezing and freeze-drying of food and frozen products; Fruit product order and quality control.

**(Hours for introduction : 3 - content handling : 9 - revision : 3)**

**Unit IV: Nuts; Oil seeds and Fat processing:**

- Oil seeds : Conditioning and oil extraction; importance of oil seeds processing in India; expeller pressing and solvent extraction of oil; oil refining; preparation of protein concentrates and isolates and their use in high protein foods; fermented and traditional products. Commercial oil resources.
- Processing of nuts- peanuts, coconuts, cashew, and almonds; problems related to processed nuts during storage. processed nut based products.
- Basic processing of fats and oils: oil extraction; degumming; refining; bleaching; hydrogenation; fractional crystallization; interesterification; glycerolysis; molecular distillation; plasticizing and tempering.
- Chemical adjuncts: lecithins; monoglycerides and derivatives; propylene glycol esters; polyglyco esters; shortening - introduction; manufacturing and uses of shortening; types of shortening.
- Margarine: manufacturing and uses of shortening; types of shortening; margarine-manufacturing process and its uses; mayonnaise and salad dressings; confectionery coatings; imitation dairy products - peanut butter and



vegetable ghee; packing and storage of fats and oils; cocoa butter; fat substitutes.

**(Hours for introduction : 3 - content handling : 9 - revision : 3)**

### **Unit V: Spices and Plantation crop processing: 15 hours**

- Importance of plantation crops
- Sugar cane processing-Extraction, neutralization, concentration, crystallization, separation and drying. Sugar refining and grading.
- Confectionaries-caramel sugar related product, sugar coating and sugar cookery. Chocolate manufacturing.
- Spices: black pepper; green pepper; white pepper; oleoresin and volatile. Cardamom; ginger; chilies; turmeric; powder; oleoresin and volatiles.
- Minor spices: Ajwain; coriander; cumin; cinnamon; fenugreek; garlic; mustard; mace and nutmeg; onion; saffron; tamarind; cloves; mint; vanilla; asafotida and spice production; processing of spices.

**(Hours for introduction : 3 - content handling : 9 - revision : 3)**

#### **Books for study:**

1. Delcour. A. Jan and Hosney R. Carl (2010) Principles of Cereal Science and Technology, AACC International
3. Lawson. H.W (2013) Food Oils and Fats: Technology, Utilization and Nutrition, Springer Publishers.

#### **Books for Reference:**

1. Smith.J.Scott and Hi.Y.H (2008) Food Processing –Principles and applications, John Wiley & Sons.
- 2.Sahay.K.M and Singh K.K.(2004) Unit Operations of Agricultural Processing, Vikas Publishing House Pvt. Ltd



**16FP3MC04 FOOD ANALYSIS LAB-III**

<b>SEMESTER III</b>	<b>CREDITS 2</b>
<b>CATEGORY MC(L)</b>	<b>NO.OF HOURS/ WEEK 4</b>

**Objectives:**

- i. To learn the operating techniques of instruments used in food analysis.
  - ii. To analyse and estimate quantitative parameters using instrumental methods.
1. Preparation of food samples for instrumental analysis.
  2. Sensory analysis tests: Difference tests, Paired comparison, Duo-Trio test, Difference from control, Ranking tests, Triangle tests, Magnitude estimation, Acceptance test, Hedonic rating and multiple sample ranking for preference.
  3. Determination of total carbohydrates in foods by Anthrone and DNS method colorimetrically.
  4. Estimation of phosphorus in foods colorimetrically.
  5. Estimation of Iron content in foods colorimetrically.
  6. Determination of Hydroxymethylfurfural (HMF) adulterant in honey using spectrophotometry.
  7. Estimation of food colours using chromatographic techniques.
  8. Determination of pH in food samples using pH meter.
  9. Estimation of iron (II) by redox titration using potentiometry.
  10. Determination of hydrogen ion concentration using acid-base titrations in food samples using conductometry.
  11. Determining the Inversion of sugar using polarimetry.
  12. Estimation of concentration of glucose using Abbe's refractometer.

Note : Demonstration of HPLC,GC and AAS for food samples.



**Books for References:**

1. Neilson Suzanne S (Ed) (2003)' Food analysis' Plenum Publishing Corporation, U.S.A.
2. Ranganna, (2011) 'Manual of analysis of fruits and vegetable products' 2<sup>nd</sup> Edition, Tata Mc Graw Hill Publishing company Ltd, New Delhi
3. S. Sadhasivam and A.Manikam, Biochemical methods, New Age international (p) ltd, publishers and Tamilnadu Agricultural university (Coimbatore), 2<sup>nd</sup> edition, 1996.

**16FP3ES01 SUSTAINABLE FOOD MANAGEMENT**  
**SEMESTER III CREDITS 3**

**CATEGORY ES(T) NO.OF HOURS/ WEEK 4**

**Objectives:**

- i. To enable the students to understand the role of management in food industry, food policies and trends.
- ii. To provide the knowledge on the need for sustainable food management and achieving global food sustainability.
- iii. To enable the students to understand the basics on food costing and pricing.

**Unit 1 – Basics on Management:**

**12 hours**

- o Management: definition, characteristics, objectives, principles, challenges, importance; levels of management - workflow in the industry - work simplification techniques.
- o Business forecasting: definition and methods of forecasting, Demand and supply analysis.
- o Decision making: Characteristics, process of decision making and types of decisions.
- o Machinery evaluation: appreciation and depreciation.

**(Hours for introduction : 2 - content handling : 7 - revision : 3)**

**Unit 2 - Food security and Sustainable food management:**

**18 hours**

- o Food security: Green and white revolution - Food for



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everyone-possibility and steps - Food security and





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growing population – Achieving global food sustainability

- Farming and agricultural subsidies, region wise distribution of commodities; Physical and social environment as factors of crop distribution and production ; Conservation of forests, agro forestry, agro ecology ; cropping pattern as indicators of environments
- Food Supply Chain management: PDS advantages and disadvantages.
- Energy, fuel and waste with regard to food industries in relation to environmental degradation.

**(Hours for introduction : 2 - content handling : 12 - revision : 4)**

### **Unit 3 - Pricing, cost control and distribution : 10 hours**

- Pricing: definition, factors affecting pricing, kinds of pricing, product pricing strategies.
- Introduction to Cost Control, Definition, Objectives and Advantages of Cost Control, Basic costing.
- Food costing: Calculation of food cost.
- Channels of distribution, middlemen and franchise, wholesaler and retailer.

**(Hours for introduction : 1 - content handling : 6 - revision : 3)**

### **Unit 4 - Organization's role in food processing: 10 hours**

- Food manufacturing scenario in India: Agriculture as industrial setup and Agro based industries - forward and backward linkages.
- Overall view of central industries and the nature of work carried out - Facility and expertise available,
- CFTRI, DFRL, NIFTEM, NDRL, NDRI, NABI, NECC - Activities and role in food processing and manufacture
- Spice board, coffee and tea development board.

**(Hours for introduction : 1 - content handling : 6 -**



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**revision : 3)**



**Unit 5 - Food policies:**

**10 hours**

- National and international food policies: Food security act and IFPRI - Vision 2020 India's commitment to the world on food policies.
- Food production and consumption trends in India: Production, procurement, distribution constraints. Post-harvest management India's commitment to the world on food policies.
- Changing food consumption pattern; per capita expenditure on food.
- Food based dietary approaches to eliminate hunger; Steps to fight malnutrition

**(Hours for introduction: 2 - content handling : 6 - revision : 2)**

**Books for study:**

1. Daniele Giovannucci et al.,( 2012).Food and Agriculture: The future of sustainability, United Nations Publishers.
2. Erach Bharchua, (2005).Textbook of environmental studies, University press.
3. Harold Koontz,Heinz Weihrich,Ramachandra Aryasri,(2010).Principles of Manangement, 12<sup>th</sup> edition ,Tata Mcgraw Hill Pvt.ltd.
4. Stephen P.Robbins,Mary Coutler and Neharkha Vohra,(2010).Manangement , 10<sup>th</sup> edition,Baba Barkha Nath Printers.

**Books for references:**

1. Bjorn Lomborg (2004),Global crisis,Global solutions, Cambridge University press.
2. John Schermerhorn.R.(2005).Management, 8<sup>th</sup> edition, John Wiley and sons Inc.New York.
3. Kathiresan. S. and Radha V.(2000). Principles of Management, 5<sup>th</sup> edition. Nath printers.



**16FPF3ES02 ENTREPRENEURS FOR FOOD  
INDUSTRIES**

**SEMESTER III**

**CREDITS 3**

**CATEGORY ES(T)**

**NO.OF HOURS/ WEEK 4**

**Objectives:**

- i. To inculcate the skills necessary to start and sustain in an entrepreneurial venture.
- ii. To analyze the business environment, recognize opportunities and generate business ideas.
- iii. To understand the process of setting up small enterprises.
- iv. To gain knowledge on how to acquire necessary resources and organizational matters for new ventures.

**Unit 1 - Introduction to Entrepreneurship:**

- Entrepreneur - entrepreneurship - Characteristics and types of entrepreneurs contributions of an entrepreneur.
- Entrepreneurship and economic development: barriers to entrepreneurship.
- Classification of small, medium and large scale manufacturing industries - Problems of small scale units and remedial measures.
- Government of India policy towards promotion of Entrepreneurship.

**(Hours for: introduction: 2 - content handling: 6 - revision: 2)**

**Unit 2 - Business environment and marketing research:**

- Factors influencing entrepreneurship: Micro and macro environment.
- Consumer Behavior- consumerism: legislations in India.
- Marketing research: Need for and Steps of Marketing Research, Questionnaire marketing Information systems- marketing communication.
- Marketing with relevance to FMCG (with specific reference to food)



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- Process for setting up a new enterprise:



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Agripreneurship. Project: Development of a proposal for establishing an enterprise and the techno-economic feasibility of the project.

**(Hours for: introduction : 1 - content handling : 10 - revision :4)**

**Unit 3 - Personnel management:**

- Personnel Management: Human resource planning, steps in Manpower Planning.
- Recruitment and Selection: Training and Development - Performance Appraisal.
- Workers participation in Management; Employer-employee relationship in food industry; Work simplification techniques.
- Motivation Theories: Maslow's theory on hierarchy of needs.

**(Hours for: introduction : 2 - content handling : 6 - revision :2)**

**Unit 4 - Marketing mix (4 P's) :**

- Product, new product development, product life cycle.
- Place: Marketing channel decision, retailing, wholesaling and distribution.
- Food retailing, organic /cyber networking.
- Pricing decision, price determination.
- Promotion mix: (sales promotion, advertising, personnel selling, publicity).

**(Hours for: introduction: 2 - content handling: 8 - revision : 5)**

**Unit 5 - Legal issues and funding agencies:**

- Ethics in Marketing: legal and regular framework
- Microfinance and empowerment-Joint ventures,
- Sources of finance -APEDA, MOFPI- Agencies for promotion of food entrepreneurship, processing industries; Source of machine and equipment
- Entrepreneurial Support System - Commercial Banks, State Financial Corporations, Small Industries



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Development, NABARD, NSIC, Khadi Village and Industries

- Commission, other relevant institutions/ organizations/NGOs at State level.
- Recent government initiatives in food entrepreneurship, allied service management in food entrepreneurship,

**(Hours for: introduction: 1 - content handling: 7 - revision : 2)**

**Books for study:**

1. Khanka SS (2012). Entrepreneurial Development, 4<sup>th</sup> edition, Chand and company Pvt ltd ., Delhi.
2. Kotler, P. Keller,K.L(2006). Marketing management, 12<sup>th</sup> edition. Pearson Education,Singapore.
3. Stephen P.Robbins,Mary Coutler and Neharkha Vohra ( 2010).Manangement , 10<sup>th</sup> edition, Baba Barkha Nath Printers.

**Books for references:**

1. Gupta .C.B and Srinivasan N.D(2005).Entrepreneurial Development, 6<sup>th</sup> edition, New offset press Delhi, India.
2. Jayashree Suresh (2011).Entrepreneurial Development, 5<sup>th</sup> edition, Margham Publications,Chennai.
3. Vasant Desai (2012). Fundamentals of Entrepreneurship and Small Business Management, Himalya Publishing House Pvt. Ltd., Mumbai .

**16PFP3TP01 SUMMER TRAINING PROGRAMME**  
**SEMESTER III CREDITS 1**  
**CATEGORY TP(P) NO.OF HOURS/ WEEK 3 - 4 WK**

1. A staff member of the department (GUIDE) will be monitoring the performance of the candidate.
2. The summer training program falls between Semester II and III. Students are expected to undergo this training soon after the second semester examinations.
3. The training will commence not later than one week



- after the completion of the semester examination.
4. Organizations for the summer placement must be confirmed before the commencement of the second continuous internal tests.
  5. Students must submit letter of induction to the respective guide within the first week of the internship.
  6. The student has to spend a total of 20 working days in the respective field.
  7. Students are expected to submit weekly reports along with daily time sheets to the respective supervisors.
  8. The reports will be used to evaluate the students performance.
  9. Students should submit a letter of completion from the organization duly signed by the authorities.
  10. If the staff is satisfied with the performance of student, he/she will be marked **“COMPLETED”** at the end of the semester and the details will be submitted to COE office through the HOD

## **16FP3ID01 FOOD BIOTECHNOLOGY SEMESTER**

**III**

**CREDITS 5**

**CATEGORY ID(T) NO.OF HOURS/ WEEK 6**

### **Objectives:**

- i. To explain the basic concepts to students who may have limited background in the rapid developing new tools of biotechnology.
- ii. To provide an overview of the essential features of food biotechnology.
- iii. To study the various uses of enzymes in food industry and also the recent trends in transgenic technology.

### **Unit 1: Fermentation Technology: (1+15+2)**

- o Fermentation in food biotechnology, types of fermentation and fermenters, fermentation system – submerged and solid<sub>77</sub> state fermentation, stages in





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fermentation process. Bioreactor Design.



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- Significance of SSF, SSF in food production. Production of amino acids, pigments and aromatic compounds.
- Yeast fermentation of Bread, Malt beverages, Distilled liquor, Vinegar,
- Fermented dairy products, Fermented vegetables.

**Unit 2: Algae and fungi for food and health: (1+15+2)**

- Utilization of algae – Algal transgenic – Microalgal and macro algal biotechnology – Nutritional value of micro and macro algae – Algae as potential source of food and energy – Algae as nutraceuticals –
- Industrial production processes- Chlorella and Spirulina – Cultivation, extraction and food applications of agar, alginate and carrageenan –
- Fungi as food –Yeasts and yeast products- Fungal enzymes used in food Industry - Mushroom cultivation – Value of edible mushrooms

**Unit 3: Enzymes in food industry:**

- Functional foods – Biocolors – Development of probiotics and prebiotics
- Applications of Microbial Biopolymers – Industrial enzymes – Production of enzymes
- Applications of enzymes - Enzymes in baking industry – Amylases – Enzymes for antistaling – Chymosin – Enzymes used in dairy industry – Enzymes used in fruit juice production and stabilization

**Unit 4: Food toxins, food sanitation and food control: (1+15+2)**

- Food toxins –Natural toxins of plant origin – Mushroom toxins – Phytoestrogens in food crops – Biogenic amines in food – Marine Phycotoxins.
- Bacterial toxins – Mycotoxins- Heavy metals and pesticide residues in food - Bacteriology of water – Sewage and waste treatment and disposal



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- Microbiology of food product – Good manufacturing practices – Hazard analysis – HACCP
- Food Control Agencies (Enforcement and control agencies) – Microbiological criteria for foods.

### **Unit 5: Genetically Modified food and Food safety: (1+15+2)**

- Transgenic products – Bt Brinjal production and issues
- Biofortification – Golden rice - Ferritin products - Cisgenic products
- Genetically Modified Crops and Global food security- food availability, economic access, nutritional value, socioeconomic impacts- Impacts of herbicide tolerant plants - FDA regulations on GM foods.

### **Books for Study:**

1. Anthony Pometto, Kalidas Shetty, 2005. Food Biotechnology, 2nd edition, CRC publications.
2. Bielecki. S, J. Polak, J. Tramper, 2000. Food Biotechnology, volume 17, Elsevier.
3. Byong H. Lee, 2015. Fundamentals of Food Biotechnology. Second Edition. John Wiley & Sons, Ltd.
4. Byong H. Lee, 2014. Fundamentals of Food Biotechnology, Wiley.
5. Gupta PK, 2008. Elements of Biotechnology, Rastogi Publications.
6. Gustavo F. Gutierrez-Lopez, 2003. Food Science and Food Biotechnology, CRC Press.
7. Fidel Toldrá, Leo M. L. Nollet, 2013. Proteomics in Foods: Principles and Applications, Springer publications.
8. Dabrowski WM, Sikorski ZE, 2004 Toxins in food. CRC Press.
9. Frazier WC, Westoff DC, 1995 Food Microbiology. 4<sup>th</sup> edition. Tata McGraw-Hill Publishing Ltd.

### **Books for Reference:**

1. Goldberg and Williams R., 1993. Biotechnology and  
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Food ingredients. Van nostrand, New York, US.



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2. Jose Teixeira A, Antonio Vicente A, 2013. Engineering Aspects of Food Biotechnology. CRC Press
3. Nair AJ, 2007. Introduction to Biotechnology and Genetic engineering, Infinity Science Press LLC
4. Henry G. Schwartzberg, M. A. Rao, 1990. Biotechnology and Food Process Engineering, CRC press.
5. Colin Andre Carter, Giancarlo Moschini, Ian M. Sheldon. 2011. Genetically Modified Food and Global Welfare, Emerald group of publishers.
6. Parmjit S. Panesar, Satwinder Marwaha S, 2013. Biotechnology in Agriculture and Food Processing: Opportunities and Challenges. CRC Press
7. Reed G and Nagodawithana TW, 1995. Biotechnology. VCH Publishers Inc.
8. Shetty K, Paliyath G, Pouretto A and Levin R, 2006. Food Biotechnology. CRC Press, Taylor and Francis group

**Websites**

1. [http://www.foodinsight.org/Background\\_on\\_Food\\_Biotechnology](http://www.foodinsight.org/Background_on_Food_Biotechnology)
2. [http://www.foodinsight.org/Food\\_Biotechnology\\_Resources](http://www.foodinsight.org/Food_Biotechnology_Resources)
3. [http://ec.europa.eu/food/plant/gmo/index\\_en.htm](http://ec.europa.eu/food/plant/gmo/index_en.htm)
4. <http://ec.europa.eu/food/>

**16PFP4MC01 FOOD SAFETY, LAWS & REGULATIONS**

**SEMESTER IV**

**CREDITS 5**

**CATEGORY MC(T)**

**NO.OF HOURS/ WEEK 6**

**Objectives:**

- i. To enable the students to recognize the importance of food safety, food quality, food plant sanitation, food laws, regulations and food packaging in food industry.



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- ii. To impart the understanding of food safety, types of hazards associated with food, design and implementation of food safety management systems.
- iii. To provide the knowledge on food regulations ( national as well as international), emerging concerns.

**Unit 1 : Quality programmes and systems for the food industry: 15 hours**

- Food safety as part of food quality- need and scope of food quality and food safety activities.
- Quality Control - Objectives, Major quality control functions, sampling procedures and plans, inspection ,methods of evaluation and testing of finished products, monitoring .
- Quality assurance - Quality plan, Quality manuals, document control, laboratory quality procedures, product and purchase specifications, process control, hygiene and sanitation, corrective action,continual improvement programmes , documentation and audits
- Total Quality Management; GMP/GHP; GLP, GAP; Indian & International quality systems and standards like ISO and Food Codex.

**(Hours for introduction : 2 - content handling :10 – revision : 3)**

**Unit 2: Food hygiene: 15 hours**

- Types of hazards associated with food – physical, chemical, biological and allergenic hazards nutritional, environmental, novel food and biotechnology related hazards.
- Food Adulteration: Intentional and Incidental- IPC provisions on food adulteration.
- Safety in food procurement, storage handling and preparation; Safety limits of sanitizers.
- Cleaning, sterilization and disinfection of equipment and premise, Pest control services,use of pesticides, and disposal of waste.



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- Food handlers hygiene, GHP, Employee Medical screening. Education and training for safe food production.

**(Hours for introduction : 1 - content handling : 10 – revision : 4)**

**Unit 3: Food Safety Management System: 25 hours**

- Implementation and integrating HACCP system with ISO HACCP/ ISO 22000 standards
- Plant layout, Prerequisites- PRP, GMPs, GAP, SOP and SSOPs.
- Food safety policies – Food allergens and its management.
- Codex alimentarius logic sequence for the application of HACCP - 12 steps - HACCP team, Product description and use, Flow diagram, Hazard analysis and risk assessment, CCP, HACCP plan, monitoring and corrective action, calibration of monitoring devices, validation of controls ,verification, traceability and recall.
- Management commitment and responsibility.
- Emerging concerns and newer approaches to food safety, GFSI initiatives .
- Accreditation and Auditing, Standardization and Testing laboratories.

Project: HACCP Plan for a food product.

**(Hours for introduction : 3 - content handling : 16 – revision : 6)**

**Unit 4: Food laws and regulations: 10 hours**

- Historical Perspectives of food laws and regulations: Establishment of Food & Drug Administration to enforce safety of food products.
- Purpose of laws to enforce safety and purity of food products; adulteration, sampling, penalties -



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Harmonised Food Standards for international trade:





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- International laws & Regulations: USFDA, EU, Codex alimentarius, FAO, World Trade Organization, FSMA, BRC – relations with national laws.

**(Hours for introduction : 2 - content handling : 6 – revision : 2)**

**Unit 5: National Food Laws:**

**25 hours**

- Legal compliances specific to Food industry in relation to food safety in India - Food Safety & Standards Act 2006, Food safety and standard rules 2011, FSSAI - Implementing Agencies, Governing bodies - mandatory and optional standards - sampling, penalties.
- Consumer protection Act - Export import regulations Export (Quality Control and Inspection) Amendment Act, Environment Protection Act, Quality Standards like BIS, Agmark, Legal Metrology (Packaged Commodities) Rules.
- Notifications on GM Foods, Fortification, Nutrition Information on Label, Organic Foods- Publications on food regulations.
- Regulations in regard to safety assessment of food contaminants and pesticide residues, Safety aspects of water.
- Patenting and Indian legislations for Intellectual Property Rights (IPR).

**(Hours for introduction : 1 - content handling : 18 – revision : 6)**

**Books for study:**

1. Hayes P.R and S.J. Forsythe (2010) Food Hygiene, Microbiology and HACCP, 3rd edition, Springer Science.
2. Lawley, R., Curtis L. and Davis, J. (2004) The Food Safety Hazard Guidebook, RSC publishing.



3. Mortimore S. and Wallace C(2013). HACCP, A practical approach, 3rd Edition, Chapman and Hill, London.
4. Patricia Curtis (2005). Guide to Food Laws and Regulations 1st Edition, Blackwell Publishing.
5. Robertson, G.L. 2006. Food Packaging: Principles and Practice (2nd ed.), Taylor & Francis

**Books for reference:**

1. Forsythe, S.J. (2010), The Microbiology of Safe Food, 2nd edition, Willey-blackwell, U.K.
2. Inteaz Alli, (2004). Food Quality Assurance Principles and Practices, CRC Press.
3. FSSAI Manual – Current Version.
4. Export/Import policy by Govt of India.

**16PFP4MC02 FOOD PROCESSING LAB I**

**SEMESTER IV**

**CREDITS 3**

**CATEGORY MC(L)**

**NO.OF HOURS/ WEEK 5**

**Objectives:**

- I. To gain knowledge on the basic principles of preservation of various food groups
- II. To enhance their practical skills on increasing the shelf life of food products by appropriate processing techniques
- III. To improve the storage quality and value addition of food products.

**I. Processing of Fruits and Vegetables:**

1. Thermal inactivation of peroxidase during blanching.
2. Influence of pH, cooking and freezing on the pigments in fruits and vegetables
3. Extraction of fruit juices and preparation of squashes/fruit cordials: Selection of raw material, crushing, pressing, filtration, processing & packaging. Estimation of Brix.
4. Thermal processing of foods-Preparation of Jams, jellies and marmalades



5. Osmotic dehydration of fruits and vegetables with salt and sugar.

6. Preparation of sauces/ketchup

## **II. Confectionery:**

7. Sugar crystallization. Relative sweetness, solubility and sizes of sugars, stages of sugar cookery, caramelization,

8. Preparation of Doughnuts/pastries

9. Process of Chocolate making

10. Preparation of caramel pudding/ Barfi

## **III. Extrusion processing of food:**

11. Preparation of traditional extruded products and steaming /frying/microwaving

## **IV. Ready-to-Eat foods:**

12. Processing of Ready-to-Eat (RTE) foods and shelf life studies.

Note: Industrial visits will be organized during this semester to food industries to provide an exposure to large scale manufacturing units and the students will be expected to present reports about their experience and observation for evaluation.

## **Books for Reference:**

1. B.C.Muzumdar and K. Muzumdar (2003) Methods of Physico-Chemical analysis of fruits:
2. Daya publishers, New Delhi, 2003.
3. S.Rangann (2011), Manual of analysis of fruit and vegetable products, 2<sup>nd</sup> Ed, Tata McGraw – Hill Publishing company Ltd, New Delhi.
4. Fellows PJ (2005). Food Processing Technology: Principle and Practice. 2nd Ed. CRC Press.



**16PFP4MC01 FOOD PROCESSING LAB II**

**SEMESTER IV**

**CREDITS 3**

**CATEGORY MC(T)**

**NO.OF HOURS/ WEEK 5**

**Objectives:**

- i. To enable the students to gain knowledge on the basic principles of processing techniques employed in food manufacturing unit.
- i. To enhance the practical skills on increasing the shelf life of food products by appropriate processing techniques
- ii. To improve the storage quality and value addition of food products.

**I. Baking science and technology:**

1. Determination of gluten content in various flours.
2. Bread making: role of ingredients, kneading time and processing, leavening power of different leavening agents-biological, physical and chemical agents.
3. Baking of biscuits, cookie and crackers
4. Use of humectants (honey, corn syrup, invert syrup, liquid glucose) in the preparation of cakes

**II. Dairy processing:**

1. Determination of adulterant and preservatives of milk
2. Preparation of cottage cheese/ whey beverages
3. Preparation of Khoa
4. Ice cream making - Factors affecting ice crystal formation during ice cream making-Sensory analysis of the quality characteristics of frozen desserts.

**III. Fermentation technology:**

1. Effect of temperature on activity of fermenting organisms in terms of acidity, pH and volume of fermented products.
2. Preparation of Fermented Foods—cereal-based, pulse-based, fruit/vegetable-based, vinegar, pickles, dairy based.

**IV. Meat and seafood processing:**

1. Determine the effect of enzymes in meat tenderization.



2. Brining and pickling of seafoods and shelf life enhancement.

**Books for References:**

1. Das H.( 2005). Food Processing Operations Analysis, Asian Books.
2. De Sukumar,( 2007) Outlines of Dairy Technology, Oxford University Press.
3. Spreer, Edgar,(2005). Milk and Dairy Product Technology, Marcel Dekker.

**16PFP4PJ01 PROJECT**

**SEMESTER IV** **CREDITS 14**

**CATEGORY MC(T)** **NO.OF HOURS/ WEEK 15**

**Objectives:**

- i. To introduce the purpose and importance of research for future development and sustenance.
- ii. To make the students plan and carry out the research work.
- iii. To learn the methodology of writing thesis and research articles in journals.

**Evaluation of the Project Work:**

The Controller of Examination appoints an External Examiner from the Panel of Examiners submitted by the Supervisor through the Head of the Department. Both the Supervisor and External Examiner will conduct the viva voce examination to the candidate and award marks.

Total Marks: 100

Quality of the Project Work and Dissertation	: 50 Marks
Oral Presentation	: 25 Marks
Viva-voce	: 25 Marks

There will be counseling for students regarding facilities available and about the Professors offering guidance. They can choose the topic of the project and the guide at the beginning of III semester. In case the student requires extension of time for



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submitting the dissertation, University rules will be followed.