

I & II YEAR FOOD CHEMISTRY

SEMESTER	COURSE CODE	NAME OF THE COURSE
I	FP 1806	Organic Chemistry of food - I
I	FP 1807	Human Nutrition
I	FP 1808	Analytical & Instrumentation Techniques
I	FP 1809	Food Microbiology
I	FP 1810	Quantitative Analysis Practical - I
I	FP 1811	Organic Analysis & Preparation Practical - II
I	FP 1812	Food Microbiology Practical - III
II	FP 2806	Organic Chemistry of Food - II
II	FP 2807	Food Biochemistry
II	FP 2808	Food Preservation & Food Safety
II	FP 2809	Research Methodology & Biostatistics
II	FP 2810	Biochemistry Practicals – Practicals IV
II	FP 2811	Instrumental Methods of Analysis – Practical V
II	FP 2952	Sustainable Food Management
II	FP 2953	Functional Foods & Nutraceuticals
III	FP 3807	Fundamentals of Agro Products & Processing
III	FP 3808	Inorganic, Physical & Chemical Components of Food
III	FP 3809	Chemistry of Dairy Products
III	FP 3810	Food Chemistry Practicals – Practicals VI
III	FP 3811	Food Processing Practicals – Practicals VII
III	FP 3875	Food Processing Technology
III	FP 3951	Computing Techniques – Excel for Food Chemists
III	FP 3952	Food Entrepreneurship
IV	FP 4805	Food from Animal Sources & Processing Techniques
IV	FP 4806	Chemistry of Food Additives
IV	FP 4807	Food Product Development & Packaging Techniques
IV	FP 4808	Project

ORGANIC CHEMISTRY OF FOOD – I
M.Sc. (Food Chemistry & Food Processing)

FP 1806

Semester I

No. of Credits : 4

Course: Major core (MC)

Total hours per Semester: 60 (5hrs/wk)

Objectives:

The course should prepare the students

- 1. To understand the aspects of organic chemistry related to food.*
- 2. To understand the techniques adopted in processing of food.*
- 3. To understand and appreciate the concept of chemistry in Food Science & Food processing.*

UNIT-1: CARBOHYDRATES:

(10 hrs)

- 1.1 Disaccharides** – Optical activity and chirality v v ,Classification of chrial molecules asymmetric and dissymmetric of organic molecules. Maltose, lactose and sucrose - solubility, solution viscosity and stability.
- 1.2 Polysaccharides:** Hydrolysis, starch granules, granule gelatinization and pasting. Retrogradation and staling. Modified food starch-swelling of starch and cellulose - modifications and derivatives. Gels.
- 1.3 Dietary fibre and carbohydrate digestibility**-Xanthan, carrageenans, algin, pectins and gum-arabic.
- 1.4 Analysis of carbohydrates:** Extraction of total carbohydrate, phenol-sulphuric acid method. Total reducing sugar –Somoyogi Nelson method. HPLC analysis of mono and oligosaccharides- Principles and method. Enzymatic method. Determination of total starch in pectin.

Self study: Chemical properties of monosaccharides – mutarotation, test for reducing and non-reducing sugars. **Monosaccharides:** Classification and structure – ring form and glycosides. Reactions – oxidation to aldonic acids and aldo lactones. Reduction to carbonyl groups-uronic acids, hydroxyl group esters. Non-enzymic browning.

UNIT -2: LIPIDS

(15 hrs)

- 2.1 **Fatty acids** – A brief study of R&S, Fischer projection, erythro & threo compounds. Geometrical and optical isomerism. Nomenclature-R/S system and stereo specific numbering. Phospholipids, classification of lipids – milk fats, lauric acids, vegetable butters; simple, compound and derived lipids – Oleic and linoleic acids. Modification of fats- Hydrogenation.
- 2.2 **Animal fats** – Physical aspects – even and random distribution- Theories of triglycerol distribution pattern. Chemical deacylation.
- 2.3 **Positional distribution of fatty acids in natural fats** :Plants and animal triglycerol. Crystallization and consistency – crystal structures, polymorphism, melting, solid fat index, and consistency of commercial fats. Factors influencing consistency. Chemical aspects – Lipolysis, auto oxidation, formation of hydroperoxides (oleate) and decomposition of hydro peroxide. Cholesterol oxidation, formation of dimers and polymers, Diels- Alder reaction.
- 2.4 **Antioxidants.** Effectiveness and mechanism of action; Synergism – characteristics of commonly used antioxidants. Thermal non-oxidable and oxidable reactions of saturated fats.
- 2.5 **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.

Self Study: Chemistry of fat and oil processing & refining – Settling and degumming, neutralization, bleaching, deodorization, hydrogenation and selectivity: Mechanism. Inter esterification- Principle. Role of food lipids in flavor, rancidity, flavor reversion, dietary lipids.

UNIT-3: AMINOACIDS, PEPTIDES AND PROTEINS

(15 Hrs)

- 3.1 **Aminoacids.** Physiochemical properties of aminoacids. Structure and classification- stereochemistry of aminoacids. peptides and synthesis of tri peptide using amino acids, glycine, alanine, lysine, cystine, Glutamine acid and arginine. Isoelectric point. Hydrophobic properties of aminoacids. Chemical reactivity of aminoacids – Reaction with ninhydrin & other reactions.
- 3.2 **Proteins.** Structural hierarchy in proteins – primary, secondary, tertiary and quaternary structure. Forces involved in the stability of protein structure- steric strain, hydrogen bond, electrostatic interactions, hydrophobic interactions, disulphide bonds, conformational stability and adaptability of proteins.
- 3.3 **Emulsifying properties:** Methods, emulsifying activity index, protein load, capacity and stability of emulsion – factors influencing emulsifications, foaming properties, flavour binding.
- 3.4 **Evaluation of protein nutritive value** - Biological methods- PER, DC, BV, NPU, NPR. Chemical methods- enzymic and microbial methods. Changes in nutritional quality and formation of toxic compounds. Compositional changes during extraction and fractionation. Protein cross linking and carbonyl amine reactions.
- 3.5 **Reactions of proteins in food.** Reaction with lipids, sulphites, chemical and enzymatic modifications of proteins – alkylation, acylation, phosphorylation, sulphitolysis, enzymatic hydrolysis, plastein reaction.
- 3.6 **Analysis of proteins :** Kjeldahl, Biuret, Bradford, Ninhydrin and turbidimetric methods. UV-Visible and IR spectrometric methods

Self study: Basic structural aspects of amino acids, peptides, poly peptides and proteins.

UNIT-4: ENZYMES

(15 Hrs)

- 4.1 **Enzymes.** Chemical nature of enzymes. Catalysis-enzyme kinetics, steady state rate kinetics and reaction order. Nomenclature, classification, typical concentration of enzymes in some food, factors influencing concentration of enzymes in some food,
- 4.2 **Enzyme cofactors.** Feature of organic cofactors, coenzymes prosthetic group – Significance of metallo enzymes in food chemistry, enzyme inactivation and control, reversible inhibitors, competitive and uncompetitive inhibition. Irreversible inhibitors.

- 4.3 **Food modification.** Role of endogenous enzymes in food quality, colour-lipoxygenase, chlophyllase, texture-pectic enzymes; flavour and aroma changes, nutritional quality in food.
- 4.4 **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 microorganism.

Self study: factors influencing enzyme reaction – Substrate activation, inhibition, reaction allosteric behaviour, enzyme concentration, pH, temperature. Chemical nature of prototropic groups in active site of enzyme. Stability of enzyme, enzyme activity at low temperature.

UNIT-5: VITAMINS

(5 hrs)

- 5.1 **Vitamins:** Classification, stability, toxicity and sources.
- 5.2 **Fat soluble vitamins.** Vitamin-A and provitamin-A. Vitamins-D and E –structure, stability and mechanism of degradation, Synthesis of vitamin A1
- 5.3 **Water soluble vitamins** –Vitamins-B and C. Folate-stability and degradation mechanism;
- 5.4 **Analysis of vitamins:** HPLC method of determination (Vitamins A, C and E). Determination of riboflavin assay by fluorescence study.

Self study: Structure of vitamin A₁, A₂, B₁, B₂, B₆, C, D, E and K (structural elucidation not required)

TEXT BOOKS

1. O. R. Fennema (2003) Food Chemistry, 3rd Ed, Tata McGraw-Hill, New York.
2. Nielson S.S and Chapman.A and Hall(1998) Food Analysis, Food Science Title, 2nd Ed., Aspen Publishers.
3. Vaclavik V.A (2008) and Christian .E.W (2008) Essentials of Food Science, Third Edition, Ed., Springer
4. Vogel(2006)Vogel's Text Book of Practical Organic Chemistry, 5th Ed., Pearson Education.
5. B. Srilakshmi (2003), Food Science , 3rd Ed., New Age International Publications.

REFERENCES

1. S. Rangamma (1977) *Manual of Analysis of Fruits and Vegetable products*. Tata McGraw- Hill Pub. Comp. Ltd., New Delhi.
2. S. Sivasankar (2002) *Food processing and preservation*, Prentice Hall of India, New Delhi.
3. S.J. Lippard (1998) *Bioinorganic Chemistry*, Viva Books (P) Limited.
4. P.K. Bhattacharya (2005) *Biochemistry*, Narosa Publishing House.

HUMAN NUTRITION

M.Sc. (Food Chemistry & Food Processing)

FP 1807

Semester I

No. of Credits : 4

Course: Major core (MC)

Total No. of hours per semester: 60(5hrs/wk)

Objectives: To prepare the students

- 1. To understand the relationship between nutrition and human well being.*
- 2. To understand the functions and importance of all nutrients for different age groups-normal and therapeutic groups.*

UNIT-1: INTRODUCTION TO NUTRITION

[15 hrs]

- 1.1 Food as a source of nutrients, functions of food, definition of nutrients .Adequate, optimum, good and malnutrition. Inter relationship between nutrients.
- 1.2 Food pyramid. Different food groups. Principles of planning diets.
- 1.3 The energy yielding nutrients .Carbohydrates – glucose, fructose, lactose, sucrose, starch, glycogen, Inulin, dextrin, dextran, cellulose and hemicellulose – functions. Food sources-storage in the body, utilization of carbohydrates and recommended carbohydrate intake.
- 1.4 Proteins – essential and non-essential amino acids, sources, requirements, functions, protein energy malnutrition – Kwashiorkor, Marasmus and Marasmic Kwashiorkor.
- 1.5 Lipids – saturated and unsaturated fatty acids. Essential fatty acids – effects of deficiency of essential fatty acids. Functions of fat-triglycerides, phospholipids, lipoproteins and cholesterol. Requirements of fat, lipids and coronary artery disease – Blood Lipids and lipemia.Total cholesterol and triglycerides, LDL, VLDL & HDL.
Self study: – *Digestion, absorption and transport of carbohydrates, proteins and lipids.*

UNIT 2: ENERGY**[10 hrs]**

2.1 Units of energy. Food as a source of energy. 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. Food sources.

2.2 Energy requirements for physical activity. Factors affecting energy requirements.

RDA –Recommended dietary allowances.

2.3 Influence of physical exercise on changes in body fat and body composition,

utilization of energy by muscle tissue – adenosine triphosphate, phosphocreatine, glucose, fat and protein.

2.4 Shift in lipid and carbohydrate utilization in relation to exercise type, intensity

and duration.

Self study: Calculation of energy requirements for different age groups involved in different physical activities.

UNIT- 3: PROTECTIVE NUTRIENTS**[15 hrs]**

3.1. Vitamins – Classification, sources and requirements. Units of measurement.

Functions and deficiency of the following vitamins – fat soluble : vitamins- A, D, E and K, water soluble vitamins : ascorbic acid, thiamine, riboflavin, niacin, B₆, folic acid, B₁₂, biotin and pantothenic acid

3.2 Minerals – Functions, sources, bioavailability, requirements (RDA). Deficiency

of following minerals : Calcium, iron, sodium, potassium, magnesium, copper, manganese, selenium, zinc, chromium, iodine, sulphur, chloride, fluoride and phosphate.

Self study: Planning diets for anemia and various vitamin deficiencies

UNIT- 4: NUTRIENT AND DRUG INTERACTION [10 hrs]

4.1 Effect of drug therapy on absorption and utilization of nutrients.

4.2 Effect of the nutrients on drug utilization.

Self study: Effect of specific drugs on the absorption and utilization of nutrients.

UNIT- 5: NUTRITION THROUGH LIFE CYCLE [10 hrs]

5.1.Nutrition through life cycle: Introduction and importance of nutrition through various age groups.

5.2 Infant nutrition – Nutrition through infancy and requirements of different nutrients as per RDA.

5.3 Nutrition of pre-schoolers, school going children, adolescents, pregnant and lactating mothers and geriatric nutrition.

5.4 Prevention of malnutrition – Applied Nutrition Programmes (ANP) globally and nationally.

Self study: Planning normal and therapeutic diets for various age groups

TEXT BOOKS

1. Swaminathan.M (1985.)- ‘Advanced text book on Food and Nutrition’ Vol.- I, BAPPCO Publishers, Bangalore.
2. M. Swaminathan (1985)- ‘Advanced text book on Food and Nutrition’ Vol.-II, BAPPCO publishers, Bangalore .
3. B. Srilakshmi(2003)- ‘Nutrition Science’, New age International (p) Ltd Publishers, New Delhi, Bangalore.
4. B. Srilakshmi(2006.)- ‘Dietetics’, New age international (p) Ltd publishers, Bangalore, revised 5th Ed., reprint
5. Kathleen.L.M and Stump.E.S (2007) - Krause’s Food and Nutrition Therapy,Saunders Publishers,12th Ed.
6. Williams S.R and Schelenker .E (2002)- Essentials of Nutrition and Diet Therapy, Mirror Mosby Publishing Company,8th Ed
7. Manay S. N. and.Swamy S.(1987)., ‘Food, facts and Principles’, Wiley eastern Ltd, New Delhi,

REFERENCES:

1. Swaminathan.M (1997.) *Human Nutrition and Dietetics*, 4th Ed., BAPPCO publishers, reprint
2. Anderson.M (1982.) '*Nutrition in health and diseases*', 17th Ed., J.B Lippincott & Co., Philadelphia,
3. Joshi J.K(2005.) *Basics of Clinical Nutrition*, Jaypee brothers, Medical publishers © Ltd., New Delhi, 1st Ed., 2003,
4. Antia (2000) *Clinical Dietetics and Nutrition*, University Press, New Delhi. 3rd Ed.
5. Shils M.E , James A. and Shike O.M (1994.) *Modern Nutrition in health and disease*; 8th Ed., Vol., I and II, Leo and Felijier Awaverly Company, Philadelphia,
6. G.Wiseman(2002) *Nutrition and health*, Taylor and Francis publishers, London.
7. Michael J.G., Barrie M. and Margetts M. (2005.) '*Public health nutrition*' Black Well Publishers, Reprint
8. Holden C., MacDonald A. and Tindall B. (2000) "*Nutrition and Child health*", Imprint Harcourt publishers Ltd,
9. Goplan .C, Ramashasthri B.V. and Balasubramanian F.C. (2004)- '*Nutritive Value of Indian foods*' NIN & ICMR publication, revised edition
10. Garrow J.S and James W.P.T '*Human Nutrition and Dietetics*' 9th Ed., , Churchill Livingstone publishers.
11. Ghosh.S(1977) '*The feeding and caring of infant and young children*' Voluntary health association of India, New Delhi,

WEBSITE: Nutrition Society Text Book Series, www.nutritiontexts.com

ANALYTICAL AND INSTRUMENTATION TECHNIQUES

(M.Sc. Food Chemistry & Food Processing)

FP 1808

Semester – I

No. of Credits : 3

Course: Major core (MC)

Total Hours per semester : 50 (4hrs/wk)

Objectives: To prepare the students

1.To learn the application of spectroscopy and other instrumental methods for the study and structural elucidation of molecules.

UNIT- 1: PREPARATION OF SOLUTIONS , ELECTRONIC AND ATOMIC ABSORPTION SPECTROSCOPY. (15HRS)

1.1 Preparation of solutions: Preparation of solutions ,percentage by weight, volume and strength. normality, molarity ,ppm, ppb.

1.2 Standard solutions: Dilutions to known concentrations

1.3 Buffer solutions :Determination of pH use of pH meter, calibration, pH and potentiometer titration preparation of buffer solutions, pH and buffers control in foods

1.4 UV-Visible spectroscopy, principle and instrumentation. Beer-Lambert's law-verification and deviation, significance of molar extinction coefficient. Spectrophotometric titration Determination of Fe(III) in the presence of aluminum.

1.4 Atomic Absorption Spectroscopy(AAS): Principle and instrumentation-Nebuliser, burner system, graphite tube furnace, resonance line source, monochromators, detectors and

spectral & chemical interferences. Determination of calcium & magnesium(in water) and tin (in canned fruit juices). Determination of Pb in petrol.

1.6 Spectrofluorimetry:Principles ,Description of fluorimetry, Analysis of riboflavin, thiamine.

Self study: Solvents used in electronic spectra. Effect of solvent polarity on the electronic transition – Solvent corrections, and solvent cut off region

UNIT- 2: IR SPECTROSCOPY

(12 hrs)

- 2.1 Principle, molecular vibrations and selection rules - Quantitative studies. Calculation of force constants for vibrations. Hydrogen bonding: intra- and intermolecular hydrogen bonding.
- 2.2 Characteristic group absorptions of organic compounds: Carbon skeleton vibrations. Alcohols, phenols, ethers, peroxides, ketones, aldehydes, carboxylic acids, esters, lactones, amines, amino acids; groups absorbing in the fingerprinting region.
- 2.3 Study of isomerism: Linkage isomerism in coordination compounds: cyano-, isocyano-, thiocyanato- and isothiocyanato complexes, geometrical isomers of organic compounds.

Self study: Instrumentation of IR Spectroscopy

UNIT-3: NMR SPECTROSCOPY

(15 hrs)

- 3.1 Principle of NMR spectroscopy .Types of relaxation . Instrumentation , chemical shifts: Factors affecting chemical shift - shielding and deshielding.
- 3.2 Spin-Spin coupling – coupling constant , chemical exchange – study of hydrogen bonding ,Interpretation of ^1H NMR spectra of simple organic compounds
- 3.3 ^{13}C NMR spectroscopy: Basic principles. Comparison of ^{13}C NMR and ^1H NMR .

Self study: Methods of simplifying complex NMR spectra-NMR shift reagents and their uses.

UNIT-4: MASS SPECTROMETRY

(8 hrs)

- 4.1 *Principle* – Fragmentation – types and rules, factors influencing fragmentation, fragmentation patterns of hydrocarbons, hydroxyl compounds, alcohols, ethers, ketones, aldehydes, carboxylic acids, amines, nitro compounds, alicyclic and heterocyclic compounds
- 4.2 *Determination of molecular formula*: Molecular ion, nitrogen rule, isotope peak, and metastable ions.

Self study: *Nature of compounds and ionization methods employed in mass spectrometry. Common rearrangements of ions in mass spectrometry.*

UNIT-5: CHROMATOGRAPHY

(10 hrs)

- 5.1 Introduction: Definition of chromatography. Theory and classification of chromatographic methods-paper, column and TLC chromatographies. Development of chromatogram-Applications.
- 5.2 HPLC- Introduction, principle of separation, components of an HPLC system. Pump, injector, column detectors and different type of detectors recorder, Application of HPLC. Super critical fluid chromatography(SFC). Instrumentation and components for SFC-Applications.
- 5.3 Gas Chromatography(GC) - Introduction. Principle-theory of gas chromatography Instrumentation. Types of detectors-evaluation of gas chromatogram. Application of GC.

Self study: Flow programming chromatography, *programmed temperature gas chromatography*.

TEXT BOOKS

1. Silverstein R.M and Webster F.X (2003) *Spectroscopic Identification of Organic Compounds*, 6th Ed., John Wiley & Sons, New York.
2. W. Kemp(1987), *Applications of Spectroscopy*, ELBS.

3. Srivastava .K and Jain P.C(1997) *Chemical Analysis, An Instrumental Approach*, 3rd Ed., S. Chand and Co., New Delhi.
4. Drago R.S(1977) *Physical Methods in Chemistry*; Saunders: Philadelphia.

REFERENCES

1. D. H. Williams and I. Fleming(1988)*Spectroscopic Methods in Organic Chemistry*, 4th Ed., Tata McGraw-Hill Publishing Company, New Delhi.
2. K. Nakamoto(1997) *Infrared and Raman Spectra of Inorganic and coordination Compounds*, Part B: 5th Ed., John Wiley & Sons Inc., New York.
3. J. A. Weil, J. R. Bolton and J. E. Wertz(1994) *Electron Paramagnetic Resonance*; Wiley Interscience.

FOOD MICROBIOLOGY

(M.Sc. Food Chemistry and Food Processing)

FP 1809

Semester: I

No. of credits : 3

Course: Major core (MC)

Total hours per semester : 50(4 hrs/wk)

Objectives: To enable the students to

- 1. To understand the microbial, biochemical and physiological aspects of food spoilage.*
- 2. To study the different types of micro organisms responsible for food deterioration and poisoning.*
- 3. To understand the various fermented foods and their importance.*

UNIT- I: MICROBES AND FOOD

(10hrs)

- 1.1 Scopes of Food microbiology-food as substrate for micro organism, food spoilage, food safety, fermented foods.
- 1.2 Micro organisms important in food microbiology.
- 1.3 Micro organism in water, air and soil. Water treatment and waste disposal.
- 1.4 Micro organisms as natural preservatives, probiotics and prebiotics
- 1.5 Factors affecting growth of micro organism in food- growth curve.

Self study: Study of fish and meat products as substrates to bacterial growth.

UNIT- II: FOOD BIODETERIORATON**(10hours)**

2.1 Types of biodeterioration- physiological and biochemical biodeterioration.

2.2 Specific spoilage organisms- characterization of SSO; CSI, MSL

2.3 Food- spoiling micro organisms- food spoiling reactions- interactions between food-spoiling bacteria- Acylated homoserine lactone-based communication and Quorum sensing

2.4 Microbial spoilage of cereal and cereal products, milk and dairy products, sea foods, meat and meat products, eggs and poultry, vegetables and fruits.

Self study: Microbiology of food taints.

UNIT- III FOOD BORNE DISEASES**(10 hours)**

3.1 Food borne infections- epidemiology, clinical features, and route of contamination, laboratory diagnosis and identification of bacterial, viral, fungal, parasitic infections.

3.2 Food borne intoxications- bacteriotoxins, mycotoxigenic molds as agents of food poisoning, algal food poisoning.

Self study: Food hygiene

UNIT- IV: MICROBIAL FOOD FERMENTATION**(10hours)**

4.1 Fermentation- fermentation biochemistry, basic principles of fermentation- organisms responsible for food fermentation-Manipulation of microbial growth and activity-controlled fermentation.

4.2 Microbiology of starters- roles of starters, classification of starter bacteria.

4.3 Fermentations in food processing- classification of fermentation- safety of Fermented foods.

4.4 Production and leavening of yeast-biosynthesis of ethanol

Self study: Dynamics of microbial population- fermented meat and meat products.

UNIT- V: INDUSTRIAL MICROBIOLOGY

(10hours)

5.1 Manufacture of ethyl alcohol from molasses- Beer production- composition and manufacture of beer, uses of ethyl alcohol

5.2 Vinegar production- Methods of manufacture- Defects of vinegar- uses of vinegar.

5.3 Bread production, production of substances added to food- dextran, xanthan and monosodium glutamate(MSG).

5.4 Mushroom cultivation and single cell proteins.

Self study: Selection of antibiotics in medicine- vitamin production.

TEXT BOOKS:

1. Vijaya Ramesh K., (2007) *Food Microbiology*, MJP Publishers,
2. John F.T. and Alicia L. (2001) *Ragout de Spencer, Food Microbiology Protocols*, Humana Press, Totowa, New Jersey,
3. Frazier W.C. and Westhoff D.C (2008) *Food Microbiology*, (4th Edn), Tata McGraw-Hill Publishing Co ,New Delhi,
4. Adams M.R. and Moss(2008) *Food Microbiology*, New age International pvt Ltd. New Delhi

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REFERENCE BOOKS:

1. James M. Jay, Martin J.Loessner and David A (2005) Golden, *Modern Microbiology*, VII Edition, Springer Science Media Inc.,
2. Moshrafuddin Ahmed and Basumatary S.K. (2006) *Applied Microbiology*, MJP publisher,
3. Prescott, Hershy, and Klein|(2006) *Microbiology* ,2nd Edition, MJP publishers,

JOURNALS:

1. International Journal of Food Microbiology-Elsevier
2. Food Microbiology Elsevier
3. Indian Journal of Microbiology
4. Journal of pure and applied Microbiology

QUANTITATIVE ANALYSIS: PRACTICAL-1

M.Sc. Food Chemistry & Food Processing

FP 1810

Semester – I

No. of Credits : 2

Course: Major core (MC)

Total hours per semester:50(4hrs/wk)

Objectives To prepare the students to

1. *To develop analytical skill in organic quantitative analysis*
2. *To understand the techniques involved in the preparation of standard solutions, standardization and calculations in the estimations of compounds.*
3. *To appreciate and apply the techniques involved in the estimation of substances.*

EXPERIMENTS

1. Estimation of hardness of water – *Analysis of water, total solid, total hardness, temporary and permanent hardness & estimation of Fe^{3+} , Ca^{2+} and Mg^{2+} in water.*
2. Estimation BOD and COD
3. Estimation of phosphate by gravimetric method – *Estimation of phosphate from white bait*
4. Estimation of nitrogen by Kjeldhal method - *Estimation of caffeine from beverage cola*
5. Estimation Pb^{2+} by visual colorimetry methods
6. Estimation of phenols and polyphenols - *Estimation of tannins by volumetric or by colorimetric method/ Estimation of total anthocyanin from fruit juices.*
7. Estimation of ketones (ethyl methyl ketone)
8. Estimation of sugars (Glucose) - *Estimation of % of reducing sugar, % of total sugars as invert sugar and % of sucrose in fruit juices, jams, jellies.*
9. Estimation of ascorbic acid from Vitamin-C (*Tablets/ lime juice/ cabbage/green chillies*).
10. Estimation of Ca^{2+} in white bait by permanganometry.

11. Estimation of Glycine – Sorensens Formol Titration.

12. Analysis of vinegar and fruit juices – *Total acidity*

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TEXT BOOKS:

1. Ranganna S., (1977), Manual of analysis of fruits and vegetable products. Tata McGraw Hill Pub. Comp. Ltd., New Delhi,

REFERENCE BOOKS:

1. Vogel (1984) *Vogel's Text book of Practical Inorganic Chemistry*, 4th Edition, ELBS/Longman, England.

2. Gurtu J.N. and Kapoor R (1987) *Advanced Experimental Chemistry*, S. Chand and Co.,

ORGANIC ANALYSIS AND PREPARATION-PRACTICAL-2

(M.Sc. Food Chemistry & Food Processing)

FP 1811

Semester – I

No. of Credits : 2

Course : Major core (MC)

Total hours per semester:50(4hrs/wk)

Objectives :

- 1. To enable the student to develop analytical skill in organic qualitative analysis and to develop preparative skills in organic preparations involving two or three stages.*
- 2. To enable the students to understand better the concepts of organic analysis and appreciate better the applications of organic chemistry towards chemical, industrial and biological systems.*
- 3. To enable the students to understand the mechanism involved in the name reactions and conditions of the reactions involving the preparations.*

EXPERIMENTS

- 1. a) Analysis** of two component and three component mixtures; separation and characterization of compounds.
b) Separation of organic preservatives and synthetic sweetening agents from food.
- 2. Preparations** involving two or three stages comprising of the following processes.
 - a) nitration

- b) halogenation
- c) diazotization
- d) rearrangement
- e) hydrolysis

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- f) reduction
- g) acylation
- h) oxidation

3. Separation of components from food sources, adulterants and food poisons.

- a) Thin layer chromatography
- b) Column chromatography
- c) Paper chromatography.

TEXT BOOKS

1. Gnanapragasam N.S. and Ramamurthy G (1998.) *Organic Chemistry – Lab manual*, S. Viswanathan Co. Pvt. Ltd,
2. Gurtu J.N. and Kapoor R (1987) *Advanced Experimental Chemistry*, S. Chand and Co.,

REFERENCE BOOKS

1. Vogel(1984) *Vogel's Text book of Practical Organic Chemistry*, 4th Edition, ELBS/Longman, England,

FOOD MICROBIOLOGY PRACTICALS

(M.Sc. Food chemistry and Food processing)

FP 1812

Semester: I

No. of credits : 2

Course : Major Core (MC)

Total no. of hours per semester:50(4hrs/wk)

Objectives: To enable the students

- 1. To understand different methods of sterilization ,staining techniques*
- 2. To study different types of micro organisms responsible for spoilage*
- 3. To study microbial destruction*

EXPERIMENTS:

- 1. Methods of sterilization**
- 2. Preparation of culture media**
- 3. Isolation & Enumeration of Bacteria from food (Pour plate, Serial dilution method)**
- 4. Gram staining of bacteria**
- 5. Most probable number (MPN) method for coliforms in water**
- 6. Microbiological examination of milk- Dye reduction test**
- 7. Detection of E.coli, Salmonella , Staphylococcus in food samples.**
- 8. Fungal examination –LPCB staining ,Slide culture technique**
- 9. Abic sensitivity testing**
- 10. Determination of thermal death point**

11. Determination of thermal death time
12. Microbial examination of curd
13. Analysis of aflatoxins by Thin layer chromatography

REFERENCE BOOKS :

1. Rajan S. and Christy R. (2010) ‘ Experimental procedures in LIFE SCIENCE’ Anjanaa Book House.
2. Joanne W, Linda S, and Christopher (2010) ‘Laboratory Exercises In Microbiology’. Laboratory manual, ‘Mc Graw – Hill companies.
3. Collee J.G ,Mackie T.M, McCartney.J.E (1996) ‘ A Book For Microbiologist and microbiology. ‘Churchill Livingstone’.
4. Monica Cheesbrough (1991), Medical laboratory manual for tropical countries Volume1 K.G Saur University of Michigan
5. Monica Cheesbrough (2006) Medical laboratory manual for tropical countries: Volume 2 K.G Saur University of Michigan

ORGANIC CHEMISTRY OF FOOD - II

(M.Sc. Food Chemistry & Food Processing)

FP 2806

Semester – II

No. of Credits : 5

Course: Major (MC)

Total hours per semester:60 (5hrs/wk)

Objectives:

- 1. To enable the student to understand and identify heterocyclic systems encountered in life systems and in food sources and products.*
- 2. To help the student understand the variety of naturally occurring organic compounds that are used as food additives.*
- 3. To give a basic idea of color and constitution and synthetic food colors.*

UNIT 1. HETEROCYCLIC SYSTEMS.

(15)

5-membered ring with one hetero atom: pyrrole, furan, thiophene, indole and carbazole.

5-membered ring containing two hetero atoms: pyrazole, imidazole-oxazole-thiazole.

6-membered ring with one hetero atom: pyridine, quinoline, iso-quinoline, pyran and benzopyran.

6-membered ring with two hetero atoms: diazines, benzodiazines, quinazolines, phenazines, phenoxazine and thiazine.

basic structure-some important oxidized and reduced forms and derivatives-heterocyclic rings in DNA, RNA-in enzymes and co-enzymes - in chlorophyll and haemoglobin-in vitamins .
Biosynthesis of cholesterol & bile acids

UNIT 2. TERPENES. (10)

Isolation-isoprene rules- application to simple systems

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Geranial, neral, ionones, geraniol, α -terpeneol, carvone, limonene, 1,8-cineole,
Menthol, menthone, α -pinene, camphor, borneol, farnesol, zingiberine, pyrethrosin,
 α -cadinene, selinenes, eudesmol, santonin, α, β -vetivones, caryophyllenes, guiacol,
longifolene, phylol, abietic acid, gibberellic acid, squalene.

Source, structure, properties - role as food ingredients wherever applicable.

UNIT 3: ALKALOIDS. (15 hours)

Chemical nature- general methods of extraction- classification.

Phenethylamine group: ephedrine, Benzedrine, mescaline, adrenaline.

Hemlock alkaloids: conine; Pomogranate alkaloid - peltatrienes; piperine;

Tobacco alkaloid-nicotine-solanaceous alkaloid-cocaine; cinchona alkaloid-cinchonine, quinine; phenanthrene alkaloid - morphine, codeine,

source, structure, effects on physiological system. Total synthesis of quinine, morphine, reserpine and cocaine'

UNIT 4: FLAVONOIDS. (10)

Sources, and structure of anthocyanins, - base hydrolysis - pH and color of anthocyanins- structures of cyanidin, pelargonidin, malvidin, hirsutidin and delphinidin chlorides; chromones – flavones – flavonols - base hydrolysis of quercetin;

Isoflavones- base hydrolysis - daidzein; color and heat stability of anthocyanins.

UNIT 5. DYES.

(10)

Color and constitution - chromophores – hypsochromes – auxochromes - nomenclature of dyes - dyes as indicators - phenolphthalein, methyl orange, indophenol.

Classification - chemical and method of application.

Azodyes –chrysoidine, methyl orange, Congored

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Diaryl methane dyes- auramine

Triphenyl methane dyes-malachite green, crystal violet.

Phthalein dyes - florescein, eosin, phenolphthaleine, rhodamine-B.

Acridine dyes- acriflavin, acridin yellow.

Anthraquinone dyes: alizarine-indigo

Food colorants: sunset yellow, orange-B, citrus red No2, yellow No5, green No3.

Preparation of Anthroquinone from anthracene, methyl orange from sulphanilic acid.

Text books:

1. Agarwal O.P. (1997), *Chemistry of organic natural products*, Vol I & II Goel Publishing House.
2. Gurdeep chatwal *Organic chemistry of natural products* Vol I & II, Himalaya Publishing House, 3rd edition.
3. Fennema. R, *Food chemistry*, Marcel & Decket Inc, 3rd edition.

Reference books:

1. John. M. de Man, (1999,) *Principles of food chemistry*, Aspen Publishers Inc.
2. Dr. Geetha Swaminathan & Mrs. Mary George, (2002), *Laboratory chemical methods in food analysis*, Margham Publishers,

FOOD BIOCHEMISTRY
(M.Sc.Food Chemistry& Food Processing)

FP 2807

Semester – II

Course – Major core(MC)

No.of.Credits : 4

Total hours per semester : 50(4 hrs/wk)

Objectives:

- 1.To Impart knowledge of biochemistry to better understand the inference of food molecules in mammals.*
- 2.To focus on the understanding **of** biochemical processes in the context **of** chemical principles*
- 3.To inculcate the better understanding on the metabolism of nucleic acid and in vivo protein synthesis.*

1. Unit 1 - Bioenergetics:

(5 hours)

- 1.1. Application of laws of thermodynamics to biochemical systems.
- 1.2. Role of high energy phosphate in bioenergetics and metabolism.
- 1.3. Redox reaction.electron transport chain and oxidative phosphorylation, mechanism-chemi osmotic hypothesis.

2. Unit 2- Carbohydrate metabolism: (10hours)

- 2.1 Metabolic pathways: glycolysis, glycogenesis, glycogenolysis, TCA cycle, HMP shunt, gluconeogenesis.
- 2.2 Disorders of carbohydrate metabolism.

3. Unit 3- Lipid metabolism: (10hours)

- 3.1 Saturated and unsaturated, essential fatty acids,
- 3.2 Function of acylglycerols, phospholipids, sphingolipids, Glycolipids, steroids.
- 3.3 Oxidation in biological systems: Factors influencing rate of lipid oxidation in food. Methods of measuring lipid oxidation- solid fat index, peroxide value, thio barbituric acid test, anisidine value, Kreis test, oxirane test and Iodine value.

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- 3.4 Metabolic pathways: Fatty acid oxidation, biosynthesis of fatty acids, cholesterol, Metabolism of lipoproteins

4. Unit 4 - Protein metabolism: (10 hours)

- 4.1 Essential and nonessential amino acids, peptide bond, structure, function of amino acids.
- 4.2 Denaturation of proteins, Metabolic breakdown and synthesis of any two essential amino acids, method for separating proteins according to its molecular weight-SDS PAGE electrophoresis
- 4.3 Amino acid oxidation and production of urea –transamination and functions of pyridoxal phosphate, deamination, decarboxylation, urea cycle, regulation of urea cycle
- 4.4 Disorders of amino acid metabolism.

5 Unit 5 - Nucleic acids , membrane biochemistry, and water, electrolytic, acid base balance : (15 hours)

- 5.1 Structure of nucleotides, DNA replication, transcription and translation, gene regulation in prokaryotes .

5.2 Structure, supramolecular architecture , transport of substances through membranes- passive, active, facilitated.

5.3 Water balance-distribution, water intake and output, electrolytic composition of the body fluids and its regulation. Production of acids and base in the body ,pH maintenance- respiratory and renal mechanism.

TEXT BOOKS:

1. Lehninger A.L, (1993), 'Biochemistry' 4th Edition, Elbs publishers, New Delhi.
2. Voet and Voet J.G (1999), 'Fundamentals of Biochemistry', 2nd Edition, John Wiley and Sons Inc, New York.
3. Sathya Narayana.V(1999), 'Biochemistry', Books and Allied (P) Ltd, Calcutta
4. Wilson .W (2005) Principles and techniques of practical biochemistry Cambridge university press, England

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REFERENCE BOOKS:

1. Zubay G.L, William W.P, and Vance D.E (1995), 'Principles of Biochemistry', W.C.Brown Publishers, England.
2. Murray R.K,Granner D.K,Meyo P.A and Rodwell V.W, (1993), 'Harper's Biochemistry',Newyork,Prentice Hall International Inc.
3. Deb A.C (1999), 'Fundamentals of bio chemistry', New central Book Agency(p) Ltd.
4. White A.P, Handler, Smith E.L and Stettin D(1973), 'Principles of Biochemistry', 5th Edition ,Mc Graw Hill Book Co.
5. Karlson P. (1975), 'Introduction to Molecular Bio chemistry', Academic Press, Newyork.
6. Suttie J.M (1972), 'Introduction to Biochemistry', Holt, Reinhart and Winston Inc, Newyork.
7. Conn E.E, and Stumpf (1978), 'Outline of Biochemistry', 4th Edition, Wiley Eastern Ltd, and New Delhi.
8. Rao K.R, (1986), 'Textbook of Biochemistry', 3rd Edition, Prentice Hall of India (p) Ltd.

9.Sambrook, J., Fritsch, E.F., and Maniatis, T. (1989) *Molecular Cloning: A Laboratory Manual*, 2nd Ed., Cold Spring Harbor Laboratory, Cold Spring Harbor, NY

FOOD PRESERVATION AND FOOD SAFETY

(M.Sc., Food Chemistry & Food Processing)

FP 2808

Semester – II

No. of Credits : 5

Course: Major Core (MC)

Total hours per semester:60 (5hrs/wk)

Objectives :To enable the students

- i. To gain knowledge on hazards and toxicity in food and their implication to health.*
- ii. To understand the regulations and monitoring agencies involved in food safety.*
- iii. To gain knowledge on food standards and food laws.*
- iv. To understand the various food preservation techniques.*

Unit 1: Food preservation and Quality Control

(12 hours)

1.1 Basic principles of food preservation, types of food preservation.

1.2 Preservation- Background- Principles and industrial applications- Equipments- Packaging considerations- Shelf life and product safety .

1.3 Quality assurance programme: Quality plan, documentation of records, product standards, product and purchase specifications, process control, hygiene and sanitation, corrective action, continuous improvement.

1.4 Quality Control - General concepts, Objectives, Major quality control functions, sampling procedures and plans, methods of evaluation and testing of finished products.

Unit 2: Food preservation Techniques (15 hours)

2.1 Thermal processing- product classification- microbial destruction- end point

thermal death time curve- survivor curve- thermal resistance curve, quality attributes- retort systems, pasteurisation.

2.2 Chilling of food- Operation, equipments, storage and transportation- Retail

display- unwrapped and wrapped products.

2.3 Physical and chemical agents of freezing- Effect of freezing on micro organisms- food freezing operation- monitoring the quality and safety of frozen foods.

2.4 Drying to minimize biodeterioration- drying processes- air drying- vacuum

drying- drying equipments- Bacteria deactivation kinetics during drying process.

Unit 3: METHODS OF FOOD PRESERVATION (10 hours)

3.1 Hurdle Technology

3.2 High pressure processing, Ohmic heating

3.3 Microwave and Radio frequency heating

3.4 Irradiation with ionizing radiations like X-rays and gamma radiation.

3.5 Chemical preservatives, preservation by use of acid, sugar and salt. High solid- high acid foods. Pectin and gel formation. Invert sugar, jelly making, other food products, food concentrates. Pickling and curing with microorganisms, use of salt, and microbial fermentation.

Unit 4.- Food Safety – An Introduction (8 hours)

4.1 Introduction to Food Safety- Definition , Safety, Hazards and Risks.

4.2 Food related Hazards- microbiological, nutritional, environmental, natural toxicants and food additives.

4.3 .Microbiological criteria of food and their significance.

4.4 Food Adulteration – Types of adulteration, Intentional and Incidental, Tests for adulteration.

Unit 5: A Preventive Approach – HACCP. (15 hours)

5.1. Food Protection systems – Pre-Requisite Programs, Good Manufacturing Practices (GMP's), Sanitary Standard Operating Principles (SSOP's)

5.2 HACCP system of Food Protection - Background, Benefits / Limitations, Principles- Applications in food industries.

Project: Develop a HACCP plan for a food industry.

5.3. Food laws and regulations –National – PFA ,Agmark grading ,BIS, Essential Commodities Act (FPO, MPO etc.) ,FSSAI,International – Codex Alimentarius, ISO,Regulatory Agencies - Consumer Protection Act.Certification systems ,Standardization and Testing laboratories.

TEXT BOOKS:

1. Gary S. Tucker, (2008),Food biodeterioration and preservation, Blackwell Publishing Ltd.,
2. Allsopp D., Seal K.J. and Gaylacgde,(2003), Introduction to biodeterioration, second edition, Cambridge University press,

REFERENCES

1. Bauman H. E.(1974), The HACCP concept and microbiological hazard categories- Food technology, 28, 30-34.
2. Mortimore S. E. and Wallace C. A. (2001), Food industry briefing series: *HACCP*, Oxford, Blackwell Publishing,
3. Ball C.O. and Olson F.C. W. (1957), Sterilization in food technology: Theory, Practice and calculation, McGraw- Hill book Co., New York,
4. Ciabanu A., Lascu G., Bercescu V. and Niculescu L.(1976)Cooling technology in the food industry, Tumbridge wells, Kent (UK), Abacus press,
5. Xu H. and Wang Y.(2005,)The New Sterilization technologies- Scientific and Technical Documents Publishing house, Beijing,
6. Decareau R. V. and Peterson R. A., (1986), Microwave processing and Engineering, Ellis Horwood series in food science and technology, Chichester (UK),
7. Mehta, Rajesh and George J. (2005), Food Safety Regulations, Concerns and Trade : The Developing Country Perspective , Macmillan,
8. The Prevention of Food Adulteration Act,(1954) , Commercial Law Publishers (India) Pvt. Ltd.
9. Rees, Naomi and David Watson(2000), International Standards for Food Safety , Aspen Publications.
10. Newslow, D.L.(2001),. The ISO 9000 Quality System: Applications in Food and Technology , John Wiley & Sons.

11. Bhatia,R. and Ichhpujan,R.L. (2004), Quality assurance in Microbiology. CBS Publishers and Distributors, New Delhi.

12.Hubbard.R, (2003), Statistical Quality Control for the Food Industry by Merton Kluwer Academic / Plenum Publishers, 3rd Edition.

JOURNALS:

1.Journal of Food Protection

2.International Journal on Food safety, Nutrition and Public health.

SCIENTIFIC RESEARCH METHODOLOGY

M.Sc., Food Chemistry & Food Processing

FP 2809

Semester – II

No. of Credits : 2

Course: Major Core (MC)

Total hours per semester : 25(2hrs/wk)

Objectives:

1. *To develop the students for genuine research studies*
2. *To introduce the purpose and importance of research for future development and sustenance*
3. *To know the various indices and abstracts in science and technology as a source of all information in chemistry.*
4. *To learn the ways of carrying out literature search for retrospective survey.*
5. *To know the methodology of writing thesis and journal articles.*

Unit- 1: BASICS OF RESEARCH

(5hrs)

- 1.1 Meaning and significance of research, basic types of research– Descriptive vs. analytical, fundamental vs. applied, quantitative vs. qualitative, conceptual vs. empirical.
- 1.2 Research Process – steps necessary to effectively carry-out research, characteristics of research, criteria of good research, problems encountered by researchers in India.
- 1.3 Techniques of defining a research problem, meaning and significance of a research design

Unit- 2: REVIEW OF LITERATURE

(5 hrs)

- 2.1 Sources of information- Primary, secondary and tertiary sources.

2.2 Indices and abstracts in science and technology: applied science and technology index, biological abstracts, abstracts, titles, current contents, engineering index, index chemicus, index medicus, physics abstracts, science citation index.

2.3 Classical and comprehensive reference works in food chemistry. Beilstein, compilations of data, synthetic methods and techniques, treatises, reviews.

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Self study

Locating the reference- Finding the abstract, finding the original document, chemical abstract service source index.

Unit- 3: ANALYTICAL DATA AND DATA ANALYSIS

(7hrs)

3.1 Concepts in collecting data and statistical analysis: sample size, normal distribution, measures of central tendency - arithmetic mean, median and mode.

3.2 Measures of dispersion - range. Standard deviation, coefficient of variation, correlation coefficient and experimental designs.

3.3 Test of significance – ‘t’ test, ‘F’ test for equalities of the variances. Analysis of variance, Chi-square test of association.

Self study

Types of data and symmetrical distribution of data.

Unit- 4: SCIENTIFIC WRITING

(5hrs)

4.1 Research reports, theses, journal articles, and books.

4.2 Requirement of technical communications- Eliminating wordiness and jargon-tautology, redundancy, imprecise words, superfluous phrases.

4.3 Steps to publish a scientific article in a journal- Types of publications-communications, articles, review; specific format required for submission, organization of the material.

4.4 Documenting- Abstracts-indicative or descriptive abstract, informative abstract, footnotes, end notes, referencing styles, bibliography-journal abbreviations (CASSI), abbreviations used in scientific writing.

Self study

Journals which publish only communications in food chemistry.

Journals which publish only reviews.

Standard journal abbreviations of select journals in food chemistry.

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Unit- 5: COMPUTER SEARCHES OF LITERATURE

(3 hrs)

5.1 ASAP Alerts, CA Alerts, SciFinder, ChemPort, Science Direct, STN International.

5.2 Journal home pages.

5.3 e-publishing

Reference books

1. Dominoswki R.L.,(1981), *Research Methods*, Prentice Hall,
2. Best J.W., (1981), *Research in Education*, 4th ed. Prentice Hall of India, New Delhi,
3. Ebel H.F., Bliefert C. and Russey W.E., (1988), *The Art of Scientific Writing*, VCH, Weinheim,
4. Cain B.E., (1988), *The Basis of Technical Communicating*, ACS, Washington, D.C.,
5. Kanare H.M., (1985), *Writing the Laboratory Notebook*; American Chemical Society: Washington, DC,
6. Dodd J.S., Ed., (1985). *The ACS Style Guide: A Manual for Authors and Editors*; American Chemical Society: Washington, DC,
7. Gibaldi J., and Achtert W.S, (1987), *Handbook for writers of Research Papers*; 2nd ed.; Wiley Eastern,.
8. Joseph A,(1986) *Methodology for Research*; Theological Publications: Bangalore,

BIOCHEMISTRY PRACTICALS - IV
(M.Sc. Food Chemistry & Food Processing)
FP 2810

Semester – II

No.of.Credits : 2

Course : Major Core(MC)

Total hours per semester : 50(4 hrs/wk)

Objectives:

1. *To enable the students to develop analytical skill in biochemistry practical.*
2. *To understand better the concepts of techniques and appreciate better the applications of bioorganic chemistry towards chemical, industrial and biological systems*

I .Blood analysis:

1. Estimation of glucose in blood – orthotoluidine method
2. Estimation of cholesterol in serum – Zak’s method
3. Estimation of inorganic phosphorus in blood – Fiske subbarow method
4. Estimation of alkaline phosphatase in blood
5. Estimation of protein in blood – Lowry method

II .Molecular biology:

6. Isolation of DNA
7. Agarose gel electrophoresis- DNA separation
8. Electrophoresis of serum

III Enzyme analysis:

9. Catalase: obtained from food source:
 - i)Effect of optimum pH
 - ii)Effect of optimum temperature
 - iii)Substrate concentration
 - iv)Enzyme concentration
10. Protease: obtained from food source:
 - i)Effect of optimum pH
 - ii)Effect of optimum temperature
 - iii)Substrate concentration
 - iv)Enzyme concentration

IV Food analysis

11. Enzymic inversion of sucrose
12. Sorenson's formol titration-casein.

References:

1. J.Jayaraman (1988), Laboratory Manual in Biochemistry, Wiley Eastern Ltd.
2. Oser B.L (1965) Hawk's Physiological Chemistry, Tata Mc Graw Hill Publishers.
3. Pearson D (1973) 'Laboratory Techniques in food analysis' John Wiley and sons, New York.
4. Varley.H (1976)-Practical Clinical Biochemistry, 4th Edition, Arnold Heinemann.

INSTRUMENTAL METHODS OF ANALYSIS PRACTICAL-4

(M.Sc. Food Chemistry & Food Processing)

FP 2811

Semester : II

No. of credits : **3**

Course: Major Core

Total hours per semester : 50(4 hrs/wk)

OBJECTIVES:

- 01. To learn the operation of instruments.*
- 02. To familiarize with sample handling techniques and data processing.*
- 03. To analyse and estimate quantitative parameters using instrumental methods.*
- 04. To analyse qualitatively the spectrum of certain chemical compounds relevant to food industry.*

List of Experiments:

01. Estimation of food colours using UV-visible spectrophotometer
02. Determination of pH in food analysis
03. Estimation of Na/K : Flame photometer
04. Estimation of iron(II) by redox titration: potentiometry.
05. Estimation of strong and weak acid: conductometry
06. Estimation of vinegar : conductometry
07. Kinetics of inversion of cane sugar: by polarimetry and comparison of acid strength

Experiments for demonstration.

01. Determination of functional groups using IR spectrometer (vannillin)
02. Separation and estimation of compounds using column chromatography.*
03. Estimation of concentration of glucose by Abbe's refractometer.
04. Determination of phosphate : Spectrophotometry.
05. Determination of chlorinated Hydrocarbons in a mixture by GC*
06. Analysis of flavour – GC – HPLC *
07. Analysis of analgesics: HPLC*

REFERENCE BOOKS:

1. David P.shoemaker, Carl W. Garland and Joseph W.Nibler(1989)
Experiments in Physical Chemistry, Fifth edition, McGraw Hill Book Company.
2. Sundaram.N, Krishnan and Raghavan.P.S (1996) *Practical Chemistry Part II* , S.Viswanathan (P) Limited.
3. Sadasivam.S and Manikkam.A(2006) *Biochemical Methods*, New Age International (P) Limited, Second Edition.

SUSTAINABLE FOOD MANAGEMENT

(M.Sc. Food Chemistry & Food Processing)

FP 2952

Semester – II

No. of Credits : 3

Course: Elective subject (ES)

Total hours per semester: 50(4 hrs/wk)

Objectives :To enable the students

1.To understand the role of management in food technology

2.To understand the basics on food costing and food control.

3.To understand the food policies and trends .

Unit 1 PRINCIPLES OF MANAGEMENT

10 hours

1.1 Management characteristics, objectives, principles, challenges, importance, levels of management, Food industry and management, planning, flow of work in the industry, work simplification techniques.

1.2 Business forecasting and decision making -definition and methods of forecasting, Demand and supply analysis .Characteristics, steps, techniques and types of decisions.

1.3 Food security: Green and white revolution. Steps to fight malnutrition. Food for everyone-possibility and steps. Food security and growing population – vision 2020.

Unit 2. DISTRIBUTION AND MANUFACTURING**10 hours**

2.1 Food and population, farming and agricultural subsidies, region wise distribution of commodities. Physical and social environment as factors of crop distribution and production, Food Supply Chain – PDS ,advantages and disadvantages, Agro ecology; cropping pattern as indicators of environments. Conservation of forests.

2.2 Machinery evaluation, appreciation and depreciation. Food manufacturing scenario in India. Agriculture as industrial setup. Agro based industries .

Unit 3: PRICING AND COST CONTROL**10 hours**

3.1 Pricing and distribution, kinds of pricing , product pricing strategies, channels of distribution, middlemen and franchise, wholesaler and retailer.

3.2 Introduction to Cost Control, Definition, Objectives and Advantages of Cost Control, Basic costing, Food costing

Unit 4 ORGANISATIONS**10 hours**

4.1 Overall view of central industries and the nature of work carried out. Facility and expertise available.

4.2 CFTRI, NDRL, NDRI, NABI, Spice board, coffee and tea development board, coordination committee on egg- Activities and role in food processing and manufacture

Unit 5 FOOD POLICIES

10 hours

5.1. National and international food policies. Food production and consumption trends in India. Production, procurement, distribution constraints. Availability of food grains, per capita expenditure on food.

5.2 Relation of food production to National Dietary Guidelines and food consumption pattern. Food based dietary approaches to eliminate hunger.

REFERENCES :

1. Kotler, P. Keller, K.L. (2006) Marketing management, 12th edition. Pearson Education, Singapore.
2. Paine, Frank A (Ed) (1997) Modern Processing, Packaging and Distribution System for Food Blackie, Glasgow and London.
3. Raphael, H J. Olsson, D. L. (1996) Package production Management 2nd edition AVU Publishing. Co., Inc, Connecticut
4. Bender, F.E. Kramer, A. K. (2000) Systems analysis for the food industry AVI Publishing. Co., Connecticut
5. Hayes, G. D. (2004.) Food Engineering data handbook. Longman scientific and Technical, New York .
6. Ramaswamy, V.S. and Namakumari, S. (2007) Marketing management- planning , implementation and control, 3rd edition. Macmillan India Ltd, New Delhi.
7. Sharma, R.K. and Gupta, S.K. (2001) Business Management. Kalyani Publishers, Delhi.

FUNCTIONAL FOODS AND NUTRACEUTICALS

(M.Sc., Food Chemistry & Food Processing)

FP 2953

Semester – II

No. of Credits : 3

Course: Elective Subject (ES)

Total hours per semester: 50(4 hrs/wk)

Objectives: To enable the students

- i. *To understand the growing importance of nutraceuticals and functional foods.*
- ii. *To understand the basic concepts of functional food and nutraceuticals and their application in day today life.*
- iii. *To impart the knowledge of the molecular basis of using micronutrients and phytochemicals in prevention of chronic diseases*
- iv. *Identify major types of health foods and nutraceutical products in the market and evaluate their safety and efficacy.*
- v. *To be aware of current topics, terms and products in this emerging field.*

Unit 1 Basic concepts of Nutraceuticals and Functional foods -An Introduction (10 hours)

1.1 An overview of the relationship of food, nutrition health and disease - Defining functional foods and Nutraceuticals, Relation of Nutraceutical Science and Functional Foods with other Sciences: Medicine, Human physiology, genetics, food technology, chemistry and nutrition.

1.2. Regulatory issues-Legislation current and expected developments, Regulatory environment and health claims- Regulations governing nutrition and health claims for functional foods and Nutraceuticals from Cereals, vegetable, pulses and fruit products, Designer oils and oilseeds, milk and dairy products.

1.3 Identification of bioactive components-Chemical properties and analytical approaches for identification

1.4 Efficacy and safety of functional foods and nutraceuticals-relationship of bioactive compounds to health benefits and disease treatments, evaluation through animal models and human clinical trials, identification of appropriate biomarkers, safety issues and toxicity, interactions of bioactive compounds with nutrients, medications,

Unit 2 - Nutraceuticals in health and diseases (10 hours)

2.1 Properties, structure and functions of various Nutraceuticals- Chemical nature – Isoprenoid derivatives, phenolic substances, fatty acids and structural lipids, carbohydrates and derivatives, amino acid base substances, microbes, minerals.

2.2 Mechanism of action – Anticarcinogenic, Antiatherogenic, Antioxidative, Anti inflammatory, Osteogenetic

Unit 3 – Nutraceutical supplements (10 hours)

3.1 Brief idea about some Nutraceutical rich supplements e. g. Bee pollen, Caffeine, Green tea, Lecithin, Mushroom extract, Chlorophyll, Kelp and *Spirulina* etc. Anti-nutritional Factors present in Foods: Types of inhibitors present in various foods and how they can be inactivated.

3.2 Nutraceuticals -Forms of nutraceuticals e.g. tinctures, capsules, powders, extraction techniques, supercritical extraction, processing techniques e.g. drying, encapsulation, effects of extraction and processing on bioactive compounds, potential role of GMP, HACCP and ISO in product development

Unit 4 – Role of Functional Foods (10 hours)

4.1 Definition, Relation of functional foods to foods & drugs.

4.2 Extraction and processing - Technologies for extraction, concentration, processing of functional foods and nutraceuticals ,Delivery and stability of functional ingredients ,Digestion and absorption of food components and gastrointestinal (GI) challenges for stability and efficacy of functional foods,

4.3 Active ingredients Sources, health benefits, safety

Fibre, short chain fatty acids, resistant starch Antioxidants and phytochemicals: sources, health benefits, safety, ingredients and applications in functional foods -Phytosterols, carotenoids, flavonoids, Prebiotics and probiotics; Functional oligosaccharides, Bioactive peptides and proteins: sources, health benefits, safety, ingredients and applications in functional foods Lipids and fatty acids: sources, health benefits, safety, ingredients and applications in functional foods

- ALA, Long-chain PUFAs, CLA.

4.4 Measurement of functional component and their bioavailability - Need for measurement-chemical measurement and physical testing and microbiological testing- functional foods and vitro studies.

Unit 5 – Nutrigenomics

(10 hours)

5.1 Nutrigenomics Definition , Recent trends and Relationship between nutritional supplementation and gene expression and disease prevention.- An overview

5.2 Transgenic plants for the large scale production of proteins for pharmaceutical and industrial uses. Plants as an alternative for biotransformation of raw materials into special chemicals.

5.3 Production technology for recombinant therapeutic products using *E.coli* with examples like human insulin, growth hormones, interferons, erythropoietin.

REFERENCES:

1. Mary, K. Schmidl and Theodore, P. Labuza (2000), Essentials of Functional Foods, Culinary and hospitality industry publication services
- 2 Robert easy Wildman (2001), Handbook of Nutraceuticals and functional foods, Culinary and hospitality industry publication services.
- 3.Chatwick, R etal (2003), Functional Foods., Springer. 7. Jeffery Horst (2002), Methods of Analysis for Functional Foods and Nuutraceuticals, CRS press. Handbook of Nutraceuticals and Functional Foods Edited by Robert E.C. Wildman, Routledge Publishers.
4. Nutraceuticals by Rapport L. and Lockwood B., Pharmaceutical Press.
5. Jeffrey W. Methods of Analysis for Functional Foods and Nutraceuticals , Hursts, Routledge Publishers.
6. Cousion P.J Food is Medicine by; Duncan Baird Publishers, London.
7. Maffei M. (Ed.), Taylor & Francis, (2003).
Dietary Supplements of Plant Origin,
8. Jean - Richard Neeser & Bruce J. German (2004). Bioprocesses and Biotechnology for Functional Foods and Nutraceuticals, Marcel Dekker, Inc.,
9. Farnworth(2003) E.F. Handbook of Fermented Functional Foods, ISBN 0-8493-1372-4
Functional Foods - Biochemical and Processing Aspects (Vol 2) (2002) J. Shi, G. Mazza and M. Le Maguer ISBN 1-56676-902-7

10. G. Mazza,(1998) Functional Foods - Biochemical and Processing ,AspectsISBN 1-56676-487-4
11. Mary K. Schmidt, Theodore P. Labuza (2000) Essential of Functional Foods, ISBN 0-8342-1261-7
12. Robert E.C.Wilman(2001). Handbook of Nutraceuticals and Functional Foods ISBN 0-8493-8734-5
- 13.G. Mazza, Ph.D, B.D.Oomah Ph. D,(2000), Herbs, Botanicals & Teasand ISBN: 1-56676-851-9
14. Alpers, D.H. et al (2002)Manual of Nutritional Therapeutics, 4th Edition
Professional's Handbook of Complimentary & Alternative Medicine, 3rd Edition.

Journals:

Functional Foods and Nutraceuticals
Nutraceuticals World
Food Technology
J. Agric. Food Chemistry
American Journal of Clinical Nutrition
European Journal of Clinical Nutrition
Journal of Nutritional Biochemistry

Fundamentals of Agro Products and Processing

(M.Sc., Food Chemistry & Food Processing)

FP 3807

Semester – III

No. of Credits : 4

Course: Major Core (MC)

No. of hrs per week : 4

Objectives:

To enable the students to understand

- i) The basic concepts of the all the various food group, their structure and chemical and nutritive composition the chemical components in food stuffs*
- ii) The fundamentals involved in the various processing operations of food groups of agricultural origin.*
- iii) The preservation and storage of the processed products and the changes that happen during the process*
- iv) The importance of value addition in their composition during processing.*

Unit -1: CEREALS AND CEREAL PRODUCTS

(15 hrs)

1.1 Processing Principles and unit operations in a manufacturing plant – An Introduction

1.2 Structure, classification, composition and nutritive value of the common cereal grains – Rice , Wheat and Millets. Products of wheat, common cereal grains and their uses.

1.3 Processing Operations of the cereals- Rice milling – parboiling. Wheat Milling, chakki grinding – bread making –baking, role of ingredients in bread making, extrusion and pasta products processing-noodles, macroni, vermicelli, breakfast cereals

1.4 Processed Products of Rice (Fermented and Unfermented products),Wheat(Whole wheat flour, maida and semolina) and millets ,maize, jowar, ragi and bajra.

1.5 Post harvest Losses, Chemical and nutritional changes , Prevention of losses, storage of cereal grains

Unit -2: PULSES

(10 hrs)

2.1 Types, composition and nutritive value- Anti nutritional factors, toxic constituents, protein contents of pulses- Sprouting.

2.2 Processing of Pulses-Traditional processing of pulses-decortication, soaking, pounding and grinding, germination fermentation, parching of pulses, puffing, milling, agglomeration, methods of cooking of pulses, storage of pulses

2.3 Effect of Processing on the nutrient, quantity and quality of pulses

2.4 Processed products of pulses- Pulse powders, pulse snacks, Soy products

2. 5 New improved technologies of legume processing- Pulse milling,canning,Quick cooking legums, Instant legume powders, Legume protein concentrates, By-product utilization of legume processing

Unit -3: OIL SEEDS AND NUTS

(10 hrs)

3.1 Composition, nutritive value and properties of common oilseeds and nuts.

3.2 Processing of oilseeds- General extraction methods Solvent extraction and Expeller methods, Refining techniques- Hydrogenation, randomization and interesterification, winterisation, plasticity

3.3 Processed products - Peanut–peanut milk and peanut butter. Coconut–desiccated coconut, coconut cake, coconut cream, coconut milk powder, Cashewnut processing, Unconventional oils

3.4 Role of fats and oils in cookery- Fat absorption, Fat turnover

3.5 Storage- Rancidity- Types and Prevention

Unit -4: FRUITS AND VEGETABLES AND SPICES

(15 hrs)

- 4.1 Classification, Composition and Nutritive value of common vegetables and fruits, pigments and flavour constituents.
- 4.2 Ripening of fruits – Growing process, respiration and ripening- Changes during ripening and Senescence –Types of Ripening – Natural and Artificial (Chemical)
- 4.3 Processing techniques – Harvesting and Preprocessing considerations, Post harvest Practices of Vegetables. Harvesting and Processing of fruits – Picking, Quality measurements, Freezing, Heat blanching, Ascorbic acid dip, Sulphur dioxide dip, Sugar syrup, Vacuum treatment. Effect of heat on colour and texture of vegetables–minimizing nutritional losses–qualitative and quantitative aspects.
- 4.4 Processed Products-Canned, pickled, frozen products- Fruit juices- Concentrates and Powders, Jams, Jellies and Marmalades. Natural and artificial preservatives used in processing.
- 4.5 Storage of fruits and vegetables – Commercial Storage operations- Types - Natural and artificial . Field Storage, Controlled atmosphere storage (CAS)
- 4.6 Definition, Classification, Uses of spices as flavouring and colouring agents.

Unit -5: SUGAR AND BEVERAGE PROCESSING

(10 hrs)

- 4.1 Sugar cane processing – extraction, neutralization, concentration and crystallization, separation and drying – sugar refining, grading of sugar
- 4.2 Confectionary -Caramels sugar related products, sugar coating, and sugar cookery. Chocolate manufacturing
- 4.3 Beverage Processing- Water Beverages, Soft Drink Beverages, Alcoholic Beverages- Wine and Beer Manufacture

4.4 Special Beverage Categories- Noncarbonated soft drinks, Powdered soft drinks

TEXT BOOKS:

1. B. Srilakshmi, Food Science, 3rd edition, New Age International Pvt. Ltd. Publishers, **2003**.
2. V. A. Parthasarathy (Ed), Chemistry of spices, CAB International, Oxford Shine, UK, **2008**.
3. G.Subbulakshmi and Shobha.A.Udipi,1st edition New Age International Pvt. Ltd. Publishers,2001
4. Food processing Technology: Principles and practice, II Ed., P.Fellows, CRC press, Cambridge, England (Woodhead Pub. Ltd.,) **2000**
5. P.S. Murano, Understanding food science and technology, Thomson Wordsworth, **2003**
6. B. Sivasankar, Food Processing and Preservation, Prentice Hall of India Pvt. Ltd., New Delhi, **2002**
7. Norman.N.Potter and Joseph.H.Hotchkiss, 5th Edition,CBS Publishers and Distributors 1995

REFERENCES:

1. L.H. Meyer, Food Chemistry, CBS Publishing & Distributors, New Delhi, **2000**.
2. Hand Book of Herbs and spices, Volume I and II, Edited by K. V. Peter, Wood head Publishing Ltd. And CRC press, **2001**.
3. S.R. Madambi and S.M. Rao, Food Science, New age international (I) limited, publishers **1997**.
4. D.E. Briggs, C.A. Boulton, P.A. Brookes and R. Stevens, Brewing: Science and Practice, CRC Press, (Woodhead Pub. Ltd.,) **2004**
5. L.H. Meyer, Food Chemistry, CBS Publishing & Distributors, New Delhi, **2000**.
6. Hand Book of Herbs and spices, Volume I and II, Edited by K. V. Peter, Wood head Publishing Ltd. And CRC press, **2001**.

7. S.R. Madambi and S.M. Rao, Food Science, New age international (I) limited, publishers
1997

INORGANIC, PHYSICAL AND CHEMICAL COMPONENTS OF FOOD

M.Sc. (Food Chemistry & Food Processing)

FP 3808

Semester – III

No. of Credits : 4

Course : Major core (MC)

No. of hours per week: 4

Objectives: **This course is mainly to make the students**

1. *To know the different kinds of acids and bases and their importance in hydrogen bonding.*
2. *To understand the structure and bonding of chemical compounds in food.*
3. *To know the physical process involved in food chemistry.*
4. *To know the applications of the concepts of colloids and thermodynamic factors in food chemistry and food processing.*

UNIT-1: CONCEPTS IN INORGANIC CHEMISTRY

(6 hrs)

1.1 **Chemical bond:** Ionic, covalent and coordinate bonds. Distinction between ionic and covalent compounds. Weak intermolecular forces- van der Waals forces.

1.2 **Water and ice :** Physical properties. Association of water molecules. Structure of ice. Ice in presence of solutes. Solute solvent - ion-dipole, dipole-dipole and dipole-induced dipole interactions – macroscopic level. Water binding and water holding capacity – molecular level (bound water).Hydrophilic and hydrophobic

solutions with organic molecules.

UNIT 2: WATER ACTIVITY AND TECHNICAL ASPECTS OF ICE (8 hrs)S

2.1 Water activity: Relative vapor pressure, temperature dependence – Moisture sorption isotherms. Relative vapour pressure and food stability . Molecular mobility and food stability . State diagrams, key concepts underlying the molecular mobility (M_m) approach to food stability

2.2 Technological aspects of ice : Freezing (state diagram).Over drying, vacuum freeze –drying (lyophilisation). Approach to food stability-Estimation of relative shelf life – relationship of T_g and M_m to relative vapour pressure and moisture sorption isotherms (MSI).

Self study: Freezing: Air drying and vacuum freeze.

UNIT-3: MINERALS:

(10 Hrs)

3.1 Minerals in food: Essential metals as nutrients .Solubility of minerals. Acid-base theory – Lowry – Bronsted and Lewis theories-chelate effect. Dietary allowances for

the mineral nutrients. Bioavailability – Ca, Fe, factors affecting the mineral composition. Nutritional aspects of minerals.

3.2.Fortification: Iron sources used in fortification-mineral composition of foods – any four (white bread, white rice cooked, whole milk, raw carrot). Chemical and functional properties of minerals in food – calcium, phosphate, iron, nickel and copper.

UNIT-4: PHYSICAL CONCEPTS

(15 Hrs)

4.1 Thermodynamics in food: Significance of ΔH , ΔS & ΔG . Coupled reactions in biological systems. Significance of E_o (SRP).

- 4.2 **Chemical equilibrium:** Reactions involving gases and solutions-temperature dependence of equilibrium constants. Use of Kirchhoff's equation for the calculation of equilibrium constant.
- 4.3 **Dispersed systems:** Food as dispersed system. Types of dispersion. Effects on reaction rate, surface phenomenon – interfacial tension and adsorption, surfactants, CMC, contact angles, curved interfaces, interfacial rheology. 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, caseinate gels, gelatin, polysaccharides, globular proteins. Concentrated starch gels- Mixed gels.
- 4.4 **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. Dehydrated products(ASLT scheme) – dry desert mix, dehydrated mashed potatoes, frozen pizza- General aspects of quality loss and shelf life test.

Self study: Emulsion and foam – Oswald ripening

UNIT-5 : ANALYSIS OF FOOD

(10 hrs)

- 5.1. **Moisture and ash analysis:** Importance of moisture assay and moisture analysis. Sample collection ,handling and removal of moisture. Decomposition of other food constituents. Oven drying-vacuum oven, microwave and IR drying, Rapid moisture analyzer technology, Karl-Fischer titrations. Ash analysis- ash content in food, dry, wet, low temperature and plasma ashing.
- 5.2. **Fibre and mineral analysis:** Importance of dietary fiber. Determination of fiber. Major components of dietary fiber-lignin. Fiber analysis- sample preparation, gravimetric method- Englyst- Cummings procedure. Mineral composition analysis of food- Estimation of calcium by gravimetric and complexometric methods.

Self study: Mineral composition of food and factors affecting food.

TEXT BOOKS

1. O. R. Fennema, *Food Chemistry*, 3rd Ed, Tata McGraw-Hill, New York, **2003**.
2. V. A. Vaclavik and E. W. Christien, *S Essentials of Food Science*, 3rd Ed., Springer, **2008**.
3. S. Nielson, *Food Analysis*, 2nd Ed., A Chapman & Hall Food Science Title, Aspen Publishers, **1998**.
4. F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, *Advanced Inorganic Chemistry*; 6th Ed.; Wiley Interscience: New York, **1988**.
5. J. E. Huheey, E. A. Keiter, and R. L. Keiter, *Inorganic Chemistry*; 4th Ed.; Harper and Row: New York, **1983**.
6. J.C. Kuriakose and S. Rajaram, *Chemistry for Engineering and Technolo*
7. R.A. Day and A.L. Underwood, *Quantitative analysis*, Prentice-Hall of India, **2001**
8. B.Srilakshmi, *Food Science*, 3rd Ed., New .Age Intl. Publ., **2003**.

REFERENCES

1. D. F. Shriver, P. W. Atkins, and C. H. Langford, *Inorganic Chemistry*; 3rd Ed.; Oxford University Press: London, **2001**.
2. T. Moeller, *Inorganic Chemistry, A Modern Introduction*; John Wiley: New York, **1982**.
3. W. L. Jolly, *Modern Inorganic Chemistry*, 2nd Ed, McGraw-Hill International Edition, **1991**.
4. G. S. Girolami, T. B. Rauchfuss, and R. J. Angelici, *Synthesis and Technique in Inorganic Chemistry*, 3rd Ed., University Science Books, Sausalito, **1999**.
5. W. L. Jolly, *The Synthesis and Characterisation of Inorganic Compounds*, Prentice Hall, New Jersey, **1970**.
6. J. Mentham, R.C. Denney, J.D. Barnes and M. Thomas, *Vogel's Textbook of Quantitative Chemical Analysis*, Pearson Education Pvt. Ltd., **2004**
7. G.H. Jeffery, J. Bassett, J. Mentham and R.C. Denney, *Vogel's Textbook of Quantitative Chemical Analysis*, Longman Scientific and Technical, **1989**.

CHEMISTRY OF DAIRY PRODUCTS
(M.Sc. Food Chemistry & Food Processing)

FP 3809

Semester – III	No. of Credits	:	3
Course : Major core(MC)	No. of hours per week:		4

Objectives :

The course should prepare the students

- 1) *To understand the chemistry of milk and milk products.*
- 2) *To encourage students to undertake more extensive study in milk.*
- 3) *To make the students to understand and appreciate the concept of chemistry in milk.*

UNIT 1: PHYSICAL PROPERTIES OF MILK

(8 hours)

- 1.1 Physical properties of Milk: ionic strength, density, redox properties of milk, colligative properties of milk, Temperature-time curve for the freezing of milk- Interfacial Tension. Acid base equilibria- pH of milk, buffering capacity of milk, titrable acidity and freshness of milk. .
- 1.2 Thermal properties of milk-specific heat of milk fat, thermal diffusivity, Interaction of light with milk – refractive index, colour. - electrical conductivity
- 1.3 Rheological properties of milk, milk gels and .milk fat

Self study:

Estimation of acidity and total solid in milk.

UNIT 2: MILK LACTOSE

(12 hours)

- 2.1 Chemical and Physical properties of lactose-Koestler number and quality of milk.
Structure and Solubility of lactose – α -lactose, β -lactose; , mutarotation of lactose, effect of pH on mutarotation, significance of mutarotation. effect of temperature.
- 2.2 Crystallisation of lactose- lactose solubility curves and factors affecting solubility, Lactose glass-effect in milk powder, whey powder and concentrates, sweetened condensed milk, ice-cream, other frozen dairy products, Thermoplasticity of lactose, role of water instickiness and caking of powders.
- 2.2 Production of Lactose & derivatives of lactose- Maillard reaction and mechanism – Amadori rearrangement of glycosyl amine, determination of lactose concentration- by polarimetry, redox titrations.

Self study:

Lactose intolerance, Galactosaemia & metabolism of galactose.

Unit 3: MILK LIPIDS AND MILK PROTEINS

(10 Hrs)

- 3.1 Milk lipids: Factors affecting the fat content in milk, Fatty acids profile of milk lipids, milk fat as an emulsion, milk fat globules membrane (MFGM).
- 3.2 Milk proteins- heterogeneity of milk proteins – preparation of casein and whey proteins – acid isoelectric precipitation., ultrafiltration, gelfiltration and rennet coagulation. Chemical and physiochemical properties of milk proteins - Hydrolysis of primary caseins by plasmin - Structural hierarchy in proteins: –amino acid sequence in casein, primary structure, secondary & tertiary structure- micelle structure.

Self study:

Changes in the concentration of fat, protein, and lactose in milk during lactation,

Unit 4: MINERALS, VITAMINS, ENZYMES AND HORMONES IN MILK (10 hours)

- 4.1 Salts of milk: Factors influencing variation in salt composition, correlation between sodium and potassium, interrelations of milk salts & constituents - soluble salts and measurements of calcium and magnesium ions. Colloidal milk salts -changes in milk salts equilibria.
- 4.2 Vitamins – Vitamin in milk fat soluble and water soluble, role of vitamins in milk and milk products. Bioavailability of vitamins.

Self study:

Enzymes and hormones- Significance of any five enzymes in milk, role of exogenous enzymes in food analysis.

Unit 5: DAIRY PRODUCTS

(10 hrs)

- 5.1 Fermented milk products- - definition, conditions, cultured milk, cultured cream,yoghurt,cheese- rennet coagulated cheeses, conversion of milk into cheese, curd, Factors affecting rennet coagulation, Protocol in manufacturing cheese from rennet casein
- 5.2 Analysis of milk and milk products – sampling milk and milk products, Roesse-Gottlich fat analysis, Gerber method of analysis, determination of specific gravity, total solid, acidity, sediment test, analysis of butter- modified Kohman test, detection of added water, total solid- Marshall rennet test, methylene blue test, Reazurin test, alcohol test, Arnold Guaiac test, phosphatase test.Milko tester.

Self study:

Milk powder- need, drying process-types of drying. Pasteurisation- types in processing milk.

Text books

- 1 Dairy Chemistry and biochemistry, P.F. Fox and P.L.H. McSweeng I, Blackie Academic & Professional 1998.
- 2 Milk and milk products, 4th ed., Tata McGraw Hill Pub. Company Ltd.,NewDelhi, 1973.
- 3 Fox, P.F. (ed.) (1982-1989) *Developments in Dairy Chemistry*, Volumes 1, 2,

3 and 4, Elsevier Applied Science Publishers, London.

4. Fox, P.F. (ed.) (1992-1997) *Advanced Dairy Chemistry*, Volumes 1, 2 and 3, Elsevier Applied Science Publishers and Chapman & Hall, London.

Reference books:

1. Jenness, R. and Patton, S. (1959) *Principles of Dairy Chemistry*, John Wiley & Sons, New York.
2. Jensen, R.G. (ed.) (1995) *Handbook of Milk Composition*, Academic Press, San Diego.
3. Walstra, P. and Jenness, R. (1984) *Dairy Chemistry and Physics*, John Wiley & Sons, New York.
4. Webb, B.H. and Johnson, A.H. (eds) (1964) *Fundamentals of Dairy Chemistry*, AVI, Westport, CT, USA.
5. Webb, B.H., Johnson, A.H. and Alford, J.A. (eds) (1974) *Fundamentals of Dairy Chemistry*, 2nd edn, AVI, Westport, CT, USA.
6. Wong, N.P., Jenness, R., Keeney, M. and Marth, E.H. (eds) (1988) *Fundamentals of Dairy Chemistry*, 3rd edn, Van Norstrand Reinhold, New York

Journals :

1. Journal of Dairy science.

FOOD CHEMISTRY PRACTICALS -VI

(M.Sc., Food Chemistry & Food Processing)

FP 3810

Semester – III

No. of Credits : 2

Course: Major Core (MC)

No. of hrs per week: 4

Objectives:

To enable the students,

- i. To gain knowledge on the concept of preparing the samples for analysis and to operate the instrument, which is used to analyze the foods.*

- ii. To understand principles of various methods of analysis and respective instruments*

EXPERIMENTS:

1. Determination of energy value of foods using bomb calorimeter (Parr oxygen bomb calorimeter). Demonstration only
2. Analysis of Protein content in by Kjeldal titration
3. Determination of Total carbohydrates in Foods colorimetrically – Anthrone and DNS method.
4. Estimation of fat by Soxhlet extraction
5. Ashing of foods, estimation of calcium, phosphorus and iron content of foods
6. Isolation and identification of synthetic food colors in sweets, confectionery, beverages.
7. Analysis of benzoic acid and sodium benzoate preservatives in processed food samples
8. Analysis of yeast, baking powder in baked food products
9. Analysis of fats and oils- Peroxide value, acid value, Saponification value, Iodine value, RM number, Free fatty acids
10. Estimation of sodium and potassium content of food using Flame Photometry
11. Estimation of Thiamin and Riboflavin content in food.
12. Analysis of adulterants in various food groups (demonstration)
13. Determination of Insoluble and Soluble fibre using Fibraplus

Mini Project: Estimation of proximate composition of various food and food products.

Visits: Exposure visits to R & D lab in industry / research institutes / food testing lab

TEXT BOOKS:

1. S. Ranganna , ‘Manual of analysis of fruits and vegetable products’, Central food technological research institute, Mysore, Tata McGraw Hill publishing company Ltd, New Delhi, **1977**.
2. S. Sadasivam, and A. Manikam, ‘Biochemical methods’, New Age International(p) Ltd. publishers and Tamil Nadu Agricultural University (Coimbatore), 2nd edition, **1996**.

REFERENCES:

1. Nielsen Suzanne S (Ed) (2003) ‘Food Analysis’ Plenum Publishing Corporation, U.S.A.
2. Scott A O (1998) ‘Biosensors for Food Analysis’, The Tetley Group Ltd, UK
3. Unni Kjaernes, Mark Harvey & Alan Warde (2007) ‘Trust in Food: A Comparative and Institutional Analysis’ Palgrave MacMillan, New York,
4. Methods of Vitamin Assay prepared and edited by Association of Vitamin Chemists, Inc, 2nd edition, Inter Science publishers, New York, **1951**.
2. Harold Varley, ‘Practical Clinical Biochemistry’, 4th edition, Arnold Heinimann, **2006**.
5. D. Pearson ‘Laboratory techniques in food analysis’, John Wiley & Sons, New York, **1973**.
5. A.G. Woodmann, ‘Food Analysis’, 4th edition, McGraw Hill Book Company, **1941**.
6. D.T. Plummer ‘An Introduction to practical Biochemistry’, Tata McGraw Hill

publishers, **1987**.

7. Physiological Chemistry, Edited by Bernard. L. Oser, Philip B. Hawk, Bernard Levusove Oser, 14th edition, Tata McGraw Hill publishing Company Ltd, New Delhi, **1965**.

8. A.D. Winton and K.B.Winton, 'The analysis of food', **1945**.

9. J. David, Holme and Hazel Pack, 'Analytical Biochemistry' Department of Biological sciences, **1983**.

10. Analysis of food colours, ISI specification book, **2001**.

11. Welcher, 'Standard methods of Chemical Analysis', **1985**.

12. G. Lunge and C.A. Keane, 'Technical methods of Chemical Analysis', Vol. 3, Part-II, **1994**.

FOOD PROCESSING PRACTICALS-VII

(M.Sc., Food Chemistry & Food Processing)

FP 3811

Semester – III

No. of Credits : 2

Course: Major Core (MC)

No. of hrs per week : 4

Objectives:

To enable the students,

- 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.*

EXPERIMENTS:

1. Experiments on Preservation

- a. Low Temperature processing -Studies on low temperature and ambient storage - Processed food / fruits / vegetables in various packaging material after giving appropriate pre-treatment.
- b. Freezing temperature - Frozen food Processing packaging and freezing and thawing (using various packaging material)
- c. High Temperature processing -Experiments on Blanching, sterilization, pasteurization, concentration (paste)
- d. Effect of chemical preservatives-Benzoate, So₂, salts (KMS, NaMS)Acetic Acid, Lactic Acid, Propionate, Sorbates

2. **Processing of cereal and pulse based products** : Products will be processed based on standardized recipes, costing will be done and value addition to enhance the nutritional value in the following food group and their products:

A . Baking technology- Breads,biscuits,cookies,cakes etc

B. Extrusion Technology – Noodles,Vermicelli,sago chips, pasta

C. Preparation of Indigenous products – Chappathi,Idli,Dokla,Vada etc

D. Preparation of pop corn and papads

E. Cereal and Pulse flour – health mixes – Regular, Roasted and Germinated

3. **Processing of Milk and milk Products:** Products will be processed based on standardized recipes, costing will be done and value addition to enhance the nutritional value in the following food groups and their products:

Paneer, Ice cream, kulfi, dahi, yoghurt, lassi,rabdi,milk based confectioned (peda, burfi, Shrikand, rasagolla, gulab jamun and whey – based beverages.

4. **Fruit and vegetable based products:** Products will be processed based on standardized recipes, costing will be done and value addition to enhance the nutritional value in the following food groups and their products:

- A. Tomato Products – Sauces, Ketchups, purees,
- B. Mango products- Squash, Jam, pickle, juice, leather, mango preserve
- C. Lemon Products - Juices, Squashes and Cordials
- D. Processing of Seasonal fruits

5. **Processing of sugar based preserves** - Jam making process, Jelly/Synthetic jelly candies, Marmalades, Murabba

6. **Processing of salt preserves:**

- A. Preparation of Brine
- B. Salting of Fish, Vegetables using various containers
- C. Pickling -Fruits and vegetables, Fish products, Sauerkraut, Fish pickle, Traditional meat pickles

7. **Processing of spices and preparation of Masalas:** Products will be processed based on standardized recipes, costing will be done and value addition to enhance the nutritional value will be implemented.

- A. Masalas- Rasam powder, Sambar powder, Tea masala, Milk masala, Garam masala
- B. Isolation of essential oil of coriander/cumin by steam distillation
- C. Preparation of oleoresin from ginger/turmeric/pepper by solvent extraction

8. **Processing of Instant mixes** - Milk mix- kheer, instant pulavs, instant traditional mixes- sambar etc., Instant mixes for gulab jamuns, jalebi etc.

9. **Sensory Evaluation** : 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.

TEXT BOOKS:

1. B.C.Muzumdar and K.Muzumdar, Methods of Physico-Chemical analysis of fruits:

Daya publishers, New Delhi, **2003**.

2. E.B.Jackson, Sugar Confectionery Manufacture, 2nd edition, Blackie Academic and

Professional, Glasgow, **1995**.

3. S.Ranganna, Manual of analysis of fruit and vegetable products, Tata McGraw-Hill

Publishing company Ltd, New Delhi, **1979**.

REFERENCES:

1. A. Chakravarthy and L.S. Dc, PHT of Cereals and Pulses, Oxford and IBH Publishing

Co., New Delhi, **1981**.

2. G.R.E. Lionnet, Sugar Technology for Students, Lang Fred, Durban, S. Africa, **1999**

3. B.B. Min and C.C Akoh, Food lipids, Marcel Decker, **1998**

4. D.B. Min and R.E. McDonald, Food Lipids and Health, Marcel Decker, **1996**.

FOOD PROCESSING TECHNOLOGY

(M.Sc., Food Chemistry & Food Processing)

FP 3875

Semester – III

No. of Credits : 5

Course: Interdisciplinary paper (ID)

No. of hrs per week : 6

OBJECTIVES:

To enable the students to

- i. To gain knowledge on the basic principles of food processing and the various methods used to process foods*
- ii. To be aware of the processed food products available in the market.*
- iii. To understand the basic principles of processing and the unit operations employed in a food processing plant.*

UNIT I – Introduction to Processing - Unit Operations

1.1 Introduction – Types of biodeterioration – Chemical, Physical and microbial deterioration

1.2 Food biodeterioration – Autolysis, Microbial spoilage, Contamination and Food spoilage, Mechanism of food deterioration – Factors affecting microbial growth – fermentation – fermentation biochemistry – putrefaction- lypolysis.

1.3 Operations in Food Processing – An overview – Handling, Cleaning, Separation Techniques, size reduction,pumping,mixing,heat exchange,concdentration, drying, , forming and packaging

UNIT -2 Storage of food in Low Temperatures

2.1Effect of cold storage and quality- storage of grains; Principles of refrigerated gas storage of food- Gas packed refrigerated foods; Sub atmospheric storage; gas atmospheric storage of foods.

2.2 Principles of freezing of food product, processes and equipment for freezing of fresh and processed foods. IQF of marine products. Frozen and cold storage. Changes during freezing and storage. Microbial aspects of frozen foods, Freeze drying and freeze concentration.

UNIT -3 Storage of foods in high temperatures

3.1 Principles of thermal processing of food. Pasteurization, sterilization and canning. Spoilage of canned foods, storage of canned foods; Influence of canning on the quality of food; improvement in canning technology. Calculation of process time temperature-schedules.

3.2 Retort processing of Ready to eat (RTE) products. Drying Water activity, microbial spoilage due to moisture. Dehydration of fruits, vegetables, milk, animal products etc. Types of dryers. Osmotic dehydration.

3.3Newer methods of thermal processing- batch and continuous; application of infra-red microwaves; ohmic heating. Intermediate moisture foods.

UNIT -4 Other Methods and Hurdle technology

4.1 Preservation by Concentration of liquid foods :Control of water activity; preservation by concentration; reverse osmosis and membrane filtration with reference to fruit juice and milk.

4.2 Non-thermal methods, chemical preservatives, irradiation, high hydrostatic pressure, smoking. Application of Hurdle technology and minimal processing. GRAS and permissible limits for chemical preservatives and legal aspects for gamma irradiation.

4.3 Use of enzymes and microorganisms in processing and preservation of foods. Lactic acid fermentation, alcoholic fermentation, pickling, smoking.

UNIT 5 Processing Technology of the Basic five food groups – An overview of the various processed food products

5.1 Cereals and Pulses -Milling of wheat, Milling of rice – parboiled rice, rice based instant food
Processing of corn, barley and millets – pearling, flaking and puffing, corn starch products,
Malting , Pulses – Decortication and dhal milling, elimination of toxic factors, fermentation and germination , Soy based products

5. 2. Milk and Milk products-Collection, Standardization, pasteurization, homogenization, UHT processing, manufacture of some of the common Indian dairy products-Paneer, khoa, curd, etc

5.3. Fruits and vegetables-Harvesting, physiological and bio chemical changes during ripening, handling and storage, general methods of processing - extraction and pulping, raw material and product specifications and standards.

5. 4. Meat, poultry, fish and egg - Ageing and tenderizing, curing, smoking and freezing of meat, fresh storage of meat. Meat based products: sausages, salaami, bacon. Fish processing and storage, pickling. Egg: storage, frozen egg, dehydrated egg powder.

5.5.Nuts and Oil seeds – Pressing, solvent extraction, purification – degumming, refining, bleaching, deodorizing. Hydrogenation – margarines, shortenings

5.6 Beverages – Alcoholic (Beer and Wine) , Non – Alcoholic (Tea, coffee and cocoa) – Processing and storage.

TEXT BOOKS:

1. Arsdel WB, Copley MJ & Morgan AI. 1973. *Food Dehydration*. 2nd Ed. Vols. I, II. AVI Publ.
2. Desrosier NW & James N.1977. *Technology of Food Preservation*. 4th Ed. AVI. Publ.
3. Fellows PJ. 2005. *Food Processing Technology: Principle and Practice*. 2nd Ed. CRC.
4. Khetarpaul Neelam (2005) ‘Food Processing and Preservation’, Daya Publications, New Delhi.
5. Salunke D K and Kadam S S (1995) ‘Hand book of Food Science and Technology: production, composition, storage and processing’ Marcel Dekker INC, New York.
6. Sivasankar B (2002) ‘Food Processing & Preservation’ Prentice Hall, India.
7. L.H. Meyar, Food chemistry, CBS publishers and distributors, New Delhi, **2000**.
8. P.S. Murano, Understanding food science and technology, Thomson

Wordsworth, **2003**

9. R. Parker, Introduction to food science, **2003**.
10. N.N. Potter and J.H. Hotchkiss, Food Science, CBS Publishers and Distributors 5th edition, **1997**.
11. B. Srilakshmi, Food Science, 3rd edition, New Age International Pvt. Ltd. Publishers,

REFERENCES:

1. P.R. Ashurst, Food Flavorings, Blackie, Glasgow and London, **2004**.
2. N.N. Potter and J.H. Hotchkiss, Food Science, CBS Publishers and Distributors 5th edition, **1997**
3. P.S. Murano, Understanding food science and technology, Thomson
Wordsworth, **2003**
4. R. Parker, Introduction to food science, **2003**.

COMPUTING TECHNIQUES- EXCEL FOR FOOD CHEMISTS

(M.Sc. Food Chemistry & Food Processing)

FP 3951

Semester – III

No. of Credits : 3

Course: Elective Subject (ES)

No. of hrs per week: 4

Objectives:

1. *To equip the student to have a working knowledge of the application software Excel 2007.*
2. *To learn to compute theoretical and experimental data from chemistry and related area.*
3. *To solve problems in quantitative chemical analysis and present the results graphically.*
4. *To apply statistical tools to data and error analysis, standard equations to represent chemical processes and to curve-fit data.*
5. *To enable one to present relevant scientific data in plots, graphs or chart in various formats and if needed to get a hard copy of the results.*

Unit- 1: GENERAL INTRODUCTION TO MICROSOFT OFFICE 2007

AND EXCEL 2007

(10 hrs)

1.1 Starting, getting help and quitting

1.2 Excel environment: rows, columns, cell, workbook, worksheet, toolbar, menu bar, formula bar etc.

1.2 Details about standard toolbar and formatting toolbar buttons.

Unit- 2: BUILDING WORKSHEETS

(8 hrs)

2.1 Entering, copying, importing and editing data.

2.2 Saving and opening files

Unit- 3: CALCULATIONS

(8 hrs)

3.1 Simple calculations; use of standard mathematical functions.

3.2 Complex calculations involving user-made functions and statistical functions.

Unit- 4: PLOTTING, PRINTING AND TRANSFER OF DATA

(9 hrs)

4.1 Standard and customized charts and graphs

4.2 Editing and annotating and pasting

4.3 Add trendline, curve fitting and error analysis

4.4 Previewing and printing spreadsheet data and graphs

4.5 Transferring data and graphs interactively.

Unit- 5: EQUATIONS FOR COMPUTATION

(10 hrs)

5.1 Arrhenius equation: $k = A \exp(-E_a/RT)$

5.2 Calculation of diffusion coefficient: $D = k_a T / \pi \beta \eta r$

5.3 Henderson - Hasselbalch equation: $pH = pK_a + \log \{[salt]/[acid]\}$

5.4 BET equation for the sorption of moisture on food materials:

$$A_w/m(1-a_w) = \{1/m_1c\} + \{(c-1)a_w/m_1c\}$$

5.5 Lambert-Beer equation: $I/I_0 = \exp(-\epsilon cl)$

5.6 Dissociation constant of a weak acid: $K_a = \alpha^2c/(1-\alpha)$

5.7 Models for accelerated shelf-life study

5.8 Calculation of nutritive and energy value

5.9 Food composition data bases

TEXT BOOK:

John Pragasam, S.J., A Handbook on EXCEL FOR CHEMISTS,

Loyola College, 2008.

REFERENCES:

1. E.J. Billo, Excel for Chemists – A Comprehensive Guide, II edition, WILEY-VCH, New York, **2001**.
2. G. Courter and A. Marquis, Microsoft Office 2000, BPB Publications, New Delhi, **1999**.
3. J. Kelly, Using Microsoft Excel 2000, Prentice-Hall of India, New Delhi, **1999**.
4. R. de Levie, A Spreadsheet Workbook for Quantitative Chemical Analysis, McGraw-Hill, Inc. New Delhi, **1997**.
5. K.V. Raman, Computers in Chemistry, Tata McGraw-Hill Ltd., New Delhi, **1993**.

FOOD ENTREPRENEURSHIP

(M.Sc. Food Chemistry and food processing).

FP 3952

Semester III

No. of Credits : 3

Course : Elective subject (ES)

No. of hours/week: 4

OBJECTIVES:

To enable students to

- Develop entrepreneurship skills
- Analyze the environment related to small scale industry and business
- Understand the process and procures of setting up small enterprises.

- To acquaint with techniques of business management and international trade for food sector.

Unit 1. INTRODUCTION

10hrs

- 1.1 Entrepreneurship – Types of entrepreneurs – entrepreneurship and Economic development.
- 1.2 Motivating factors- theory of motivation; barriers to entrepreneurship.-political, social ,technological.

Unit 2. IDENTIFICATION OF BUSINESS ENVIRONMENT: 15 hrs

2.1 Micro and macro environments; consumer Behavior; consumerism-legislations in India.

2.2 Marketing research-components of marketing research, introduction, review of literature, research methodology, analysis and marketing Information systems- marketing communication

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

Unit 3. SMALL SCALE INDUSTRIES:

10 hrs

3.1 Small scale units; Types of small scale units; Problems of small scale units remedial measures, Marketing with relevance to FMCG(with specific reference to Food),Personnel management.

3.2 Employer – employee relationship in food industry.

Unit 4. MARKETING MIX (4 P's):

15 hrs

4.1 Product, new product development, product life cycle

4.2Place - Marketing channel decision, retailing, wholesaling and distribution.

4.3Pricing decision, price determination

4.4 Promotion mix-(sales promotion, advertising, personnel selling, publicity)

Unit 5. LEGAL ISSUES AND FUNDING AGENCIES: 10 hrs

5.1 Government of India policy towards promotion of Entrepreneurship.

5.2 Ethics in marketing, legal and regular framework-microfinance and empowerment.

5.3 Joint ventures, Funding agencies -APEDA, MOFPI, MSME.

TEXT BOOK

1. C.B.Gupta(2012) ,Marketing management(14th reprint) Jain book depot, India
2. Deshpande V (1984) 'Entrepreneurship of small scale food industries. Concept, growth and management 'deep and deep pub, New Delhi.
3. Parek U and Rao T V (1978) 'Personal efficacy in developing entrepreneurship 'learning systems, New Delhi.
4. Rao T V Parekh L U (1982) 'development entrepreneurship. A handbook 'learning system, New Delhi.

REFERENCES:

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

FOOD FROM ANIMAL SOURCES AND PROCESSING TECHNIQUES

(M.Sc., Food Chemistry & Food Processing)

FP 4805

Semester – IV

No. of Credits : 4

Course: Major core (MC)

No. of hrs per week : 5

Objectives: *To enable the students*

- i. To understand the importance, composition and nutritive value of meat, meat products, seafoods and dairy products.*
- ii. To gain knowledge on the composition and nutritive value of foods of animal origin.*
- iii. To understand the various unit operations in animal food manufacturing plant*

Unit-1:ANIMAL PRESERVATION AND PROCESSING - INTRODUCTION

(10 hrs)

- 1.1 Food deterioration– Consequences and causes of food autolysis, microbial spoilage, contamination and poisoning.
- 1.2 Unit Operations in animal food processing – Handling, cleaning, separating techniques, size reduction, pumping, mixing, heat exchange, concentration, drying, forming and packaging.
- 1.3 Recent trends in animal food preservation and processing. Concept of halal and kosher

Unit-2: MILK AND MILK PROCESSING

(15 hrs)

- 1.1 Composition and Nutritive value of milk. adulterants in milk. Microbial contaminants in milk
- 1.2 Processing of milk -Methodology of milking, Clarification, pasteurization, homogenization, fortification .Milk substitutes
- 1.3 Production of non-fermented milk products – whey protein concentrate, Skim milk, evaporated milk, condensed milk, dry milk, khoa, rabri, chhaina, ice cream, standardized milk, toned milk, double toned milk, recombined milk, sterilized milk, filled milk, flavoured milk, and cream.
- 1.4 Fermented milk products – butter, cheese, paneer, curd, shrikhand, yoghurt, kafir, kumiss, acidophilus milk and sour cream

Unit-3: POULTRY AND POULTRY PRODUCTS

(8 hrs)

- 2.1 Eggs–Formation, structure, composition and nutritive value of egg white and egg yolk (proteins, fats, pigments, vitamins and minerals)
- 2.2 Evaluation of egg quality - Candling, floating in water, and grading of eggs. Storage of Eggs.

Egg Products – Frozen, Pasteurised, Dehydrated, Desugared. Egg substitutes

2.3 Poultry – Classes of poultry meat, classification, composition- tenderness flavor, colour and nutritive value

2.4 Processing of Poultry for meat – Production, consideration, processing plant operations – slaughtering and bleeding, scalding, defeathering, eviscerating, chilling Storage of poultry - Chilling, freezing (whole and cuts), canning, dehydration

2.5 Poultry meat products- Whole birds, parts, sausages, combination with other food groups.

Unit-4 : MEAT AND MEAT PROCESSING

(15 hrs)

3.1 Structure, muscle – connective tissue – collagen – elastin – adipose tissue – cartilage.

3.2 Composition and nutritive value Classes of meat and related products. Desirable characteristics of meat.

3.3 Post-mortem changes in meat. Changes in meat on cooking – denaturation of protein, hydrolysis of collagen. Colour change, drip formation, meat aroma, and dispersion of fat, decrease in vitamins, surface reddening and overcooking.

3.4 Processing- ageing of meat, tenderizing meat – mechanical, chemical (curing – salting, pickling), addition of enzymes – papain, bromelin, ficin, marinading, Chilling, freezing and thawing, canning, Cooking of meat- Dry heat and moist heat

3.5 Processed meat products and meat substitutes- Sausages and table ready meats, frankfurter. Meat substitutes – Textured protein products and vegetable protein products.

Unit 5: SEA FOODS

(12 hrs)

3.1 Composition and nutritive value of sea foods. Classification of fishes, Spoilage factors, Perishability of seafoods Selection criteria of fish, Fish allergy and remedies.

3.2 Processing stages for seafoods – Procurement and Preservation methods- Chilling, freezing, canning, curing and drying

3.3 Aquaculture – Fish farming – Types Extensive, Intensive and semi- intensive farming.
Tuna fishery.

3.4 Fish Processing and fish products – Fish meal, fish flour, fish oil and fish byproducts.

TEXT BOOKS :

1. B. Srilakshmi, Food Science, New Age International Pvt. Ltd. Publishers, 3rd edition, **2003**.
2. L.H. Meyar, Food chemistry, CBS publishers and distributors, New Delhi, **2000**.
3. P.S. Murano, Understanding food science and technology, Thomson
Wordsworth, **2003**
4. R. Parker, Introduction to food science, **2003**.
5. N.N. Potter and J.H. Hotchkiss, Food Science, CBS Publishers
and Distributors 5th edition, **1997**.
6. B. Srilakshmi, Food Science, 3rd edition, New Age International Pvt. Ltd. Publishers,

REFERENCES:

3. P.R. Ashurst, Food Flavorings, Blackie, Glasgow and London, **2004**.
4. N.N. Potter and J.H. Hotchkiss, Food Science, CBS Publishers and
Distributors 5th edition, **1997**
3. P.S. Murano, Understanding food science and technology, Thomson
Wordsworth, **2003**
4. R. Parker, Introduction to food science, **2003**.

CHEMISTRY OF FOOD ADDITIVES

(M.Sc. Food Chemistry & Food Processing)

FP 4806

Semester – IV

No. of Credits : 4

Course: Major Core (MC)

No. of hrs per week: 5

Objectives:

1. *To enable the student to understand the importance of*
 - i) *additives in food industry*
 - ii) *flavoring agents, food colors and sweeteners*
2. *To appreciate the changes in their properties on processing.*

Unit -1: PRESERVATIVES AND ANTIOXIDANTS

(15 hrs)

1.1 Additives–contaminants–role of additives-intentional additives-

Preservatives–benzoic acid–parabens–citric acid–sorbic acid–sulphites–nitrites–
nitrates–hydrogen peroxide.

1.2 Antioxidants: Generation–causes–effects–Naturally occurring antioxidants–role of Vitamin C– Vitamin E –tocoferols–lipoic acid–evaluation of antioxidant property.

Unit -2: COLORANTS

(15 hrs)

2.1 Pigments in animals and plants tissues- myoglobin, oxymyoglobin, metmyoglobin -
color of meat, color change on processing - pigment stability on packaging-

2.2 Chlorophyll - influence of pH on processing; technology of color preservation -
enzymic - metallo complex formation; carotenoids-occurrence-distribution.

2.3 Betalains–structure–stability-effects of pH, heat and light.

2.4 Extraction of carotenes, lycopene, chlorophyll and curcumin.

Unit -3: FLAVOURS

(15 hrs)

3.1 Taste: sensory assessment of flavors-structural basis-sweet, bitter and sour taste models–
flavour enhancers–astringency-pungency-vegetable and spice flavors-allium, cruciferae-
mushroom.

3.2 Odour: theory and sense of odour-flavours from shikimic acid pathway-pear, banana, apple,
eugenol, vanillin.

3.3 Volatile terpenoids–noot ketone, geraniol, nerol, ± carvone, flavour from lactic acid; ethanol
fermentation - diacetyl

3.4 Fish food flavours; thermally induced flavors.

3.5 Biosynthesis of tomato flavour.

Unit -4: SWEETENERS

(5 hrs)

4.1 Natural intense sweeteners - Sweetener index.

4.2 Non-nutritive-low calorie sweeteners–cyclamate–saccharin – aspartame-alitame

acesulfame K-sucralose–polyhydric alcohols as sweeteners. Structure-comparison of different sweetness-adverse effects if any as food additives.

Unit -5: FLOUR IMPROVERS

(10 hrs)

5.1 Doughs: leavening agents- starters and cultures-nutritional needs of yeast-

activity analysis of yeast-gas retention.

5.2 Batters- gas productive and retention-baked products- prevention of mold.

5.3 Anticaking agents-pH control.

TEXT BOOKS:

1. R.Fennema, Food chemistry, Marcel and Decker Inc, 3rd edition, **1996**.
2. J.M. de Man, Principle of food chemistry, Aspen Publishing Inc, **1999**.
3. F.D. Vargas, O.P. Copez, Natural colourants for food and nutraceutical uses, CRC Press New York, **2003**.
4. S.Sadasivam and A. Manikkam, Bio-chemistry methods - New Age International Pvt Ltd 2nd edition, **1996**.

REFERENCES:

1. Anti-oxidants in food-practical application, Edt: Pokorny, Nedgalka Yanishliva & Michael Gordon, CRC Press New York, **2001**.
2. Food flavour technology, Sheffield academic press, Edt: Andrew J. Taylor, CRC Press New York, **2002**.
3. L.H. Meyer, Food chemistry, CBS Publishers and Distributors, New Delhi, **2000**.
4. Shakuntala Manay and Shadaksharaswamy, Food, fact and principles, New Age International Publishers, New Delhi, **2001**.

FOOD PRODUCT DEVELOPMENT AND PACKAGING TECHNIQUES

(M.Sc., Food Chemistry & Food Processing)

FP 4807

Semester – IV

No. of Credits : **5**

Course: Major Core (MC)

No. of hrs per week : 5

Objectives of the course

- i. To impart the basic concepts and principles in formulation of new food products based on the consumer and market survey*
- ii. Understand concepts about sensory evaluation of food ,analyse and interpret sensory evaluation data*
- iii. To understand the concepts, principles and types of Packaging and the laws pertaining to its efficiency and safety.*

Unit 1 Designing new products – An Introduction

(15 hours)

1.1 Organisation and assignment of team. Definition of roles. Product. Concepts; how to proceed; factors to consider; concept methodology; consumer testing; product attributes – what they are and their significance. Concept testing approaches; sampling methods; role of sensory evaluation; preparation of concept testing documentation.

1.2 Tapping traditional foods and unconventional sources of foods. Minimizing post harvest losses.

1.3 Market Survey, Consumer survey to identify new products in terms of

- Line Extension
- Repositioning Existing Products
- New form/Reformulation
- New packaging of existing products
- Innovative products
- Creative Products.

UNIT 2: Product formulation – Prerequisites and methods (15 Hours)

2.1 Requirements for product development authorization. Development of product specifications. Prototype development; role of ingredients and processing in defining attributes; scale up.

2.2 Process flow sheet development; factors to consider in process development; process optimization. Factors to consider beyond formulation and processing - shelf life requirements; product performance testing; market positioning

2.3 Product Roll out and Road-blocks to successful product development.

Unit 3 Sensory Evaluation (10 hours)

3.1 Introduction to sensory analysis and uses of sensory tests. General testing conditions.

3.2 Establishing sensory panels: Selecting and recruiting panelists, orienting, screening for trained panels, training panelists, monitoring performance.

3.3 Recognition tests for 4 basic tastes, odour and aroma, Threshold tests. Analytical tests : (i) Difference, (ii) Ranking, (iii) Descriptive, (iv) Scoring and (v) Rating

3.4. Planning an Experiment for Sensory Evaluation : (i) Designing the questionnaire and score card, (ii) Identifying descriptors.

3.5 Conducting and Analyzing the Test: Preparing samples, Presenting samples, Using reference samples, Reducing panel response error, Consumer oriented tests and Product oriented test. Collecting and analyzing sensory data, statistical analysis, interpretations. Report Writing

Unit 4- Basics to Packaging and Packaging methods (10 hours)

4.1 Packaging- Definition, Functions ,Significance, Classification and types.

4.2 Packaging materials-types, various uses, merits & drawbacks.

4.3. Packaging systems and methods-Vacuum and gas flush packaging, CAP and MAP, Aseptic and retort packaging, box in box.

4.4 Modern concepts of packaging technology. Aseptic packaging - Form Fill Seal packaging- Edible Films Retort pouches Easy - Open - End, Boil -In- bags Closures

4.5 Food packaging Laws & Specifications

Unit 5 Quality testing, safety and environmental aspects (10 hours)

5.1. Packaging requirements for fresh and processed foods- Criteria for selection of proper packaging based on the required shelf life .

5.2. Quality testing of packaging materials- Transportation hazards -Shelf life testing of different packaged foods. - Oxygen interactions, moisture interchanges and aroma permeability.

5.3 Role of packaging- Packaging aesthetic and graphic design; Food labeling ,Coding and marking including bar-coding.

5.4 Safety aspects of packaging materials- sources of toxic materials - Interaction of packages with foods.- global migration of plastics- tin can corrosion.

5.5 Environmental Issues- recycling and waste disposal.

References

1. Robertson, G.L. Food Packaging: Principles and Practice (2nd ed.), Taylor & Francis 2006
2. Parry R. T. and Blakistone B. A. Principles & Applications of MAP Springer, New York, 1999
3. Food Packaging Technology Handbook. NIIR Board, National Institute of Industrial Research, 2003
4. Ahvenainen, R. (Ed.) Novel Food Packaging Techniques, CRC Press, 2003
5. Han, J.H. (Ed.) Innovations in Food Packaging, Elsevier Academic Press, 2005
6. Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) Food Packaging Technology, CRC Press, 2003
7. Robinson J, Roberts H, Barnard E, and Shepard T (2001) 'Design and Make It Food Technology' Nelson Thomes Ltd, UK.
8. Fuller,G. W. (1994) 'New Food Product Development from Concept to Market Place' CRC Press, Boca Raton,USA
9. Gould W A (1991) 'Research and Development Guidelines for the Food Industry' CTI Pub, Baltimore.
10. Lyon, D H (1992) 'Guidelines for Sensory Analysis in Food Product Development and

Quality Control' Chapman and Hall, London.

11. Robinson J, Roberts H, Barnard E, and Shepard T (2001) 'Design and Make It Food Technology' Nelson Thomes Ltd, UK.

Journals:

1. International Journal of Food Science and Technology
2. Food Technology
3. Journal of Food Technology
4. Trends in Food Science and Technology
5. Critical Reviews in Food Science and Nutrition

PROJECT WORK

M.Sc. Food Chemistry & Food Processing

FP 4808

Semester - IV

No. of hrs /week : 15

Course: Major Core(MC)

No. of credits : 11

Objectives:

- 1. To introduce the purpose and importance of research for future development and sustenance*
- 2. To make the students plan and carry out the research work*
- 3. 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 submitting the dissertation, University rules will be followed.