

LOYOLA COLLEGE (*Autonomous*), **CHENNAI-34**
Department of Chemistry
M.Sc (Food Chemistry and Food Processing)-SHIFT-2
TEMPLATE

Semester	MC	SU	ED	SE	Total Credits
I	FP-1800:Inorg. Phy. & Analy.Chem.(MC)(4) FP-1801- Org.Chem.Food-I.(MC)(4) FP-1802-Appl. Spectroscopy.(MC)(4) FP-1803-Human Nutrition.(MC)(4) FP-1804-Quant.Analysis Prsct. 1(MC)(2) FP-1805-Org.Analy. & Prep. Pract. 2(MC)(2)	-	-	-	20
II	FP-2800- Organic Chemistry of food –II (MC)(4) FP-2801- Nutritional Biochemistry (MC)(4) FP-2802- Chemistry of Dairy products (MC)(4) FP-2803- Biochemistry- Food Microbiology- Practical-3 [MC](2) FP-2804- Instrumental methods of analysis- Practical-4 [MC](3) FP-2805- Seminar- I [MC](2)	ZO-2901- Medical Lab Technology [SU](2)-	EL-2876 Effective communication [ED](1)	FP-2950- Herbs and Spices [SE](20) (OR) FP-2951- Food Microbiology [SE](2)	24
III	FP-3800- Fundamentals of Agro Products [MC](4) FP-3801- Food from Animal sources [MC](4) FP-3802- Food Processing- Agro products [MC](4) FP-3803- Chemistry of Food Additives [MC](4) FP-3804- Science and Society [MC](3) FP-3805- Food Chemistry- Practical-5[MC](3) FP-3806- Food Processing-Practical 6 [MC](3)	-	-	-	25
IV	FP-4800- Food Processing- Animal products [MC](4) FP-4801- Scientific Research Methodology [MC](1) FP-4802- Project [MC](7) FP-4803- Seminar-II [MC](2)	FP-4900- Computing Techniques: Excel for Food Chemists [SU](2)	EL-4876- Business Communication [ED](1) CO-4875- Fundamentals of management [ED](2)	FP-4950- Food Biotechnology [SE](2) (OR) FP-4951- Food Deterioration and Preservation [SE](2)	21
Total credits	78	04	04	04	90

Course	Ending code
MC= Major Core	: 800
ED= Extra Disciplinary	: 875
SU= Supportive	: 900
SE= Subject Elective	: 950

Credits allotment

MC=78
SU = 04
ED =04
SE =04

TOTAL: 90 Credits

Infrastructure Available

The department has established itself with a well equipped Chemistry Laboratory for organising experiments for the practical papers in the first semester and Food Chemistry Laboratory to carry out its practical experiments in the third semester as prescribed by the syllabi.

COURSE OF STUDY

SEMESTER – I [20 Credits]						
S.No	SUB. CODE	NAME OF PAPER	COURSE		EXAMINATION	
			Hrs/ week	Credits	Hours	Marks
01	FP-1800	Inorganic, Physical and Analytical Chemistry (MC)	5	4	3	100
02	FP-1801	Organic Chemistry of Food –I (MC)	5	4	3	100
03	FP-1802	Applications of Spectroscopy (MC)	5	4	3	100
04	FP-1803	Human Nutrition (MC)	5	4	3	100
05	FP-1804	Quantitative analysis – Practical-1 [MC]	4	2	5	100
06	FP-1805	Organic analysis and preparation- Practical- 2 [MC]	4	2	5	100
07	FP-2805	Seminar-I [MC]	2	-	-	-
TOTAL			30	20	-	600

No. of Courses:

MC: 6

No. of Credits:

MC: 20

FP-1800. INORGANIC, PHYSICAL AND ANALYTICAL CHEMISTRY

M.Sc (Food Chemistry & Food Processing)

Semester – I	No. of Credits : 4
Course : Major core (MC)	No. of hours per week: 5
Total No of hrs/Sem : 60	

Objectives: This course is mainly to make the students

01. To know the different kinds of acids and bases and their importance in hydrogen bonding.
02. To understand the structure and bonding of chemical compounds in food.
03. To know the physical process involved in food chemistry.
04. To know the applications of the concepts of colloids and thermodynamic factors in food chemistry and food processing.

UNIT-1: CONCEPTS IN INORGANIC CHEMISTRY (15 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.
- 1.3 **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
- 1.4 **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-2: MINERALS: (10 Hrs)

- 2.1 **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.
- 2.2 **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-3: PHYSICAL CONCEPTS**(15 Hrs)**

- 3.1 **Thermodynamics in food:** Significance of ΔH , ΔS & ΔG . Coupled reactions in biological systems. Significance of E_o (SRP).
- 3.2 **Chemical equilibrium:** Reactions involving gases and solutions-temperature dependence of equilibrium constants. Use of Kirchoff's equation for the calculation of equilibrium constant.
- 3.3 **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.
- 3.4 **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-4. CHROMATOGRAPHY**(10 hrs)**

- 4.1 **Introduction:** Definitions of chromatography. Theory and classification of chromatographic methods – paper, column and TLC chromatographies. Development of chromatograms- Applications.
- 4.2 **High Performance Liquid Chromatography, HPLC:** Introduction, characteristic features of HPLC, comparison of HPLC and GLC. Principle of HPLC. Instrumentation. Components-types of detectors. Quantitative analysis. Applications of HPLC. Super critical fluid chromatography(SFC). Characteristics of super critical fluids, Instrumentation and components for SFC, Comparison of SFC with HPLC and GLC, Applications of SFC. Recent developments in SFC.
- 4.3 **Gas Chromatography(GC):** Introduction. Principle-theory of gas chromatography. Instrumentation. Types of detectors- evaluation of gas chromatogram. Plate theory for gas chromatography. Hyphenated techniques. Application of GC. Preparative gas chromatography.

Self study: Flow programming chromatography, Programmed temperature gas chromatography

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 Technology*. Vol.I
7. D. A. Skoog, D. M. West and F. J. Holler, *Analytical Chemistry –An Introduction*. Saunders College Publishers, **1990**.
8. R.A. Day and A.L. Underwood, *Quantitative analysis*, Prentice-Hall of India, **2001**
9. 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**.

FP-1801: ORGANIC CHEMISTRY OF FOOD - I

M.Sc (Food Chemistry & Food Processing)

Course : Major core (MC)
Total No of Hrs /Sem : 60

No. of Credits : 4
No. of hours per week: 5

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 **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.
- 1.2 **Disaccharides** – Maltose, lactose and sucrose - solubility, solution viscosity and stability. Gels.
- 1.3 **Polysaccharides:** Hydrolysis, starch granules, granule gelatinization and pasting. Retro gradation and staling. Modified food starch-swelling of starch and cellulose – Modifications and derivatives.
- 1.4 Xanthan, carrageenans, algin, pectins and gum-arabic. Dietary fibre and carbohydrate digestibility.
- 1.5 **Analysis of carbohydrates:** Extraction of total carbohydrate, phenol-sulphuric acid method. Total reducing sugar – Somogyi 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.

UNIT -2: LIPIDS

(15

hrs)

- 2.1 **Fatty acids** – Nomenclature-R/S system and stereospecific 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 **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.
- 2.5 **Antioxidants.** Effectiveness and mechanism of action; Synergism – characteristics of commonly used antioxidants. Thermal non-oxidable and oxidable reactions of saturated fats.
- 2.6 **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. 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. Protein denaturation-theory of denaturation, denaturing agents–physical agents, temperature, hydrostatic pressure, shear, chemical agents, pH, organic solvents, solutes, detergents, chaotropic salts. Protein hydration-solubility, pH, temperature.
- 3.3 **Emulsifying properties:** Methods, emulsifying activity index, protein load, capacity and stability of emulsion–factors influencing emulsifications, foaming properties, flavour binding. Thermodynamics of protein- flavors interaction, factors influencing–viscosity .
- 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.
- 4.5 **Enzymes in food analysis** – Pasteurizations, structure and general properties of vitamin E, bioavailability, causes of variation, losses of vitamins in food.

Self study: actors 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.
- 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, *Food Chemistry*, 3rd Ed, Tata McGraw-Hill, New York, **2003**.
2. S.S.Nielson, A Chapman and Hall, *Food Analysis*, Food Science Title, 2nd Ed., Aspen Publishers, **1998**.
3. V. A. Vaclavik and E.W.Christien *Essentials of Food Science*, Third Edition, Ed., Springer, **2008**.
4. *Vogel's Text Book of Practical Organic Chemistry*, 5th Ed., Pearson Education, **2006**.
5. B. Srilakshmi, *Food Science*, 3rd Ed., New .Age Intl. Publ. **2003**.

REFERENCES

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

FP:1802 APPLICATIONS OF SPECTROSCOPY

M.Sc. Food Chemistry & Food Processing

Semester – I	No. of Credits : 4
Course : Major core(MC)	No. of hours per week : 5
Total No of hrs/Sem : 60	

Objective:

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

UNIT- 1: FLAME PHOTOMETRY, ELECTRONIC AND ATOMIC ABSORPTION SPECTROSCOPY (15 hrs)

- 1.1 Flame spectrometry. Principle. Instrumentation and interferences. Determination of alkali metals.
- 1.2 UV-Visible spectroscopy , principle and instrumentation. Beer-Lambert's law- verification and deviation, significance of molar extinction coefficient. Types of electronic transitions-selection rules .Spectrophotometric titration, Determination of Fe(III) in the presence of aluminium.
- 1.3 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 Zn, Pb and Cu. Determination of mercury by flame atomic absorption.

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

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. Overtones and combination bands.

- 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 .
 ^1H decoupling – Broad decoupling – Off resonance proton decoupling

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, McLafferty rearrangement, 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: OTHER ANALYTICAL METHODS (10 hrs)

- 5.1 *Fluorimetry*: Principle , relationship between excitation and fluorescence spectra. Factors affecting fluorescence emission. Determination of quinine in tonic water and codeine & morphine in a mixture.
- 5.2 *ESR Spectroscopy* – Principle , hyperfine splitting. Application to organic free radicals.
- 5.3 *Mossbauer Spectroscopy* – Principle , application to study of Fe(II) and Fe(III) complexes.
- 5.4 *Photo Electron Spectroscopy(PES)* – Principle – Simple application - ESCA analysis

Self study: Instrumentation of Fluorimetry, ESR and Mossbauer spectrophotometers.

TEXT BOOKS

1. R. M. Silverstein and F. X. Webster, *Spectroscopic Identification of Organic Compounds*, 6th Ed., John Wiley & Sons, New York, **2003**.
2. W. Kemp, *Applications of Spectroscopy*, ELBS, **1987**.
3. K. Srivastava and P.C. Jain, *Chemical Analysis, An Instrumental Approach*, 3rd Ed., S. Chand and Co., New Delhi, **1997**.
4. R. S. Drago, *Physical Methods in Chemistry*; Saunders: Philadelphia, **1977**.

REFERENCES

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

FP:1803. HUMAN NUTRITION

M.Sc (Food Chemistry & Food Processing)

Semester – I

No. of Credits : 4

Course : Major core(MC)

No. of hours per week: 5

Total No of hrs/Sem : 60

Objectives:

- 01) *To understand the relationship between nutrition and human well being.*
- 02) *To understand the functions and importance of all nutrients for different age groups and special 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 malnutritions. 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.
- 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

[5 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

[15 hrs]

- 5.1. Infant nutrition. Nutrition of pre-schoolers, school going children, adolescents, pregnant and lactating mothers and geriatric nutrition. Prevention of malnutrition – Applied nutrition programmes.

Self study: Planning diets for various age groups

TEXT BOOKS

1. M. Swaminathan, 'Advanced text book on Food and Nutrition' Vol.- I, BAPPCO Publishers, Bangalore, **1985**.
2. M. Swaminathan, 'Advanced text book on Food and Nutrition' Vol.-II, BAPPCO publishers, Bangalore , **1985**.
3. B. Srilakshmi, 'Nutrition Science', New age International (p) Ltd Publishers, New Delhi, Bangalore, Reprint, **2003**.
4. B. Srilakshmi 'Dietetics', New age international (p) Ltd publishers, Bangalore, revised 5th Ed., reprint , **2006**.

WEBSITE:

Nutrition Society Text Book Series, www.nutritiontexts.com

REFERENCES:

1. M. Swaminathan, *Human Nutrition and Dietetics*, 4th Ed., BAPPCO publishers, reprint, **1997**.
2. L.Anderson. , '*Nutrition in health and diseases*', 17th Ed., J.B Lippincott & Co., Philadelphia, **1982**.
3. Y.K. Joshi, *Basics of Clinical Nutrition*, Jaypee brothers, Medical publishers © Ltd., New Delhi, 1st Ed., 2003, reprint, **2005**.
4. F.P.Antia , *Clinical Dietetics and Nutrition*, University Press, New Delhi. 3rd Ed.,**2000**.
5. M, E .Shils , A.James and O.M.Shike, *Modern Nutrition in health and disease*; 8th Ed., Vol., I and II, Leo and Felijier Awaverly Company, Philadelphia, **1994**.
6. G.Wiseman, *Nutrition and health 2002*, Taylor and Francis publishers, London.
7. J.G. Michael , M. Barrie and M. Margetts '*Public health nutrition*' Black Well Publishers, Reprint **2005**.
8. C.Holden, A.MacDonald and B.Tindall "*Nutrition and Child health*", Imprint Harcourt publishers Ltd, **2000**.
9. *Nutrient requirements and recommended dietary allowance for Indians*, NIN & ICMR publication, 1st Ed., 1990, reprint **2004**.
10. C. Goplan, B.V. Ramashasthri and F.C. Balasubramanian '*Nutritive Value of Indian foods*' NIN & ICMR publication, revised edition-1989, reprint – **2004**.
11. Ghafoornissa, K.Kamala , '*Diet and heart disease*' NIN publication, 1st Ed., 1994, reprint , **1998**.
12. J.S. Garrow and W.P.T. James '*Human Nutrition and Dietetics*' 9th Ed., , Churchill Livingstone publishers.
13. M. S. Chaney, '*Nutrition*' – Houghton Mifflin Comp. The Riverside Press, Cambridge, Massachusetts.
14. S. Ghosh '*The feeding and caring of infant and young children*', Voluntary health association of India, New Delhi, **1977**.
15. D.Passmore and J.F.Brock , *Human Nutrition and Dietetics*, F & S Livingston Ltd, Edinburgh, London, **1993**.
16. S.R.Mudambi and M.N. Rajagopal, '*Fundamentals of food and Nutrition*', Wiley eastern Ltd, 3rd Ed.,New Delhi
17. S. N. Manay and S.Swamy, '*Food, facts and Principles*', Wiley eastern Ltd, New Delhi, **1987**.
18. L. Kathleen and S.Escott , *Stump nutrition and diet therapy*', An imprint of ELSEBIE, 11th edition, Saunders , **2000**.
19. S.R.Williams '*Essentials of Nutrition and Diet Therapy*, 5th Ed., Times Mirror/Mosby College Publishing, **1990**.

FP-1804 QUANTITATIVE ANALYSIS: PRACTICAL-1

M.Sc. Food Chemistry & Food Processing

Semester – I

No. of Credits : 2

Course : Major core(MC)

No. of hours per week: 4

Objectives

01. To enable the student to develop analytical skill in organic quantitative analysis
02. to understand the techniques involved in the preparation of standard solutions, standardization and calculations in the estimations of compounds.
03. 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 colourimetric 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.
12. Analysis of vinegar – *Total acidity,*

TEXT BOOK:

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

REFERENCE BOOKS:

2. *Vogel's Text book of Practical Inorganic Chemistry*, 4th Edition, ELBS/Longman, England, **1984**.
3. *Vogel's Text book of Practical Organic Chemistry*, 4th Edition, ELBS/Longman, England, **1984**.
4. J.N. Gurtu and R. Kapoor, *Advanced Experimental Chemistry*, S. Chand and Co., **1987**

FP-1805 ORGANIC ANALYSIS AND PREPARATION
PRACTICAL-2

M.Sc. Food Chemistry & Food Processing

Semester – I	No. of Credits	: 2
Course : Major core(MC)	No. of hours per week:	4

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.
 - nitration
 - halogenation
 - diazotization
 - rearrangement
 - hydrolysis
 - reduction
 - acylation
 - 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. N.S. Gnanapragasam and G. Ramamurthy, *Organic Chemistry – Lab manual*, S. Viswanathan Co. Pvt. Ltd, **1998**.
2. J.N. Gurtu and R. Kapoor, *Advanced Experimental Chemistry*, S. Chand and Co., **1987**

REFERENCE BOOKS

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

SEMESTER – II [24 Credits]						
S.No	SUB. CODE	NAME OF PAPER	COURSE		EXAMINATION	
			Hrs/ week	Credits	Hours	Marks
08	FP-2800	Organic Chemistry of food -II (MC)	4	4	3	100
09	FP-2801	Nutritional Biochemistry (MC)	4	4	3	100
10	FP-2802	Chemistry of Dairy products (MC)	4	4	3	100
11	FP-2803	Biochemistry-Food Microbiology-Practical-3 [MC]	4	2	4	100
12	FP-2804	Instrumental methods of analysis-Practical-4 [MC]	4	3	4	100
13	FP-2805	Seminar- I [MC]	2	2	-	-
14	EL-2876	Effective communication [ED]	2	1	-	-
15	ZO-2901	Medical Lab Technology [SU]	3	2	3	100
*16(a)	FP-2950	Herbs and Spices [SE]	3	2	3	100
*16(b)	FP-2951	Food Microbiology [SE]				
TOTAL			30	24	-	500

No. of Courses:

MC:6

* SE: Any one of the two [16(a) or 16(b)]

ED:1

SU:1

No. of Credits:

MC: 19

SE : 02

ED:01

SU:02

FP 2800 – ORGANIC CHEMISTRY OF FOOD - II

M.Sc. Food Chemistry & Food Processing

Semester – II

Course : Major (MC)

No. of Credits : 4

No. of hours per week: 4

Objective:

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. (10)

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

UNIT 2. TERPENES. (10)

Isolation-isoprene rules- application to simple systems

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, guaiacol,

longifolene, phylol, abietic acid, gibberellic acid, squalene.

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

UNIT 3: ALKALOIDS. (10)

Chemical nature- general methods of extraction- classification.

Phenethylamine group: ephedrine, Bazedrine, 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.

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

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.

Text books:

1. I.L. Finar, *Organic chemistry* Vol II, Pearson Education, Asia.
2. O.P. Agarwal, *Chemistry of organic natural products*, Vol I & II Goel Publishing House, 1997.
3. Gurdeep chatwal, *Organic chemistry of natural products* Vol I & II, Himalaya Publishing House, 3rd edition.
4. Edt: R.Fennema, *Food chemistry*, Marcel & Decket Inc, 3rd edition.

Reference books:

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

FP-2801-NUTRITIONAL BIOCHEMISTRY

M.Sc. Food Chemistry and Food Processing.

Semester-II
Major core (MC)

No. of Credits: 4
No. of Hrs/Week: 4

OBJECTIVES

This course aims at presenting a concise but lucid core of biochemical knowledge and understanding that is desirable for all students of food chemistry.

Unit .I: BIOLOGICAL OXIDATION. (5 Hours)

- 1.1 Electron transport mechanism-NADH dehydrogenase, Cytochromes.
- 1.2 Electron transport chain and oxidative phosphorylation and its regulation.
Self study - High energy phosphate bond, energy conservation, storage and release of high energy phosphate : Role of high energy phosphate in metabolism myokinase reaction.

Unit .II: CATABOLISM OF FUEL MOLECULES AND INTEGRATION OF MAMMALIAN METABOLISM. (15 Hours)

- 2.1 Carbohydrates- Reactions of glycolysis (anaerobic pathway).
Citric acid cycle (TCA cycle)- Reactions of TCA cycle, Synthesis of acetyl coenzyme A.
- 2.2 The Hexose Monophosphate pathway, Inborn errors of carbohydrate metabolism.
- 2.3 Amino acid oxidation and production of urea –transamination and functions of pyridoxal phosphate, deamination, decarboxylation, urea cycle, regulation of urea cycle, Inborn errors of amino acid metabolism.
- 2.4 Lipids- β oxidation of fatty acids, oxidation of unsaturated fatty acids.
- 2.5 Integration of metabolic pathways.
Self study: Glycogen breakdown, Catabolism of ketone bodies.

Unit .III: BIOSYNTHESIS AND UTILISATION OF PHOSPHATE BOND ENERGY (10 Hours)

- 3.1. Carbohydrates-gluconeogenesis from TCA cycle intermediates, glycogen bio synthesis and regulation.
- 3.2. Lipids-Biosynthesis of saturated fatty acids and cholesterol.
Self study: Triacyl glycerol and ketone body formation.

Unit .IV: WATER, ELECTROLYTE AND ACID BASE BALANCE OF MAMMALIAN SYSTEM. (10 Hours)

- 4.1. Water balance-distribution of water, water intake and water output.

- 4.2. Electrolyte balance-Electrolyte composition of body fluids, regulation of electrolyte balance.
- 4.3. Acid-Base balance-production of acids and bases by the body, maintenance of blood pH, respiratory and renal mechanism for pH regulation.
Self study: Dehydration, overhydration, disorders of acid-base balance.

Unit .V: GENETIC CONTROL OF METABOLISM. (10 Hours)

- 5.1. Nucleotides and nucleic acids-characteristic bases.
- 5.2. DNA metabolism-DNA replication, DNA repair DNA recombination and bioengineering.
- 5.3. RNA metabolism-DNA dependent synthesis of RNA, RNA components, types and structure.
- 5.4. Protein metabolism-the genetic code, protein biosynthesis (translation).
Self Study: DNA and RNA-structure and properties.

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. Jeremy M.Berg, John L Tymoczko & Lubert Stryer L, (1995), 'Biochemistry', 5th Edition W.H.Freemann and Co, New York.
4. Sathya Narayana.V, 'Biochemistry', Books and Allied (p) Ltd, Calcutta, 1999.
5. West E.S Todd, W.R Mason H.S and Van Bruggen J.T (1970) 'Text Book of Biochemistry', 4th Edition, The Mc Millan Co.

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, Mayo 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.N, (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.

FP 2802 CHEMISTRY OF DAIRY PRODUCTS

M.Sc. Food Chemistry & Food Processing
Semester – II
Course : Major core(MC)

No. of Credits : 4
No. of hours per week: 4

Objectives :

The course should prepare the students

- 1) *To understand the chemistry and biochemistry 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. Rheological properties of milk, milk gels and .milk fat - electrical conductivity

Self study:

Estimation of acidity and total solid in milk.

UNIT 2: MILK LACTOSE

(12 hours)

- 2.1 Chemical and Physical properties of lactose-Koestle number and quality of milk. Structure and Solubility of lactose – α -lactose, β -lactose; reducing sugar, mutarotation of lactose, effect of pH on mutarotation, significance of mutarotation. effect of temperature, 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, by redox titrations.

Self study:

Lactose intolerance, Galactosaemia & metabolism of galactose.

Unit 3: MILK LIPIDS AND MILK PROTEINS**(10 Hrs)**

- 3.1 Milk lipids: Fatty acids profile of milk lipids, milk fat as an emulsion, milk fat globules membrane (MFGM).
- 3.2 Milk proteins and salts of milk, 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**(12 Hrs)**

- 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 – Fat soluble vitamins and the role of retinol (Vit. A), calciferols (Vit. D), tocopherols and related compounds (Vit. E), phyloquinone and related compounds (Vit. K) in milk.. B-group vitamins –role of thiamin (Vitamin B), riboflavin (Vitamin B₂), niacin, biotin pantothenic acid, pyridoxine and related compounds (Vitamin B₆), folate, cobalamin (Vitamin B₁₂), ascorbic acid in milk. 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**(8 hrs)**

- 5.1 Fermented milk products- - definition, conditions, cultured milk, cultured cream, 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, 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.

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., New Delhi, 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 Nostrand Reinhold, New York

FP-2803-BIOCHEMISTRY-FOOD MICROBIOLOGY PRACTICAL-3

M.Sc. Food Chemistry and Food Processing.

Semester-II
Major core (MC)No. of Credits: 2
No. of Hrs: 4

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.
3. To enable the students to understand the importance of micro biology in food.

I. Biochemistry practical.

1. Electrophoresis of serum.
2. Estimation of Haemoglobin.
3. Determination of plasma Cholesterol.
4. Determination of plasma alkaline phosphatase activity.
5. Analysis of blood and urine sugar (glucose).
6. Estimation of xanthine oxidase.
7. Enzymic inversion of sucrose.
8. Sorensens formol titration (casein)

II. Food Microbiology Practical.

1. Methods of sterilization.
2. Preparation of culture media
 - a) Nutrient agar b) Potato dextrose agar.
3. Serial dilution technique.
4. Pure culture-Streaking.
5. Gram staining of bacteria.
6. Microbiological examination of milk and water.
7. Enumeration of bacteria by total viable count/standard plate count.
8. Study of yeast and fungi in food.
9. Detection of *E.coli*, *salmonella*, *staphylococcus* in food samples.

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. David.T.Plummer-'Introduction to Practical Biochemistry' Tata Mc Graw Hill Publishers.
5. Varley.H (1976)-Practical Clinical Biochemistry, 4th Edition, Arnold Heinemann

FP 2804 – INSTRUMENTAL METHODS OF ANALYSIS PRACTICAL-4	NO. OF CREDITS : 3
SEMESTER : II	NO.OF HOURS/WEEK: 4
Course: MC	
NO. OF HOURS / SEMESTER:50	

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. Determination of functional groups using IR spectrometer (vannillin)
02. Estimation of food colours using UV–visible spectrophotometer
03. Analysis of antacid – pH meter.
04. Determination of pH of hair shampoos.
05. Estimation of Na/K : Flame photometer
06. Estimation of calcium in Serum _by_AAS.
07. Estimation of iron(II) by redox titration: potentiometry.
08. Estimation of strong and weak acid: conductometry
09. Estimation of vinegar : conductometry
10. Kinetics of inversion of canesugar: by polarimetry and comparison of acid strength.
11. Separation and estimation of compounds using column chromatography.*
12. Estimation of concentration of glucose by Abbe’s refractometer.
13. Non–aqueous titration. Determination of aniline
14. Determination of phosphate in serum: Spectrophotometry.
15. Determination of Fluoride by potentiometric titration.
16. Determination of salicylic acid in aspirin ___Fluorescence.
17. Determination of chlorinated Hydrocarbons in a mixture by GC*
18. Analysis of flavour – GC – HPLC *
19. Analysis of analgesics: HPLC*

- Experiments for demonstration.

Reference books:

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

FP-2805 SEMINAR AND REPORT	
M.Sc Food Chemistry and Food Processing	
Semester; I – IV	No. of hours/week:2
Course:Major Core(MC)	No. of credits : 2x1=2
Total No. of hours/sem.:30	

Objectives:

To make the student understand, prepare and present the topics in the subject related to Food Chemistry in a class room.

Testing & Evaluation:

Each student will choose a topic in the subject related to Food Chemistry , prepare and present it in a class in the presence of students and faculty members . There will be discussion on the subject following the presentation. It will be evaluated by the faculty members present in the seminar.

The evaluation is based on subject matter and mode of presentation.

The components in the subject matter include

- (i)Standard of subject
- (ii)Planning
- (iii)Mastery and preparation
- (iv)Originality and logical development
- (v)Summary and references.

The components in the mode of presentation include

- (i)Language and diction
- (ii)Voice as a tool of communication
- (iii)Teaching Aids & Blackboard use
- (iv)Economy of time
- (v)Related to audience.

EL 2876 – EFFECTIVE COMMUNICATION

M.Sc. Food Chemistry & Food Processing

Semester – II
Course : ED

No. of Credits : 1
No. of hours per week: 2

Objectives

- *To introduce to the students the basic concepts related to communication and its purpose*
- *To make the students to be aware of the nuances of discourse*
- *To expose to the students how the choice of words / style of language may affect communication*
- *To train the students in non-verbal language to harness their communication skills*
- *To motivate the students to practice speech delivery, interactive skills and organize speech events successfully*

Unit 1 – Structure of Human Communication

- a) Ethnography of communication
- b) Process of communication
 - Sending information
 - Mental activity
 - Physical activity
 - Vocal activity
 - Receiving information
 - Accuracy in listening & observing

Unit 2 – Style of communication

- a) Choice of words- expressions, generalities, register, code, slangs, taboos, ambiguities, euphemism etc
- b) Syntax structure- short, simple, precise, direct, polite

Unit 3 – Non-verbal communication

- a) Body language – facial expressions, eye contact, gestures, postures
- b) Tone – pitch, audibility, voice modulation, rate of speed
- c) Space – place, time and condition

Unit 4 – Speaking Effectively

- a) Group discussions – setting goals & roles
- b) Presentations
 - preparing speech/report delivery & group sharing
 - Appropriate usage of technology and communication aids
 - Organizing meetings, campaigns
- c) Conversations
 - telephoning, interviewing, acting out skits
 - Telephone etiquettes, politeness principle, courteous behavior

Methodology

Lectures, workshop, audio & video presentations,
Group activities, public speech, mock interview etc

REFERENCES:

1. Robert G King: *Fundamentals of Human Communication*
2. Asha Kaul: *Effective business communication*
3. Stewart L. Tubbs & Sylvia Moss: *Interpersonal Communication*
4. Malcolm Coulthard: *An Introduction to Discourse Analysis*

FP-2950. HERBS AND SPICES	
M.Sc Food Chemistry and Food Processing	
Semester : II	
Course: Subject Elective (SE)	No. of credits: 2
Total No. of hours/sem.: 30	No. of hours per week: 3

Objectives:

01. The main objective of this course is to make the students to learn about herbs and spices and their quality specifications.

02 They will also learn the chemistry and uses on some important Commonly used and medicinal spices.

UNIT I: INTRODUCTION**(6 Hours)**

- 1.1 Definition of spices- Taxonomic classification- spice flavours- processing issues- uses of herbs and spices as flavouring, deodorizing and colouring agents.
- 1.2 Functional role of herbal spices- Introduction functional properties- Nutritional properties- Anti-oxidant properties- Insect repellent properties- Medicinal properties.

Self study: Properties and uses of medicinal spices

UNIT II: QUALITY SPECIFICATIONS FOR HERBS AND SPICES (6 Hours)

- 2.1 Definition of quality- International quality specification- ASTA and ESA- Tests of quality.
- 2.2 Quality indices for spice essential oils- Physical properties of essential oils- Problem of adulteration- Edible and mineral oils and ethanol as adulterants- Detection of adulterants.

Self study: Estimation of adulterants in spice essential oils

UNIT III: HERBS AND SPICES AS ANTIMICROBIALS (6 Hours)

- 3.1 Introduction- Barriers to the use of herb and spice, essential oils as antimicrobials in foods- Antimicrobial activity- Applications of essential oils in foods.
- 3.2 Screening for health aspects of herbs – Types of assays- Receptor binding assays- scintillation and fluorescence polarization assays- Assay quality- Screening bio-active compounds.

Self study: Spices with significant antimicrobial activity and their health effects.

UNIT IV:CHEMISTRY AND USES OF SPICES (6 Hours)

Description, quality issues, handling after harvest, chemical components, processing, functional properties and uses of the following commonly used spices:

1. Black pepper
2. Garlic
3. Turmeric
4. Coriander and curry leaf
5. Mustard
6. Cumin

Self study: Other commonly used spices.

UNIT V:MEDICINAL SPICES (6 Hours)

Origin, botany, chemistry, functional properties, toxicology and uses of the following medicinal herbs and spices:

1. Cinnamon
2. Ginger
3. Saffron
4. Asafoetida
5. Cardamon
6. Vanilla

Self study: Other medicinal spices.

TEXT BOOKS:

1. K. V. Peter (Editor), *Hand Book of Herbs and spices, Volume I and II*, Wood head Publishing Ltd. and CRC press, **2001**.
2. A. Partrasarathy (Editor), *Chemistry of spices*, CAB International, Oxford shire, UK, **2008**.

REFERENCES:

1. Straus .D. A and Wolstromer R. J. *The examination of various Essential oils*, Proceedings of VI conference on Essential oils, San Francisco, **1974**.
2. Anon, *Production of Organic spices*, Spices board, Cochin, India, **1998**.
3. Anon, Potential uses of pepper and pepper isolate, Int. Pepper. News. Bull., **1997**
4. Sen A. R, Roy B. R, Adulteration in Spices, Proceedings of Symposium on Development and prospects of spice industry in India, **1974**.
5. Krishnamurthy M. N, Padmabai .R, Natarajan C. P, Chemical composition of Cardamon, J. Food. Sci. Technology, 4, **170** (1967).
6. Hirasa .K, Masa M. T, *Spice science and Technology*, Mareal Derker inc., Tokyo, **1998**.
7. Bhatnagar S. S, Chopra R. N, Ghosh .J, Saha M. N, Santapan .H, Sastri B. N, *Wealthy India*, CSIR, 1950.

FP-2951 FOOD MICROBIOLOGY	
M.Sc Food Chemistry and Food Processing	
Semester: II	No. of credits: 2
Course: Elective Subject (SE)	No. of hours /week: 3
Total No. of hours/semester: 30	

Objectives:

- The objectives of this course are to make the students to*
1. *understand microbial, biochemical and physiological aspects of food spoilage.*
 2. *study different types of micro organisms responsible for food deterioration and poisoning.*
 3. *learn about fermented foods.*

UNIT- I: MICROBIAL AND BIOCHEMICAL ASPECTS OF FOOD SPOILAGE

- 1.1 Micro organisms in food spoilage- Biochemical spoilage- yeasts and moulds in food spoilage- chemical spoilage.
- 1.2 Food spoilage- importance of microbial physiology- response of microbes to physiological factors.
- 1.3 Food- spoiling micro organisms- food spoiling reactions- interactions between food- spoiling bacteria- Acylated homoserine lactone-based communication and Quorum sensing.

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

UNIT- II: SPOILAGE MICROORGANISMS IN FOODS

- 2.1 Spoilage organisms in Breweries- origin of spoilage yeasts in wine industry- specific spoilage organisms.
- 2.2 Microbial spoilage of cereal and cereal products- spoilage of cereals- spoilage of cereal products.
- 2.3 Spoilage of milk and dairy products- microbes involved in spoilage of these products.

Self study: Microbiology of food taints.

UNIT- III FOOD POISONING

- 3.1 Bacterial food poisoning- Food poisoning by *Bacillus cereus*, *Clostridium botulinum*, *Brucella* sp., *Vibrio cholerae* and *Staphylococcus*- Laboratory diagnosis of food poisoning by bacteria- Listeriosis.
- 3.2 Food-borne viruses- Epidemiological features- viral Gastro enteritis- Hepatitis- Properties of food – borne viruses- Detection routes of contamination- Survival-determination of fresh products- Prevention and control of food poisoning.

Self study: Food poisoning by algae – Food hygiene

UNIT- IV: MICROBIAL FOOD FERMENTATION

- 4.1 Basic principles of fermentation- organisms responsible for food fermentation- Desirable fermentation- Manipulation of microbial growth and activity- controlled fermentation.
- 4.2 Fermentation in food processing- classification of fermentation- safety of fermented foods- Principles behind safety of fermented food processes.

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

UNIT- V: INDUSTRIAL MICROBIOLOGY

- 5.1 Production of yeast- Recovery and preservation- 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.

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

TEXT BOOKS:

1. K. Vijaya Ramesh, *Food Microbiology*, MJP Publishers, 2007.
2. Editors: John F.T. Spencer, Alicia L. Ragout de Spencer, *Food Microbiology Protocols*, Humana Press, Totowa, New Jersey, 2001.

REFERENCE BOOKS:

1. James M. Jay, Martin J. Loessner and David A. Golden, *Modern Microbiology*, VII Edition, Springer Science Media Inc., 2005.
2. Moshrafuddin Ahmed and S.K. Basumatary, *Applied Microbiology*, MJP publisher, 2006.

ZO 2901 – MEDICAL LAB TECHNOLOGY

M.Sc. Food Chemistry & Food Processing

Semester – II

Course : SU

No. of Credits : 2

No. of hours per week: 3

Objectives:

1. *To impart knowledge on the principles of laboratory techniques adopted in medical science.*

UNIT 1: HAEMATOLOGY

Composition of blood and their function - Haemopoiesis, types of anemia, Mechanism of blood coagulation. Normal values of haemogram.

UNIT 2: BIOCHEMISTRY

Principle, procedure and clinical significance of blood sugar, SGOT, SGPT hypoglycemia, hyperglycemia.

UNIT 3: MICROBIOLOGY

Ultrastructure of bacteria. Characteristics & preparation of culture media-sterilisation procedure.

UNIT 4: IMMUNOHAEMATOLOGY AND BLOOD BANKING

Blood grouping and Rh typing, screening the donor, collection, transport, storage of blood, blood components and lab procedures.

UNIT 5: DIAGNOSTIC PATHOLOGY

Characteristics and qualitative analysis of urine, stool, sputum, seminal CSF & amniotic fluid. A brief account of human parasites.

References:

1. Mukerjee, K.L., *Medical Laboratory Technology* – Vol I, II, III. Tata Mc Graw Hill, New Delhi, 1999
2. Sood, R, *Medical Laboratory Technology, Methods and Interpretation*, 2005
3. Godkar, P.B and Godkar, D.P. *Text book of Medical Laboratory Technology*, Bhalani Publishers, India, 2003
4. Mohan, H., *A Text book of pathology*, jaypee brothers, New Delhi, 2005

SEMESTER – III [25 Credits]						
S.No	SUB. CODE	NAME OF PAPER	COURSE		EXAMINATION	
			Hrs/ week	Credits	Hours	Marks
17	FP-3800	Fundamentals of Agro Products [MC]	4	4	3	100
18	FP-3801	Food from Animal sources [MC]	4	4	3	100
19	FP-3802	Food Processing- Agro products [MC]	4	4	3	100
20	FP-3803	Chemistry of Food Additives [MC]	4	4	3	100
21	FP-3804	Science and Society [MC]	4	3	4	100
22	FP-3805	Food Chemistry- Practical-6 [MC]	4	3	-	-
23	FP-3806	Food Processing- Practical 6 [MC]	4	3	3	100
24	FP-4803	Seminar-II [MC]	2	-	-	-
Total			30	25		600

No. of Courses:

MC: 7

No. of Credits:

MC: 25

FP-3800: FUNDAMENTALS OF AGRO PRODUCTS

M.Sc., Food Chemistry & Food Processing	No.of Hours/Sem.	:60
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 chemical components in food stuffs*
- ii) the importance of fruits and vegetables*
- iii) the composition and medicinal value of spice and condiments.*

Unit -1: CEREALS AND CEREAL PRODUCTS (15 hrs)

- 1.1 Wheat-Structure, classification, composition and nutritive value- Products of wheat- Whole wheat flour, maida and semolina.
- 1.2 Rice-Composition and nutritive value- Rice products-starch, bran, bran oil and parched rice products - parched paddy and flaked rice.
- 1.3 Millets-Composition and nutritive value-Products of millets-maize, jowar, ragi and bajra.

Unit -2: PULSES (10 hrs)

- 2.1 Types, composition and nutritive value- Antinutritional factors, toxic constituents, protein contents of pulses- Sprouting.
- 2.2 Medicinal values of pulses- rajmah, green gram, cow peas, bengal gram, pintos spotted, black gram, masoor dhal, khesari dhal, broad bean, horse gram, red gram and roasted bengal gram.

Unit -3: OIL SEEDS AND NUTS (10 hrs)

- 3.1 Composition and nutritive value of soya bean, peanut, coconut, sunflower, sesame and palm kernel nuts and seeds- Food and therapeutic uses.
- 3.2 Soya bean- soya bean milk, okara, tofu, textured vegetable proteins.

Peanut–peanut milk and peanut butter.

Coconut–desiccated coconut, coconut cake, coconut cream, tender coconut water, coconut milk powder.

3.3 Fats and oils- properties, uses in food products (as cooking media and shortening).

Unit -4: FRUITS AND VEGETABLES (15 hrs)

4.1 General classification and composition–texture and pigments–flavour constituents.

4.2 Effect of heat on colour and texture of vegetables–minimizing nutritional losses–qualitative and quantitative aspects.

4.3 Canned, frozen and dry fruits–Chemical and flavour constituents. Natural preservatives, artificial preservatives added to fruit juices, natural antioxidants, role of antioxidants.

Unit -5: SPICES AND CONDIMENTS (10 hrs)

5.1 Flavour constituents in Indian preparations-structure and chemistry of active ingredients in poppy seeds, ajwain, aniseed, nutmeg, caraway seeds and bay leaves.

5.2 Condiments-Structure, composition, extraction of active ingredient and medicinal value-Chillies-Coriander seeds-Fenugreek seeds-Turmeric.

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**.

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**.

FP-3801: FOOD FROM ANIMAL SOURCES

M.Sc., Food Chemistry & Food Processing	No. of Hours/Sem. :60
Semester – III	No. of Credits : 4
Course: Major core (MC)	No. of hrs per week : 4

Objective:

To enable the students to understand the importance of meat, meat products, aquafoods and dairy products.

Unit-1: PHYSICO CHEMICAL CHANGES IN MEAT ON COOKING (15 hrs)

- 1.1 Changes in meat on cooking—denaturation of protein, hydrolysis of collagen.
- 1.2 Colour change, drip formation, meat aroma, dispersion of fat, decrease in vitamins, surface reddening and overcooking.

Unit-2: MEAT AND MEAT PRODUCTS (10 hrs)

- 2.1 Structure, muscle—connective tissue—collagen—elastin—adipose tissue—cartilage.
- 2.2 Classes of meat and related products. Desirable characteristics of meat.
- 2.3 Composition and nutritive value, post-mortem change in meat.

Unit-3: SEA FOODS (12 hrs)

- 3.1 Types of fishes- Shrimps and prawns. Fish catch- intensive and semi intensive farming-Tuna fishery and other sea foods.
- 3.2 Composition and nutritive value of sea foods. Selection of fish.

Unit-4: MILK (15 hrs)

- 4.1 Milk and colostrum. Composition and chemical analysis of milk– Milk proteins, milk fats, milk sugar, ash, salts and enzymes, nutritive value of milk.
- 4.2 Physicochemical properties- Effect of heat, phenolic compounds, acids and salts in milk. Microbial contaminants in milk
- 4.3 Methodology of milking, adulterants in milk.
- 4.4 Bioethics of milk products.

Unit-5: POULTRY AND POULTRY PRODUCTS**(8 hrs)**

- 5.1 Eggs–Formation, structure, composition and nutritive value of egg white and egg yolk (proteins, fats, pigments, vitamins and minerals)
- 5.2 Poultry–Classes of poultry meat, classification, tenderness flavour and colour, composition and nutritive values.

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, NewDelhi, **2000**.

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**.

FP-3802: FOOD PROCESSING – AGRO PRODUCTS	
M.Sc., Food chemistry & Food Processing	No. of hours/Sem.:60
Semester – III	No. of Credits : 4
Course: Major Core (MC)	No. of hrs per week : 4

Objective:

To enable the students to understand the storage, preservation and processing of agro products.

Unit – 1: PROCESSING OF CEREAL GRAINS**(15 hrs)**

1.1 Storage and preservation of cereal grains.

1.2 Processing -wheat milling, chakki grinding – bread making –fermenting, sheeting moulding, baking, role of ingredients in bread making, extrusion and pasta products processing-noodles, macroni, vermicelli, rice milling – parboiling.

1.3 Cereal products – fermented and unfermented products, flaked breakfast cereals, corn chips, special flours – cereal cookery.

1.4 Processing of cereal grains: Beers and beer like beverages-Malts(barley, oats sorghum or millets) specifications, brewing. Mashing liquor and mash pH, The influences of mash thickness and mash temperature, Wort carbohydrates, mashing and lautering system , chemistry of Wort boiling, antioxidant activity of BHT, maturations- flavor and aroma changes. Packaging – types of packaging materials, bottling, canning, printing interaction between packaging and foods.

Unit – 2: PROCESSING AND REFINING OF FATS AND OILS**(10 hrs)**

2.1 Storage, preservation and packaging of fats and oils

2.2 Refined oils - plasticity, hydrogenation, winterization emulsions, rancidity, types and prevention of rancidity

2.3 Role of fats and oil in cookery – fat absorption.

2.4 Fat turnover, role of fat to improve the texture of foods – unconventional oils

Unit – 3: FRUITS AND VEGETABLES PROCESSING (10 hrs)

- 3.1 Storage, preservation and packaging of fruits and vegetables.
- 3.2 Ripening – natural and artificial ripening of fruits – harvesting, post harvesting.
- 3.3 Processing operation – trimming, washing, blanching, packaging and freezing.
- 3.4 Manufacture of fruit juice – canning, pickling – dehydration.

Unit – 4: SUGAR PROCESSING (15 hrs)

- 4.1 Storage, preservation and packaging of sugar.
- 4.2 Sugar cane processing – extraction, neutralization, concentration and crystallization, separation and drying – sugar refining, grading of sugar.
- 4.3 Sweeteners-liquid glucose, liquid fructose, sorbitol, honey.
- 4.4 Confectionary - caramelization- water and oil soluble caramels, sugar related products, sugar coating, sugar cookery.
- 4.5 Chocolate manufacturing

Unit – 5: PULSE PROCESSING (10 hrs)

- 5.1 Storage, preservation and packaging of pulse.
- 5.2 Milling – soaking, germination, fermentation, parching of pulses.
- 5.3 Pulse cookery –effect of cooking – factors affecting cooking quality – role of pulses in cookery.
- 5.4 Processing of soya bean.

TEXT BOOK:

- 3. Food processing Technology: Principles and practice, II Ed., P.Fellows, CRC press, Cambridge, England (Woodhead Pub. Ltd.,) **2000**
- 4. P.S. Murano, Understanding food science and technology, Thomson Wordsworth, **2003**
- 5. B. Sivasankar, Food Processing and Preservation, Prentice Hall of India Pvt. Ltd., New Delhi, **2002**

REFERENCES:

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**

FP -3803: CHEMISTRY OF FOOD ADDITIVES

M.Sc. Food Chemistry & Food Processing	No. of Hours/Sem.	:60
Semester – III	No. of Credits	: 4
Course: Major Core (MC)	No. of hrs per week	: 4

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, \pm 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 NewYork, **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**.

FP-3804: SCIENCE AND SOCIETY

M.Sc. Food Chemistry & Food Processing	No. of Hours/Sem. :45
Semester – III	No. of Credits : 3
Course: MC	No. of hrs per week : 3

Objectives:

1. To understand the importance of science in society
2. To know the implications of scientific investigations in society
3. To understand the importance of biotechnology and bioethics
4. To know the impact of electronic revolution and informatics in society
5. To apply the knowledge of science to be men and women for others.

Unit -1: SCIENCE- METHOD AND FUNCTION (10 hrs)

- 1.1 The scientific age-promises and failures; a short history of science- industrialization of science- 20th century science in India; the scientific temper and cultural lag- the transfer and transformation of technology;
- 1.2 Technology- high, low, intermediate, appropriate; its transfer from developed to developing countries, from urban to rural milieu; Patterns- advantages and disadvantages.

Unit -2: ENERGY, ENVIRONMENT AND ECOLOGY (10 hrs)

- 2.1 Fossil fuels, Crisis and prognosis, acid rain, green house effect. Nuclear energy: fission, fusion, dangers, decisions: cause for a moratorium. Non-conventional energy
- 2.2 Human and Nature: Symbiosis, ecology and its equilibrium- vanishing species. Environment: degradation; denudation, afforestation and social forestry, bio-fertilizers and bio-pesticides internal environment; use and abuse of drugs, food health and nutrition.

Unit -3: BIOTECHNOLOGY, IT AND BIOETHICS (10 hrs)

- 3.1 Recombinant DNA techniques; cloning; cell- fusion, genetic engineering, in- vitro fertilization; transplantation of organs; gerontology, applications of biotechnology in various fields; promises and perils, stem cells, genetically modified foods.
- 3.2 The Electronic revolution: Computers and modern society. Cybernetics (robotics). Informatics- mass media; dissemination of informations.

Unit -4: SCIENCE AND PROGRESS (10 hrs)

- 4.1 The scientific method: assumptions and limitations (philosophy of science). Evolution and destiny of man. The function of ethics: progress and happiness of man,

science and salvation (religions and value systems) - historic conflicts and possible mutual aid.

4.2 Human existence in danger? - Pollution, resources, population, eco-balance, military technology, science for peace, sustainable development.

Unit -5: SCIENTIFIC POLICY

(5 hrs)

5.1 Futurology, education and human resources development. The responsibility of man, of the scientist and of the scientific community.

5.2 Science and faith- challenges to faith, philosophy of science, towards a new paradigm for reality, the need for sane society.

TEXT BOOKS:

1. B. Russell, The impact of science on society, Blackie & Son Pub. Ltd. Madras, 20th Reprint, **1981**.
2. R. J. Berry, Ecology and ethics, Interscience Press, London, **1972**.

REFERENCES:

1. P.M. Gregorios(Ed), Science and our future, CLS Madras-3, **1978**.
2. P.M. Gregorios, Science for Sane Societies, CLS Madras-3, **1980**.
3. A. N. Kothare, S.J. John Misquitta and S. Palsule, Science, Technology and social change Wiley Eastern Ltd. **1986**.
4. P.T. de chardin and S.J. Collins, The future of man, London, **1964**.
5. E. F. Schumacher and Radhakrishna, Small is beautiful, New Delhi-2 (Indian Repr.) **1977**.
6. N. Anderson, Hodden and Stoughton, Issues of life and death, London, **1975**
7. W. Heisenberg, The part and the Whole (Der Teil and das Ganze), Piper & Co Verlag, Munich, **1971**.
8. C. A. Coulson, Science and Christian belief, Fontana books, Collins, London (2 Edn.) **1971**.
9. B. R. Nanda(Ed), Science and Technology in India, Vikas Publ. House, New Delhi, **1977**.
10. Management of Indian Science for developments and Self- reliance (Proceedings of SYS Symposium- 1980) Allied Publishers, **1983**.
11. A. Toffler, The Third Wave (New perspectives on tomorrow), Pan Books Ltd. (1981) - Collins **1980**.
12. F. Capra and Flamings, The turning point (science and the rising culture), Fontana Paperbacks- Collins, **1982**.

FP-3805 : FOOD CHEMISTRY PRACTICALS - 5

M.Sc. Food Chemistry & Food Processin	No. of Hours/Sem. :60
Semester – III	No. of Credits : 3
Course: Major core (MC)	No. of hrs per week : 4

Objectives:

1. *To enable the student to understand the different techniques of laboratory procedures applicable to food.*
2. *To impart analytical skills through food analysis.*

LIST OF EXPERIMENTS

1. Analysis of fats/oils – Any two of the following; acid value, iodine number, Reichert-Meissel number and saponification value of fats- Detection of adulterants in fats/ oils.
2. Determination of salt content in commercial table butter.
3. Determination of fat content in milk/ cream.
4. Isolation of lactose and casein from milk and isoelectric point of casein.
5. Determination of pectin as calcium pectate (fruits- guava or apple).
6. Determination of riboflavin from curry leaves(fluorimetric method)
7. Detection of vegetable coloring matter in red wine/ detection of coal tar dyes in jams or sweet meats.
8. Isolation and determination of tannin/ caffeine in coffee or tea.
9. Determination of total lipids in egg yolk and qualitative test for egg albumin, casein and gelatin.
10. Determination of iron from ash solution (fish)
11. Determination of proximate composition of food (crude fat, moisture, sugars, nitrogen content and dietary fibre) of sesame seeds/ malted cereals.
12. Determination of energy value of foods using bomb calorimeter (Parr oxygen bomb calorimeter). Demonstration only

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. 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**.
3. D. Pearson 'Laboratory techniques in food analysis', John Wiley & Sons, New York, **1973**.
4. A.G. Woodmann, 'Food Analysis', 4th edition, McGraw Hill Book Company, **1941**.
5. D.T. Plummer 'An Introduction to practical Biochemistry', Tata McGraw Hill publishers, **1987**.
6. Physiological Chemistry, Edited by Bernard. L. Oser, Philip B. Hawk, Bernard Levusove Oser, 14th edition, Tata McGraw Hill publishing Company Ltd, New Delhi, **1965**.
7. A.D. Winton and K.B.Winton, 'The analysis of food', **1945**.
8. J. David, Holme and Hazel Pack, 'Analytical Biochemistry' Department of Biological sciences, **1983**.
9. Analysis of food colours, ISI specification book, **2001**.
10. Welcher, 'Standard methods of Chemical Analysis', **1985**.
11. G. Lunge and C.A. Keane, 'Technical methods of Chemical Analysis', Vol. 3, Part-II, **1994**.

FP-3806: FOOD PROCESSING PRACTICALS - 6

M.Sc. Food Chemistry & Food Processing	No. of Hours/Sem. :60
Semester – III	No. of Credits : 3
Course: Major core (MC)	No. of hrs per week : 4

Objective:

To enable the student to understand the different techniques of laboratory procedures applicable to food processing.

LIST OF EXPERIMENTS

1. Preparation of dehydrated fruits (grapes) or vegetables (dry beet-root) – Analysis of dehydrated fruits – Preparation of samples, enzyme test (catalase or peroxidase), blemish count, bulk density and determination of coefficient of rehydration, freezing of foods.
2. Preparation and analysis of canned foods: Calculation of initial strength of covering syrup required to get the desired cut out strength.
3. Determination of salt content in brine (Mohr method) used in canned products.
4. Preparation, preservation and analysis of squashes, jams, jellies, marmalades and pickles.
5. Determination of percentage of a) reducing sugar b) total strength as invert sugar c) sucrose and d) total sugar in cane sugar juice.
6. Preparation of table sugar from cane sugar juice. Quality assessment test on sugar crystals.
7. Determination of equilibrium of relative humidity (ERH) in food samples by i) vacuum drying or infra red heating or Karl-Fischer method. Procedure for selection of packaging material.
8. Preparation of tomato product (tomato ketchup) –analysis of total and insoluble solid and sugar scale by refractometer.

9. Common test methods for fats

- | | | |
|--|-----------------------|------------------------|
| a) Cold test | b) Colour, (Lovibond) | c) Dropping point |
| d) Flavor | e) Melting point | f) Oil stability index |
| g) Peroxide value | h) Solid fat index | i) Solid fat content |
| j) Total lipids and thiobarbituric acid reactive substances (TBARS). | | |

10. Miscellaneous methods – Various stages in sugar cookery, measurement of syrup strength, clarification of fruit juices, recoverable oil in citrus juices and beverages.

11. Measurement of texture/viscosity of processed food (sauces, ketchup, mayonnaise, cream style corn), shelf-life study and sensory evaluation.

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**.

SEMESTER – IV [21 Credits]						
S.No	SUB. CODE	NAME OF PAPER	COURSE		EXAMINATION	
			Hrs/ week	Credits	Hours	Marks
25	FP-4800	Food Processing-Animal products [MC]	4	4	3	100
26	FP-4801	Scientific Research Methodology [MC]	2	1	-	
27	FP-4802	Project [MC]	10	7	-	100
28	FP-4803	Seminar-II [MC]	2	2	-	-
29	EL-4876	Business Communication [ED]	2	1	-	-
30	CO-4875	Fundamentals of Management [ED]	3	2	3	100
31	FP-4900	Computing Techniques:Excel for Food Chemists [SU]	3	2	3	100
*32(a)	FP-4950	Food Biotechnology [SE]	3	2	3	100
*32(b)	FP-4951	Food biodeterioration and reservation [SE]				
TOTAL			29	21	-	500

No. of Courses:

MC: 4
 * SE: Any one of two [32(a) or 32(b)]
 SU: 1
 ED:2

No. of Credits:

MC: 14
 SE: 02
 SU : 02
 ED:03

FP-4800: FOOD PROCESSING - ANIMAL PRODUCTS

M.Sc., Food Chemistry & Food Processing	No. of Hours/Sem. : 60
Semester – IV	No. of Credits : 4
Course : Major core (MC)	No. of hrs per week : 4

Objective:

To enable the students to understand the importance of animal husbandry and animal based food processing with special reference to poultry and dairy.

Unit-1: PRESERVATION AND PROCESSING (10 hrs)

- 1.1 Food deterioration– Autolysis, microbial spoilage, contamination, poisoning, preservation and processing of animal foods.
- 1.2 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.
- 1.4 Concept of halal and kosher

Unit-2: SEA FOODS (8 hrs)

- 2.1 Storage, preservation and processing – Chilling, freezing, canning, curing and drying.
- 2.2 Fish cookery and fish products – Fish meal, fish flour, fish oil and fish byproducts.

Unit-3: MEAT AND MEAT PRODUCTS (15 hrs)

- 3.1 Meat storage, preservation and processing- Chilling, freezing and thawing, canning ageing of meat, tenderizing meat – mechanical, chemical (curing – salting, pickling, smoking).Addition of enzymes – papain, bromelin, ficin, marinading
- 3.2 Cooking of meat- Dry heat and moist heat.
- 3.3 Processed meat products and meat substitutes- Sausages and table ready meats, frankfurter. Meat substitutes – Textured protein products and vegetable protein products.

Unit - 4: POULTRY AND POULTRY PRODUCTS**(15****hrs)**

- 4.1 Evaluation of egg quality –Candling, floating in water, and grading of eggs.
Storage preservation and processing – cold storage, freezing and drying–egg cookery and substitutes.
- 4.2 Poultry for meat – Production, consideration, processing plant operations– slaughtering and bleeding, scalding, defeathering, eviscerating, chilling and packaging.
- 4.3 Storage and preservation - Chilling, freezing (whole and cuts), canning dehydration and cooking
- 4.4 Processing and cooking of poultry – Poultry meat products.

Unit - 5: DAIRY PRODUCTS**(12 hrs)**

- 5.1 Milk storage and preservation - chilling, freezing, dehydration, addition of chemical inhibitors and irradiation.
- 5.2 Milk processing – clarification, pasteurization, homogenization, fortification and bleaching.
- 5.3 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.
- 5.4 Fermented milk products – butter, cheese, paneer, curd, shrikhand, yoghurt, kafir, kumiss, acidophilus milk and sour cream
- 5.5 Milk substitutes, legal standards for milk and its packaging.

TEXT BOOKS:

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

REFERENCES:

1. S.N. Mahindra, Food contaminants-origin, propagation and analysis, A.P.H Publishing corporation, **2004**.
2. D.R.Heldman, R.W.Hartel, Principles of food processing, International Thomson publication,**1997**
3. P.M Gamman and K.B.Sherrigtan , The science of food, Maxwell Macmillan pergamon publishing corporation 3 rd edition **1990**.
4. C.L.Cutting, Fish processing and preservation, Agro botanical publications (India),**1996**.

CH – 4801: SCIENTIFIC RESEARCH METHODOLOGY

M.Sc., Food Chemistry & Food Processing 30	No. of Hours/Sem. :
Semester – IV 1	No. of Credits :
Course: Major Core (MC) 2	No. of hours per week :

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: OBJECTIVES 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: CHEMICAL LITERATURE**(5 hrs)**

- 2.1 Sources of chemical information- Primary, secondary and tertiary sources.
- 2.2 Indices and abstracts in science and technology: applied science and technology index, biological abstracts, chemical abstracts, chemical titles, current chemical reactions, 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.

Self study

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

Unit- 3: ANALYTICAL DATA AND DATA ANALYSIS

(10hrs)

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.

Unit- 5: COMPUTER SEARCHES OF LITERATURE

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

FP-4802 : PROJECT WORK	
M.Sc Food Chemistry & Food Processing	
Semester - IV	No. of hrs /week :10
Course: Major Core(MC)	No. of credits : 7

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.

FP – 4803 SEMINAR AND REPORT

M.Sc Food Chemistry and Food Processing	No. of hours/sem.: 30
Semester: I – IV	No. of hours/ week : 2
Course: Major Core (MC)	No. of credits : 2

Objective:

To make the student understand, prepare and present the topic in the subject related to Food Chemistry in a class room

Testing and Evaluation:

Each student will choose a topic in the subject related to the Food Chemistry, prepare and present it in the class for an hour in the presence of students and faculty members. There will be discussion on the subject following the presentation. It will be evaluated by the faculty members present in the seminar.

The evaluation is based on subject matter and mode of presentation.

Subject matter

1. standard of subject
2. planning
3. mastery and preparation
4. originality and logical development
5. summary and references

Mode of presentation

1. language and diction
2. voice as a tool of communication
3. teaching aids and use of black board
4. economy of time
5. relating to audience

**FP -4900: COMPUTING TECHNIQUES- EXCEL FOR
FOOD CHEMISTS**

M.Sc. Food Chemistry & Food Processing	No. of Hours/Sem. :45
Semester – IV	No. of Credits : 2
Course: Supportive(SU)	No. of hrs per week : 3

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, menubar, formula bar etc.
- 1.3 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: $\text{pH} = \text{pK}_a + \log\{[\text{salt}]/[\text{acid}]\}$
- 5.4 Second order rate constant for diffusion limited reactions:

$$k_{\text{diff}} = 4\pi N_A (D_a + D_2) R / 1000$$
- 5.5 BET equation for the sorption of moisture on food materials:

$$A_w/m(1-a_w) = \{1/m_1 c\} + \{(c-1)a_w/m_1 c\}$$
- 5.6 Lambert-Beer equation: $I/I_0 = \exp(-\epsilon c l)$
- 5.7 Dissociation constant of a weak acid: $K_a = \alpha^2 c / (1-\alpha)$
- 5.8 Models for accelerated shelf-life study
- 5.9 Calculation of nutritive and energy value
- 5.10 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**.

CO-4875: FUNDAMENTALS OF MANAGEMENT	
M.Sc. Food Chemistry & Food Processing	No. of Hours/Sem.: 45
Semester – IV	No. of Credits : 2
Course: Extra Disciplinary(ED)	No. of hrs per week: 3

Objectives:

To help students:

- i) Understand the basic principles and functions of management*
- ii) To gain some exposure to the Techniques of Managing an Enterprise*

UNIT I: INTRODUCTION TO MANAGEMENT

Introduction to management - Meaning, Functions, Approaches: Henry Fayol – F.W. Taylor; Applications – Marketing, Finance, Human Resources Management.

UNIT II: PLANNING

Planning- Nature, Importance, Process, Types of Planning, Objectives, Policies, Procedures, Decision Making – Steps.

UNIT III: ORGANISING

Organisation – Nature and Importance; Principles of Organising- Delegation and Decentralisation; Departmentation, Organisational charts and Manuals.

UNIT IV: STAFFING AND DIRECTING

Recruitment process, Selection, Training methods; Functions of directing, Motivation theories (Need Hierarchy theory- Hygiene approach); Leadership- Importance and styles.

UNIT V: COORDINATING AND CONTROLLING

Meaning and its need, Features, Steps; Control techniques (Basics of TQM, CPM, Budgeting and 6 Sigma).

Textbooks:

C.B.Gupta, Business Management, Sultan Chand Publications, reprint 2008.

Dinkar Pagare, Business Management, Sultan Chand Publications, reprint 2009.

Reference Books:

Koontz O'Donnell, Weirich, Essentials of Management, Tata McGraw Hill Publishing Company, New Delhi, 5th Edition.

L.M. Prasad, Business Management, Sultan Chand Publications, Reprint 2006.

EL-4876: BUSINESS COMMUNICATION

M.Sc. Food Chemistry & Food Processing	No. of Hours/Sem. :30
Semester – IV	No. of Credits : 1
Course: Extra Disciplinary(ED)	No. of hrs per week : 2

Objectives:

1. *To enable the learner to imbibe the nuances of various types of communication*
2. *To impart language skills pertaining to corporate communication through business correspondence, public presentations and the related activities*
3. *To inculcate soft skills needed to survive in the customer-based communicative events*
4. *To familiarize the learner to the art and science of listening, speaking, reading and writing for technical objectives and specific purposes*

Unit-1: INTRODUCTION TO COMMUNICATION (4 hrs)

Process of communication - Types of communication - Communication skills

Unit-2: BUSINESS COMMUNICATION (8hrs)

Difference between Spoken & Business communication - Business vocabulary & expressions – Definitions & terms: conference, symposium, convention, panel etc

Unit-3. PROCESS OF WRITING (4 hrs)

Planning& Researching- Prewriting- Writing – Rewriting - Presentation

Unit-4: BUSINESS WRITING (6 hrs)

Letters - E-mails - Job Applications – Resume - Memos - Circulars – Notice – Reports - Agenda – Minutes – Paragraphs - Essays – Papers - Press Release

Unit-5: PROFESSIONAL PRESENTATION (8 hrs)

Preparation of materials & resources - Target Audience – Purpose – Structure - Technological aids - Building customer relations - Telephonic etiquette - Body language - Accent & Tone – Selling Techniques.

REFERENCES:

1. Cutts and Martin, The Plain English Guide: How to Write and Communicate Better. New Delhi: OUP, **1995**.
2. J. Seely, Oxford Guide to Effective Writing and Speaking. New York: Oxford University Press, **2005**.

FP-4950 : FOOD BIOTECHNOLOGY	
M.Sc. Food Chemistry & Food Processing	No. of Hours/Sem. :45
Semester- IV	No. of Credits : 2
Course: Subject Elective (SE)	No. of hrs per week : 3

Objectives:

To enable the students to understand

- i) the biotechnology of food flavor products*
- ii) the application of algae in food*
- iii) the role of enzymes in food processing.*

Unit-1: INTRODUCTION TO BIOTECHNOLOGY**(9 hrs)**

- 1.1 Scope and importance of biotechnology- commercial potential- an interdisciplinary challenge, genetically modified organisms and genetically modified foods
- 1.2 Quantitative approach- modern concepts- quality control in manufacturing- product safety- good manufacturing practices- good laboratory practices- marketing.

Unit-2: BIOTECHNOLOGY OF FOOD FLAVOUR PRODUCT**(6 hrs)**

- 2.1 Introduction- traditional fermentation- carbon, lipid and amino acid metabolism.
- 2.2 Flavour of foods- De Novo synthesis of flavours- bioconversion- vanillin.
- 2.3 Soya sauce production
- 2.4 Production fish based sauce

Unit-3: APPLICATION OF ALGAE IN FOOD**(9 hrs)**

- 3.1 Nutritional value of micro and macro algae- Algae as a source of nutraceuticals- Industrial production processes- chlorella and spirulina
- 3.2 Food processing of algae based industrial products- Cultivation methods, extraction and food applications of agar, alginate and carrageenan.

Unit-4: BIOTECHNOLOGY OF WINE PRODUCTION (12 hrs)

- 4.1 The Yeasts- fermentation and formation of metabolic products- Factors affecting fermentation- temperature, ethanol and CO₂ - insoluble particles- sugar content of fermentation substrate- volatile acidity, metal content and pesticides.
- 4.2 Preservatives- yeast metabolites and legally permitted preservatives- Decrease of wine quality by microbial action- Effect of fungi on wine quality.

Unit-5: ENZYMES IN FOOD PROCESSING (9 hrs)

- 5.1 Quality assurance of industrial enzymes- enzymes for starch modification
- Use of enzymes in baking industry- amylases
- 5.2 Enzymes for antistaling- Chymosin.
- 5.3 Enzymes used for dairy product processing- cheese- lactase and food proteins
- 5.4 Enzymes used for fruit juice production and stabilization.

TEXT BOOK:

K. Shetty, G. Paliyath, A. Pouretto and R. Levin (editors), Food Biotechnology, CRC Press, Taylor and Francis groups, **2006**

REFERENCES:

1. G. Reed, and T.W. Nagodawithana, Biotechnology, Volume 9, VCH Publishers Inc., New York, **1995**.
2. A.J. Nair, Introduction to Biotechnology and Genetic engineering, Infinity Science Press LLC, New Delhi, **2007**.

FP- 4951: FOOD DETERIORATION AND PRESERVATION	
M.Sc Food Chemistry Food Processing	No. of Hours/Sem. :45
Semester - IV	No. of credits : 2
Course: Elective Subject (SE)	No. of hrs / week : 3

Objectives:

1. *To examine the role of agents of micro- biological origin and their metabolites in food biodeterioration and to study the commercial methods available to counteract these agents and produce safe whole-some foods.*
2. *To learn preservation techniques based on reducing or preventing the growth of spoilage micro organisms.*

Unit-1: BIODETERIORATION IN FOOD**(8 hrs)**

1.1 Introduction- Types of biodeterioration- Micro organisms involved in biodeterioration.

1.2 Food biodeterioration- Mechanism of food biodeterioration- Factors affecting microbial growth- fermentation- fermentation biochemistry- putrefaction- lypolysis.

Unit -2: CHEMICAL DETERIORATION OF FOODS**(8 hrs)**

2.1 Oxidative and Hydrolytic Rancidity – Mechanism and prevention – Role of antioxidants.

2.2 Auto-oxidation, Maillard reaction and Light induces reactions.

2.3 Deterioration of fermented and pickled products.

2.4 Chemical changes in canned foods.

Unit-3: THERMAL PROCESSING**(9 hrs)**

3.1 Product classification- microbial destruction- end point thermal death time

Curve- survivor curve- thermal resistance curve, quality attributes- retort systems.

3.2 Chilling of food- Operation, equipments, storage and transportation- Retail display-

Unwrapped and wrapped products.

Unit -4: FREEZING AND DRYING AS MEANS OF CONTROLLING**BIODETERIORATION****(12 hrs)**

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

4.2 Drying to minimize biodeterioration- drying processes- air drying- vacuum drying- drying equipments- Bacteria deactivation kinetics during drying process.

Unit-5: METHODS OF FOOD PRESERVATION**(8 hrs)**

5.1 Hurdle technology – Basic concepts of Hurdle technology – Hurdles in food preservation – Applications of hurdle technology in Industrialized and Developing countries –Limitations of hurdle technology

5.2 Novel methods of preservation - Background- Principles and industrial applications- equipment- packaging considerations- Shelf life and product safety of the following preservation methods: Ohmic heating -High pressure processing Microwave and radio frequency heating – Pulsed electric field and ultrasonic -Irradiation with ionizing radiations like X-rays and gamma radiation.

5.3 Packaging materials and methods as applied for foods

TEXT BOOKS:

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

REFERENCES:

1. C.O. Ball and F.C. W. Olson, Sterilization in food technology: Theory, Practice and calculation, McGraw- Hill book Co., New York, 1957.
2. A. Ciabanu, G. Lascu, V. Bercescu and L. Niculescu, Cooling technology in the food industry, Tumbridge wells, Kent (UK), Abacus press, 1976.
3. H. Xu and Y. Wang, The New Sterilization technologies- Scientific and Technical Documents Publishing house, Beijing, **2005**.
4. R. V. Decareau and R. A. Peterson, Microwave processing and Engineering, Ellis Horwood series in food science and technology, Chichester (UK), 1986.
5. Lothar Leistner, Grahame Warwick Gould , Hurdle technologies: Combination treatments for food stability,safety and quality , Kluwer Academic /Plenum publishers,New york, 2002.
6. L.Skibsted,J.Risbo,M.Anderson (Eds) ,Chemical deterioration and physical instability of Food and beverages,Woodhead Publishing Limited, London 2009.