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<td>FP-4801: Scientific Research Methodology (MC)(1)</td>
<td>FP-4802: Project (MC)(7)</td>
<td>FP-4803: Seminar-II (MC)(2)</td>
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Course | Ending code
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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]

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**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)**

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

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

**UNIT-1: CONCEPTS IN INORGANIC CHEMISTRY**

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


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:**


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

3.1 *Thermodynamics in food*: Significance of $\Delta H$, $\Delta S$ & $\Delta G$. 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.


*Self study*: Emulsion and foam – Oswald ripening

UNIT-4. CHROMATOGRAPHY


*Self study*: Flow programming chromatography, Programmed temperature gas chromatography

UNIT-5 : ANALYSIS OF FOOD


5.2. *Fibre and mineral analysis*: Importance of dietary fiber. Determination of fiber. Major components of dietary fiber-lignin. Fiber analysis- sample preparation,

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

**TEXT BOOKS**


**REFERENCES**

FP-1801: ORGANIC CHEMISTRY OF FOOD - I
M.Sc (Food Chemistry & Food Processing)

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)
1.2 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, algins, pectins and gum-arabic. Dietary fibre and carbohydrate digestibility.

Self study: Chemical properties of monosaccharides – mutarotation, test for reducing and non-reducing sugars.

UNIT -2: LIPIDS (15 hrs)
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.

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**UNIT-3: AMINOACIDS, PEPTIDES AND PROTEINS**


**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, sulphotolysis, 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

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, chlorophyllase, texture-pectic enzymes; flavour and aroma changes, nutritional quality in food.

4.4 **Enzymes as processing aids:** Production of sweetners, 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

5.1 **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 A<sub>1</sub>, A<sub>2</sub>, B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, C, D, E and K (structural elucidation not required).

TEXT BOOKS

REFERENCES

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)

1.3 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)

2.2 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**


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**

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**


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**


**REFERENCES**

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

UNIT 2: ENERGY [10 hrs]

2.1 Units of energy. Food as a source of energy. Determination of energy value of
food - direct and indirect calorimetry. Basal and resting metabolism. Factors
influencing, energy requirements – recommendations for different age groups and
special conditions – ICMR and FAO. Food sources.
2.2 Energy requirements for physical activity. Factors affecting energy requirements.
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]


Self study: Planning diets for various age groups

TEXT BOOKS


WEBSITE:

REFERENCES:

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.
12. Analysis of vinegar – Total acidity,
TEXT BOOK:

REFERENCE BOOKS:
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.

   a) nitration
   b) halogenation
   c) diazotization
   d) rearrangement
   e) hydrolysis
   f) reduction
   g) acylation
   h) oxidation
3. **Separation** of components from food sources, adulterants and food poisons.
   
   a) Thin layer chromatography
   
   b) Column chromatography
   
   c) Paper chromatography.

**TEXT BOOKS**


**REFERENCE BOOKS**

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**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
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, guiacol,
longifolene, phylol, abietic acid, gibberelic 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, Benzedrine, mescaline, adrenaline.
Hemlock alkaloids: conine; Pomogranate alkaloid - pelletrienes; piperine;
Tobacco alkaloid-nicotine-solanaceous alkaloid-cocaine; cinchona alkaloid-cinchonine,
quinine; phenanthrene alkaloid - morphine, codeine,
source, structure, effects on physiological system.
UNIT 4: FLAVONOIDS.  

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.  

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:  

Reference books:  
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

Reference Books
FP 2802 CHEMISTRY OF DAIRY PRODUCTS

M.Sc. Food Chemistry & Food Processing  No. of Credits             : 4
Semester – II  No. of hours per week:  4
Course : Major core(MC)

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).

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), phylloquinone 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, Roese-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

Reference books
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 microbiology 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).
   7. Enzymic inversion of sucrose.
   8. Sorensons 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:
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
11. Separation and estimation of compounds using column chromatography.*
15. Determination of Fluoride by potentiometric titration.
17. Determination of chlorinated Hydrocarbons in a mixture by GC*
18. Analysis of flavour – GC – HPLC *
19 Analaysis of analgesics: HPLC*

• Experiments for demonstration.
Reference books:


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 bioactive 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:


REFERENCES:


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 microorganisms responsible for food deterioration and poisoning.
3. learn about fermented foods.

UNIT- I: MICROBIAL AND BIOCHEMICAL ASPECTS OF FOOD SPOILAGE

1.1 Microorganisms 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 microorganisms- 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 cereces, clostridium botulinium, Brucella sp., vibro cholerae and staphylococcus- Laboratory diagnosis of food poisoning by bacteria- Lissrerosis.


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


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

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

TEXT BOOKS:


REFERENCE BOOKS:


Objectives:

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

UNIT 1: HAEMATOLOGY

Composition of blood and their function - Haemapoiesis, 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


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


References:
2. Sood, R, Medical Laboratory Technology, Methods and Interpretation, 2005
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**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
Semester – III
Course: Major Core (MC)

No.of Hours/Sem. : 60
No. of Credits : 4
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)

4.2 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:**

**REFERENCES:**
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)
2.2 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:

REFERENCES:
**Objective:**

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

**Unit – 1: PROCESSING OF CEREAL GRAINS**

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**

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:
5. B. Sivasankar, Food Processing and Preservation, Prentice Hall of India Pvt. Ltd., New Delhi, 2002
REFERENCES:


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-
    nitrates–hydrogen peroxide.
1.2 Antioxidants: Generation–causes–effects–Naturally occurring antioxidants-role of

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.
2.4 Extraction of carotenes, lycopene, chlorophyll and curcumin.

Unit -3: FLAVOURS (15 hrs)
3.1 Taste: sensory assessment of flavors-structural basis-sweet, bitter and sour taste
    models–flavour enhancers–astringency-pungency-vegetable and spice flavors-allium,
    cruciferae-mushroom.
3.2 Odour: theory and sense of odour-flavours from shikimic acid pathway-pear, banana,
    apple, eugenol, vanillin.
3.3 Volatile terpenoids—noot ketone, geraniol, nerol, ± carvone, flavour from lactic acid; ethanol fermentation - diacetyl

3.4 Fish food flavours; thermally induced flavors.

3.5 Biosynthesis of tomato flavour.

**Unit -4: SWEETENERS** (5 hrs)

4.1 Natural intense sweeteners - Sweetener index.

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

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

**Unit -5: FLOUR IMPROVERS** (10 hrs)

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

    activity analysis of yeast-gas retention.

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

5.3 Anticaking agents-pH control.

**TEXT BOOKS:**


**REFERENCES:**

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.

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

5.1 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:


REFERENCES:

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:
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
2006.
3. D. Pearson ‘Laboratory techniques in food analysis’, John Wiley & Sons, New York,
1941.
6. Physiological Chemistry, Edited by Bernard. L. Oser, Philip B. Hawk, Bernard
Levussove Oser, 14th edition, Tata McGraw Hill publishing Company Ltd, New
Delhi, 1965.
8. J. David, Holme and Hazel Pack, ‘Analytical Biochemistry’ Department of Biological
sciences, 1983.
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:

REFERENCES:
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<tr>
<th>S.No</th>
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**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: 0 2
- ED:03
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, frankferter. 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:


REFERENCES:

4. C.L.Cutting, Fish processing and preservation, Agro botanical publications (India), 1996.
CH – 4801: SCIENTIFIC RESEARCH METHODOLOGY

<table>
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<th>Course</th>
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<th>Semester – IV</th>
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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)*


5.2 Journal home pages.

5.3 e-publishing
Reference books
5. H.M. Kanare, Writing the Laboratory Notebook; American Chemical Society: Washington, DC, 1985.
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.
**Objective:**

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

**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 blackboard
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: \( pH = pK_a + \log([\text{salt}]/[\text{acid}]) \)
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:
   \( A_w/m(1-a_w) = \{1/m_c\} + \{(c-1)a_w/m_c\} \)
5.6 Lambert-Beer equation: \( I/I_0 = \exp(-\varepsilon c l) \)
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:
**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:

1) *Understand the basic principles and functions of management*
2) *To gain some exposure to the Techniques of Managing an Enterprise*

**UNIT I: INTRODUCTION TO MANAGEMENT**


**UNIT II: PLANNING**


**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:

Reference Books:
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& Resarching- Prewriting- Writing – Rewriting - Presentation

Unit-4: BUSINESS WRITING (6 hrs)

Unit-5: PROFESSIONAL PRESENTATION (8 hrs)

REFERENCES:
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 CO$_2$ - 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,
2.   A.J. Nair, Introduction to Biotechnology and Genetic engineering, Infinity
**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 wholesome foods.

2. To learn preservation techniques based on reducing or preventing the growth of spoilage microorganisms.

**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  
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  
4.1 Physical and chemical agents of freezing- Effect of freezing on microorganisms-  
    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  
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:

REFERENCES:
4. R. V. Decareau and R. A. Peterson, Microwave processing and Engineering, Ellis Horwood series in food science and technology, Chichester (UK), 1986.